The new global world order

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Abstract

New large and comprehensive regional trade agreements are being negotiated across the Atlantic, the Pacific, and in Southeast-Asia. If these deals get through, the world trade system will have profoundly changed. What are the economic effects that are to be expected? This paper estimates a Ricardian multi-industry trade model on bilateral trade data for the year 2010. Key parameters are the degree of productivity dispersion and the trade cost elasticities of preferential trade agreements of different intensity. The effects of signing the mentioned trade deals on sectoral trade volumes and regional production networks, sectoral value added, national and global welfare are simulated. The effects are compared and conditioned with those of an ambitious multilateral liberalization scenario.

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1 Motivation

New large and comprehensive regional trade agreements are being negotiated across the Atlantic, the Pacific, and in Southeast-Asia. If these deals get through, the world trade system will have profoundly changed. What are the economic effects that are to be expected?

This paper estimates a Ricardian multi-industry trade model on bilateral trade data for the year 2010. Key parameters are the degree of productivity dispersion and the trade cost elasticities of preferential trade agreements of different intensity. The effects of signing the mentioned trade deals on sectoral trade volumes and regional production networks, sectoral value added, national and global welfare are simulated. The effects are compared and conditioned with those of an ambitious multilateral liberalization scenario.

The effects of the Transatlantic Trade and Investment Partnership (TTIP) have been researched intensively (for example Francois et al., 2013b,a; Felbermayr et al., 2013). Other treaties like the Regional Comprehensive Economic Partnership (RCEP) or the Trans-Pacific Partnership (TPP) currently negotiated have been less researched so far. Also, a unifying framework is missing, where the combined effects are assessed, should all treaties be negotiated successfully. We contribute to these studies by developing a TTIP scenario as well as several alternative scenarios that could describe the new global world order.

Our paper is closely related to structural gravity applications. To take into account general equilibrium effects of trade liberalization, this strand of literature resorts to counterfactual policy experiments, simulating effects of trade cost changes on (gross) trade patterns and welfare in general equilibrium. Several studies investigate the effects of abolishing the Canada-US border, (for example, Anderson and van Wincoop, 2003; Bergstrand et al., 2013). Other studies simulate the gains from trade vs autarky (see, for example, Eaton and Kortum, 2002) or free trade agreement (FTA) formation (Egger et al., 2011;
Egger and Larch, 2011) or deal with the role of trade imbalances for welfare (Dekle et al., 2007). Caliendo and Parro (2012) introduce input-output linkages in a multi-sector Eaton and Kortum (2002)-type gravity model. They provide a new method to identify the main model parameter – the dispersion of productivities within sectors – and simulate the welfare effects of tariff cuts in the wake of the North American free trade agreement (NAFTA) formation.\footnote{A comprehensive summary of the welfare implications of trade liberalization in different formulations of the gravity model (single vs. multi-sector, input-output linkages, homogenous vs. heterogeneous firms etc.) is given by Costinot and Rodríguez-Clare (forthcoming).} We contribute to the literature by investigating the consequences of the effects of preferential trade agreements of different intensity.

The paper proceeds as follows. In Section 2 we describe the gravity model with input-output linkages developed by Caliendo and Parro (2012) and . Section 3 explains how we identify the models key parameters, namely value added and input-output coefficients, as well as a sectoral measure of productivity dispersion and the average effect of shallow, middle and deep FTAs. In Section 4 we describe the counterfactual experiment and present the simulation results of the effects of a Transatlantic Trade and Investment Partnership on welfare, specialization and trade diversion.

\section{Theory part}

The model builds on Caliendo and Parro (2012) which provide a multi-sector version of the Eaton and Kortum (2002) gravity model with input-output linkages. Caliendo and Parro (2012) use tariff data to later identify the elasticity of substitution and then do counterfactual analysis by manipulating tariff levels. FTAs and other bilateral trade costs are not modeled explicitely; they are not changed in the counterfactual scenarios and therefore do not matter for the analysis because the equilibrium is solved in changes as e.g. in Dekle et al. (2008). In this paper, we also model trade costs as a function of FTAs and other trade cost proxied and provide counterfactual analysis with the FTA.
dummy (with different treatment intensities). Effects of TTIP would be simulated by setting US-EU tariffs to zero plus switching on the FTA dummy.

2.1 Consumption and production

There are \( N \) countries indexed by \( i, n \) and \( J \) sectors indexed by \( j, k \). The representative consumer’s utility over final goods consumption \( C^j_n \) follows Cobb-Douglas preferences, with \( \alpha^j_n \) denoting sectoral expenditure shares

\[
u(C_n) = \prod_{j=1}^{J} C^j_n^{\alpha^j_n}.
\] (1)

Household income \( I_n \) comprises wage income and lump-sum tariff rebates. The labor force \( L_n \) of a country is mobile across sectors, i.e. \( L_n = \sum_{j=1}^{J} L^j_n \), but not between countries.

In each sector \( j \), a continuum of goods \( \omega^j \) is produced with labor \( l^j_n(\omega^j) \) and a composite intermediate input \( m^{k,j}_n(\omega^j) \) of each source sector \( k \) according to the following production function:

\[
a^j_n(\omega^j) = x^j_n(\omega^j)^{-\theta^j} \left[ l^j_n(\omega^j) \right]^{\beta^j_n} \left[ \prod_{k=1}^{J} m^{k,j}_n(\omega^j)^{\gamma^k_{n,j}} \right]^{(1-\beta^j_n)},
\] (2)

where \( \beta^j_n \geq 0 \) is the value added share in sector \( j \) in country \( n \) and \( \gamma^k_{n,j} \) denotes the cost share of source sector \( k \) in sector \( j \)’s intermediate costs, with \( \sum_{k=1}^{J} \gamma^k_{n,j} = 1 \). It implies sectors are interrelated because sector \( j \) uses sector \( k \)’s output as intermediate input, and vice versa. \( x^j_n(\omega^j) \) is the inverse efficiency of good \( \omega^j \) in sector \( j \) and country \( n \). \( \theta^j \) describes the dispersion of efficiencies in a sector \( j \). A higher \( \theta^j \) implies higher dispersion of productivities across goods \( \omega^j \). The dual cost \( c^j_n \) of an input bundle depends on a country’s wage rate \( w_n \) and the price of the composite intermediate goods \( k \) country \( n \) has to pay

\[
c^j_n = \Upsilon^j_n w_n^{\beta^j_n} \left[ \prod_{k=1}^{J} p^k_n \gamma^k_{n,j} \right]^{(1-\beta^j_n)},
\] (3)
where $\Upsilon^j_n$ is a constant. Note that sectoral goods $\omega^j$ only differ in their efficiency $x^j_n(\omega^j)$. Consequently, we re-label goods with $x^j_n$.

Let $\kappa^j_{in}$ denote trade costs of delivering good $j$ from country $i$ to country $n$. They consist of iceberg trade costs $d^j_{in} \geq 1$, with $d^j_{nn} = 1$, and ad-valorem tariffs $\tau^j_{in} \geq 0$ such that $\kappa^j_{in} = (1 + \tau^j_{in})d^j_{in}$. Following other gravity applications, we can model iceberg trade costs as a function of bilateral distance, FTAs (potentially several FTAs dummies for different treatment intensities) and other observable trade cost proxies as $d^j_{in} = D_{in} \rho^j e^{\delta^j Z_{in}}$, where $D_{in}$ is bilateral distance, and $Z_{in}$ is a vector collecting dichotomous trade cost proxies (contiguity and FTAs). Perfect competition and constant returns to scale imply that firms charge unit costs

$$p^j_{in}(x^j_i) = \kappa^j_{in} \left[ x^j_i \right]^{\theta^j} c^j_i. \quad (4)$$

Label a particular intermediate good with the vector of efficiencies $x^j = (x^j_1, \ldots, x^j_N)$. Country $n$ searches across all countries for the supplier with the lowest costs. Consequently, the price $n$ pays for good $x^j$ is

$$p^j_n(x^j) = \min_i \{ p^j_{in}(x^j_i); i = 1, \ldots, N \}. \quad (5)$$

Comparative advantage is introduced by assuming that countries differ in their productivity across sectors. The set of goods a country produces follows an exponential cumulative distribution function. The distribution of productivities is assumed to be independent across countries, sectors, and goods. The joint density of $x^j$ is

$$\phi^j(x^j) = \left( \prod_{n=1}^N \lambda^j_n \right) \exp \left\{ - \sum_{n=1}^N \lambda^j_n x^j_n \right\}, \quad (6)$$

where $\lambda^j_n$ shifts the location of the distribution, and thus, measures absolute advantage.

The composite intermediate good $q^j_n$ in each sector $j$ is produced with a Dixit-Stiglitz CES technology. Let $\eta^j$ denote the elasticity of substitution and $r^j_n(x^j)$ the demand for
intermediate good $x^j$. The sum of costs for all intermediate goods $x^j$ are minimized subject to

$$
\int r_n^j (x^j)^{\frac{\eta_j-1}{\eta_j}} \phi^j (x^j) dx^j \geq q_n^j.
$$

(7)

As usual, demand for $x^j$ depends on the variety’s price relative to the sectoral price index

$$
p_n^j = \left[ \int p_n^j (x^j)^{(1-\eta^j)} \phi^j (x^j) dx^j \right]^{\frac{1}{1-\eta^j}}.
$$

Note that $r_n^j (x^j)$ is the demand for intermediates of $n$ from the respective lowest cost supplier of $x^j$. The composite intermediate good $q_n^j$ is either used to produce intermediate input of each sector $k$ or to produce the final consumption good.

### 2.2 Gross exports

Solving for the distribution of prices and integrating over the sets of goods where each country $i$ is the lowest cost supplier to country $n$, we get the price of the composite intermediate good

$$
p_n^j = A^j \left( \sum_{i=1}^{N} \lambda_i^j (c_i^j K_{in}^j) \right)^{-\theta^j},
$$

(9)

where $A^j = \Gamma [1 + \theta (1 - \eta_j)]^{\frac{1}{1-\eta_j}}$ is a constant. Prices are correlated across all sectors (via $c_i^j$). The strength of the correlation depends on the coefficients of the input-output table $\gamma_{in}^k$. Similarly, a country $n$’s expenditure share $\pi_{in}^j$ for source country $i$’s goods in sector $j$ is

$$
\pi_{in}^j = \frac{\lambda_i^j (c_i^j K_{in}^j)^{\frac{1}{\beta_j}}}{\sum_{i=1}^{N} \lambda_i^j (c_i^j K_{in}^j)^{\frac{1}{\beta_j}}}.
$$

(10)

These shares apply to gross exports. Hence, gross exports follow the usual gravity equation.
2.3 General equilibrium

Let \( Y^j_n \) denote the value of gross production of varieties in sector \( j \). For each county \( n \) and sector \( j \), \( Y^j_n \) has to equal the value of demand for sectoral varieties from all countries \( i = 1, \ldots, N \).\(^4\) So, the goods market clearing conditions are given by

\[
Y^j_n = \sum_{i=1}^{N} \sum_{k=1}^{J} \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} \gamma_{i}^{j,k} (1 - \beta_{i}^{k}) Y_{i}^{k} + \sum_{i=1}^{N} \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} \alpha_{i}^{j} I_{i},
\]

\( \text{(11)} \)

where national income consists of labor income, tariff rebates \( R_{i} \) and the (exogenous) trade surplus \( S_{i} \), i.e. \( I_{i} = w_{i} L_{i} + R_{i} - S_{i} \) and \( X_{i}^j \) is country \( i \)'s expenditure on sector \( j \) goods. The first term on the right hand side gives demand of sectors \( k \) in all countries \( i \) for intermediate usage of sector \( j \) varieties produced in \( n \), the second term final demand.

Both intermediate and final demand are divided by \( (1 + \tau_{ni}^j) \) to convert them from CIF to FOB values. Tariff rebates are \( R_{i} = \sum_{j=1}^{J} X_{i}^j \left( 1 - \sum_{n=1}^{N} \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} \right) \).\(^5\)

The model is closed with an income-equals-expenditure condition that takes into account trade imbalances for each country \( n \). The value of total imports plus the trade

\(^4\)Our exposition differs from Caliendo and Parro (2012) in that they use total expenditure on composite goods instead of total production of varieties as endogenous variable. So in Caliendo and Parro (2012) the value of gross production comprises all foreign varieties that are bundled into the composite good without generation of value added. The value of production of sectoral varieties seems a more natural choice.

\(^5\)Instead of the goods market clearing condition, one can also use the expenditure equation \( X_{i}^j = \left( \sum_{k=1}^{J} \gamma_{i}^{j,k} (1 - \beta_{i}^{k}) (F_{i}^{k} X_{i}^{k} + S_{i}^{k}) + \alpha_{i}^{j} I_{i} \right) \) as in Caliendo and Parro (2012).
surplus has to equal the value of total exports, which is equivalent to GDP $Y_n$:

\[
\sum_{j=1}^J \left( \sum_{k=1}^J \gamma_{nk}^j (1 - \beta_n^k) Y_n^k + \alpha_n^j I_n \right) \sum_{i=1}^N \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} + S_n = \sum_{j=1}^J Y_n^j \equiv Y_n,
\]

\[
\sum_{j=1}^J \sum_{i=1}^N \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} X_i^j + S_n = \sum_{j=1}^J \sum_{i=1}^N \frac{\pi_{ni}^j}{(1 + \tau_{ni}^j)} X_i^j
\]

(12)

### 2.4 Comparative statics

Our policy experiments deal with the effects of TTIP and other currently discussed FTAs. To simulate these policy experiments, we switch on the FTA dummy and change the tariff structure from the currently prevailing level $\tau$ to a counterfactual level $\tau'$, where tariffs go down to zero for country pairs forming an FTA. As suggested by Dekle et al. (2008), instead of solving for the new equilibrium one can also solve for the equilibrium changes. This approach has the advantage that we do not need information on, e.g. the level of technological know-how $\lambda_i^j$.

Denote with $\hat{x} \equiv \frac{x'}{x}$ the relative change in a variable $x$. The formation of TTIP implies a change in trade costs $\hat{\kappa}_{in}^j = \frac{(1+\tau_{in}^j)^{\delta(FTA_{in}^j-FTA_{in})}}{(1+\tau_{in}^j)}$, s.t. the tariffs between the US and the EU fall to zero and the FTA dummy for these pairs switches to one. The equilibrium change in input costs is given by

\[
\hat{c}_{in}^j = \hat{w}_{in}^{\beta_n^j} \left( \prod_{k=1}^J \hat{p}_{nk}^k \right)^{\gamma_{nk}^j} \left( 1 - \beta_n^j \right).
\]

(13)

The change in the price index is

\[
\hat{p}_{in}^j = \left( \sum_{i=1}^N \frac{\pi_{ni}^j}{\pi_{ni}^j} \left[ \hat{\kappa}_{in}^j \hat{c}_{in}^j \right]^{-1/\theta_i} \right)^{-\theta_j}.
\]

(14)
The change in the bilateral trade shares

\[
\frac{\hat{\pi}_{jn}}{\hat{\pi}_{jn}^{*}} = \left( \frac{c_{jn}^{*}}{\hat{p}_{jn}} \right)^{-1/\theta_{jn}}.
\]  

(15)

The trade balance is

\[
\sum_{j=1}^{J} F_{jn}' X_{jn}' + S_{n} = \sum_{j=1}^{J} \sum_{i=1}^{N} \frac{\hat{\pi}_{jn}'}{1 + \tau_{ni}'} X_{i}' + S_{n},
\]  

(16)

and the counterfactual expenditure in each country and each sector

\[
X_{jn}' = \sum_{k=1}^{J} \gamma_{jk} (1 - \beta_{kn}') \left( \sum_{i=1}^{N} \frac{\pi_{kn}'}{1 + \tau_{ni}'} X_{i}' \right) + \alpha_{jn} I_{n}',
\]  

(17)

where \( F_{jn} = \sum_{i=1}^{N} \frac{\pi_{jn}}{(1 + \tau_{jn})} \) and \( I_{n}' = \hat{w}_{n} w_{n} L_{n} + \sum_{j=1}^{J} X_{jn}' (1 - F_{jn}') - S_{n} \).

This system of equations of equilibrium changes can be solved with a searching algorithm proposed by Alvarez and Lucas (2007) which assumes a seed for the wage change, computes price and trade share changes and the new expenditure levels based on this wage change, then evaluates the trade balance condition to finally update the wage change with a projection until the equilibrium is found.\(^6\) Caliendo and Parro (2012) provide a formulation of the above system of equation in terms of wage changes only.

Welfare changes can be measured by the change in real income and are given by

\[
\hat{W}_{n} = \frac{\hat{I}_{n}}{\prod_{j=1}^{J} \hat{p}_{jn} \alpha_{jn}^{*}}.
\]  

(18)

3 Parameter identification

We need to identify the model parameters \( \alpha, \beta, \gamma \) and \( \theta \) and \( \delta \) and require data on bilateral trade shares, tariff levels as well as countries’ total value added and trade surplus. In this

\(^6\)This algorithm is also used by Dekle et al. (2008) and in a multi-sector input-output version by Caliendo and Parro (2012).
section, we describe the identification strategy of these parameters. Due to the Cobb-Douglas utility and production function with constant returns to scale, $\alpha, \beta$ and $\gamma$ can be computed as expenditure respectively cost shares. In other words, we can impute these parameters directly from input-output tables.

The sectoral productivity dispersion can be directly identified from the gravity equation: the coefficient of tariffs in the gravity equation is $1/\theta^j$, see (10). While tariff data is directly observable, iceberg trade costs are not. In order to estimate (10), the gravity literature typically assumes a functional form of iceberg trade costs based on proxies such as bilateral distance and dummies for contiguity and for whether a country pair is in a free trade agreement (FTA). Therefore, we proceed by assuming that $d_{in}^j = D_{in} \rho^j \delta^j Z_{in}$, where $D_{in}$ is bilateral distance, and $Z_{in}$ is a vector collecting dichotomous trade cost proxies (contiguity and FTAs). Plugging this functional form into the trade share equation given in (10) and multiplying by $X_{jn}$, allows us to formulate the following log-linearized estimable gravity equation for each sector $j$:

$$\ln(\pi_{in}^jX_{jn}) = -\frac{1}{\theta^j} \ln \tau_{in}^j - \rho^j \ln D_{in} - \delta^j Z_{in} + \nu_{in}^j + \mu_{jn}^j + \varepsilon_{in}^j,$$

(19)

where $\nu_{in}^j \equiv \ln(\lambda_i^j/c_j^j)$ is an exporter fixed effect, $\mu_{jn}^j \equiv \ln(X_{jn}/\sum_{i=1}^N \lambda_i^j [c_j^i/c_{jn}^j]^{\theta^j})$ an importer fixed effect, and $\varepsilon_{in}^j$ an i.i.d. error term. The sectoral productivity dispersion is given by the coefficient on tariffs.

Alternatively, we can identify the sectoral productivity dispersion as suggested by Caliendo and Parro (2012). The idea is to divide a country pair’s trade flow with trade flows of other trade partners such that importer, exporter and pair specific symmetric effects cancel each other out. The corresponding estimation equation is

$$\ln \frac{X_{in}^j X_{hi}^j X_{hn}^j}{X_{ni}^j X_{ih}^j X_{hn}^j} = -\frac{1}{\theta^j} \ln \left(\frac{\pi_{in}^j\pi_{hi}^j\pi_{hn}^j}{\pi_{ni}^j\pi_{ih}^j\pi_{hn}^j}\right) + \varepsilon_{inh}^j,$$

(20)

where $\varepsilon_{inh}^j$ is an i.i.d. error term. We provide results for both the Caliendo and Parro
(2012) estimation methodology and the gravity equation with importer and exporter fixed effects and bilateral trade cost controls.

3.1 Data

Data are obtained from the world input-output database (WIOD). It features data on input-output linkages, final consumption levels (both bilateral) and sectoral value added for 40 mainly OECD countries for the years 1995-2011 with a sectoral breakdown roughly at the two digit ISIC level, i.e. 35 industries. Of these, one is the agricultural, one the mining and quarrying sector; the rest consists of 14 manufacturing and 19 services industries. Bilateral sectoral trade levels for all goods, including the services industries, can be constructed from the world input-output table. Note that there exists only one production factor in the model. Consequently, value added is equivalent to labor input. In the WIOD database, the value added coefficient captures labor as well as capital services.

Data on bilateral tariff levels for manufacturing sectors is taken from the UNCTAD’s TRAINS database. It provides effective applied tariffs at the 6 digit level of the Harmonized System goods classification. We aggregate this data to the WIOD sectoral level with import value weights. Information on tariff levels for service sectors is not available.

Bilateral distance and a dummy for contiguity are obtained from the CEPII distance database.

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7See Table 4 for a country list.

8Note that the WIOD does not have information on bilateral input-output coefficients. These are imputed from national input-output tables with the proportionality assumption. Accordingly, a sector’s usage of a certain intermediate input is split between trade partners according to their respective import share of the intermediate. See Timmer (2012) for an in-depth description of methods and assumptions used to construct the WIOD.

3.2 Depth of integration

Data on the depth of integration is taken from Dür et al. (2014). Their index of depth of an FTA counts the numbers of provisions (partial scope agreement, substantive provisions on services, investments, standards, public procurement, competition and intellectual property rights) the FTA covers. The index ranges from 0 to 7, where 0 indicates a partial scope agreement and 7 is the deepest level of integration. We recode this index of depth into three dummies: a shallow, middle and deep FTA dummy. The shallow FTA dummy switches to one when the depth index is between 0-7, the middle dummy for values between 2-7, and the deep dummy for 4-7, respectively. In other words, in the gravity regressions the shallow FTA dummy captures the effect of having an FTA, while the middle and deep dummy capture the additional effect of increasing the depth of the agreement to middle and deep, respectively. Figure 1 shows the distribution of the index of depth provided by Dür et al. (2014). Most FTAs currently fall in the middle category, whereas deep agreements are less common.

The depth of an FTA varies by type of agreement. North-North agreements are dominated by deep integration, while a middle depth is the predominant type of agreement for North-South FTAs. And South-South FTAs are almost exclusively shallow trade agreements. Therefore, we assume that TTIP has the trade cost reducing effects of an average deep agreement in our baseline scenario. But we also provide welfare results under alternative depths of integration.

3.3 Model parameters: value added intensity, input-output coefficients, productivity dispersion

Country- and sector-specific parameter values for $\alpha, \beta$ and $\gamma$ are taken from the input-output tables provided by the WIOD database. Parameter values for sectoral expenditure shares, $\alpha_j$, are computed as sectoral expenditure for final consumption (summed over all
sourcing countries) divided by total expenditure for final consumption. Sectoral value added coefficients, $\beta^j_i$, are constructed as value added divided by output value. Figure 3 shows boxplots of each sector’s value added intensity. Within a given sector, there is heterogeneity in terms of countries’ value added intensity. There is also substantial variation in the value added intensity across sectors. For example, the education sector relies little on intermediate inputs; its median value added intensity is around 80%. On the other end of the spectrum are sectors like “Coke, Refined Petroleum and Nuclear Fuel” or “Transportation equipment” where only around 15 respectively 25% of the output value are attributed to value added. The former sector relies heavily on materials from the mining and quarrying sector such as crude oil while the latter uses intermediate inputs from other manufacturing and service industries. Summarizing, service sectors have a high value added coefficient while manufacturing sectors are at the lower end of the spectrum. The model takes this heterogeneity across sectors and across countries into account by allowing for sector- and country-specific value added coefficients $\beta^j_i$.

Input-output coefficients, $\gamma^k_j$, are obtained by summing a sector $j$’s usage of intermediate inputs from sector $k$ over all countries, and then dividing by sector $j$’s total costs of intermediates. Figure 4 (a) and (b) depict the US and Chinese input-output table for the year 2011, respectively. It shows contour plots of $\gamma^k_j$ for all sourcing sectors $k$, listed on the vertical axis, and all demanding sectors $j$, listed on the horizontal axis. A darker shade in the contour plot indicates a stronger input-output relationship. Intermediate usage is highest along the diagonal, i.e. for products of the demanding sector’s own sector $k = j$. But some off-diagonal entries also stand out. In the US, many service sectors rely on intermediates from the “Other business activities” sector. All transport sectors have a high usage of products from the “Coke, Refined Petroleum and Nuclear Fuel” sector or machinery and equipment sectors use basic metals as inputs, to give just a few examples. Countries differ in terms of their sourcing structure. The Chinese input-output table looks slightly different than the US table, which is most evident for the intermediate inputs of
the “Other business activities” and also “Electrical and optical equipment” sectors.

Sectoral productivity and FTA coefficients

Sectoral productivity dispersions, $\theta^j$, and the FTA coefficients are identified with a log-linearized cross-sectional gravity equation as given in (20) or (19). Tables 1-3 provide the results. Each column corresponds to a separate estimation for the respective sector. The first row shows the estimate for the (inverse) productivity dispersion, $1/\theta^j$ from the Caliendo and Parro (2012) methodology. The higher $1/\theta^j$, the smaller the productivity dispersion in the respective sector. The coefficients are fairly stable across the different estimation procedures. As one might expect, “Basic metals and fabricated metal”, “Mining and Quarrying”, and “Coke, refined petroleum and nuclear fuel” are at the top of the list. These sectors are characterized by rather homogeneous products, and thus have a high estimate of $1/\theta^j$. At the lower end of the table are sectors like “Transport equipment”, and “Manufacturing nec” which provide rather heterogeneous goods. All in all, the sorting of the sectors seems plausible.\(^{10}\) Also, the order of magnitude of the estimated coefficients seems plausible. In the gravity literature, the estimates typically lie between 2 and 10. Data on bilateral tariffs is not available for service sectors. Therefore, we cannot apply our estimation strategy for sectors of ISIC chapters E through Q. Instead, we use an average $1/\theta^j = 5.959$ for all service sectors taken from Egger et al. (2012).

Entering an FTA increases bilateral trade volumes in manufacturing sectors. Our gravity results also show that the depth of integration matters. Going from a shallow to a middle and from a middle to a deep FTA has additional trade increasing effects. The total effect of a deep FTA on bilateral trade can be quite substantial. For example in the “Machinery” sector, the combined coefficient is $0.288 + 0.925 + 0.415 = 1.628$; this corresponds to a quadrupling of trade in that sector. However, FTAs do not, over the

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\(^{10}\)The estimates indicate that the agricultural sector has a rather high productivity dispersion. This is unexpected. However, given that this sector aggregates agriculture, hunting, forestry and fishing, this might be due to an aggregation bias.
board, increase trade flows in service sectors. We find some trade increasing effects for
“Hotels & Restaurants”, the transport sectors, “Financial intermediation” and the “Real
estate activities” sector.

Other gravity covariates (log of distance, contiguity, common language) are not shown,
but have the expected signs and magnitudes.

4 Counterfactual scenario: A Transatlantic Trade and
Investment Partnership

Here, we provide some preliminary results on the effects of a Transatlantic Trade and
Investment Partnership based on the WIOD database. The goal however is to include
more countries in the sample, and thus use the GTAP database as the main datasource.

To model the effects of TTIP, we assume it will be a deep trade integration agreement.
But we also provide results for welfare effects when TTIP would only reduce tariffs between
the EU and the US to zero, as well as when TTIP additionally has the average effect of
a shallow or middle FTA.

Table 4 provides an overview of the welfare effects for TTIP for different scenarios.
Let us focus on the deep integration scenario first. On average, real income increases
by 2.94% in the EU.\textsuperscript{11} On the world level, real income increases by 1.45%. For TTIP
countries real income rises, on average, by 3.15%, while real income falls by 0.04% on
average for non-TTIP countries.

The result that TTIP countries gain, while on average non-TTIP countries lose from
TTIP is also present in the other simulated scenarios. But the effects are less pronounced.
It is also noteworthy to see that under the scenario of tariff reductions only, the welfare
changes are minimal. In other words, the welfare effects do not come from lowering the

\textsuperscript{11}The countries’ real income change is weighted with GDP shares.
Figure 5 relates the changes in welfare to changes in openness of the respective countries. The higher the increases in openness, the higher tend to be the welfare gains from TTIP.

Figure 6 suggests that one can expect TTIP to lead a reindustrialization in TTIP countries and at the same time reduce the share of service industries in GDP.

The next graph shows the initial level of the revealed comparative advantage (RCA) in exports and its change in the counterfactual. The upper right quadrant contains sectors with an initial comparative advantage that could increase the RCA even more. The lower left quadrant contains sectors with the reverse situation, a revealed comparative disadvantage that is increased further in the counterfactual. If TTIP leads to specialization in line with comparative advantage we would expect to see sectors align in the first and third quadrant. Figure 7 depicts the results on specialization for Germany and the USA. Germany tends to specialize in sectors with a RCA, such as “Transport equipment” and reduce exports of sectors with a revealed comparative disadvantage, such as “Petroleum products” or “Mining”. For the USA, however, no such pattern emerges.

Last, Figure 8 suggests that trade diversion within the EU is overstated when measured in gross exports. The trade reducing effect of TTIP within the EU is larger with gross exports than for value added trade flows, and more so for sectors producing goods at the upper end of the global value chain like e.g. “Chemicals”. This suggests that while direct trade between EU countries is dampened, indirect trade (via the US and other countries) is less affected.

5 Conclusion

—to be completed—
References


Figure 1: Status quo of depth of trade integration

Note: The figure plots the index of depth of FTAs as in Dür et al. (2014). The depth index counts the number of provisions and ranges from 0-7. The different provisions are: partial scope agreement, substantive provisions on services, investments, standards, public procurment, competition and intellectual property rights.
Figure 2: Depth of trade integration and type of agreement

Note: The figure plots the depth of trade integration based on data as in Dür et al. (2014). A value of 1 signifies shallow FTAs, 2 middle FTAs and 3 deep FTAs. Shallow, middle and deep FTA are coded as values between 0-1, 2-3, and 4-7, respectively of the depth index of Dür et al. (2014) which is a count of the number of provisions of the FTA and ranges from 0-7. The different provisions are: partial scope agreement, substantive provisions on services, investments, standards, public procurement, competition and intellectual property rights.
Figure 3: Heterogeneity in sectoral value added intensity 2011

Note: The figure shows boxplots of each sector’s value added per dollar of output for the year 2011. For each sector, the vertical line within the box gives the median value of the countries’ value added intensity, the box shows the range of 50% of the observations, the outer lines depict the 95% range and the dots show outliers.
Figure 4: The US and Chinese input-output table 2011

(a) US input-output table

(b) Chinese input-output table

Note: The figure shows the contour plot of input-output coefficients, $\gamma_{kj}^{ij}$, for (a) the USA and (b) China for the year 2011. The sourcing sectors $k$ are listed on the vertical axis, while the demanding sectors $j$ are listed on the horizontal axis. Input-output coefficients range from 0 to 0.8, where a darker shade indicates a stronger input-output relation.
Figure 5: Changes in real income and value-added based openness with TTIP

Note: The figure plots the changes in real income (in %) against the changes in openness (in %) for the TTIP scenario of deep trade integration for all sample countries. Openness is measured as value added exports plus value added imports over GDP. Ireland and Luxembourg for scaling reasons not in graph.
Figure 6: Changes in manufacturing and services shares with TTIP

Note: The figure shows the density of changes of the share of manufacturing (solid line) and services (dashed line) value added (in percentage points) for the TTIP scenario of deep trade integration distinguished by TTIP (blue line) and non-TTIP countries (maroon line). Ireland and Luxembourg for scaling reasons not in graph.
Figure 7: Changes in Revealed comparative advantage

(a) Germany

(b) United States

Note: The figure shows a scatter plot of the sectoral measure of revealed comparative advantage plotted against its change (in percentage points) from switching to the TTIP scenario with deep integration, for (a) Germany and (b) the United States.
Figure 8: Changes in trade and value added trade within EU and total trade.

(a) Food, Beverages and Tobacco  
(b) Textiles and Textile products

(c) Leather and Footwear  
(d) Wood and Wood products

(e) Pulp, Paper, Printing and Publishing  
(f) Coke, Petroleum products, Nuclear Fuel

(g) Chemicals and Chemical Products  
(h) Rubber and Plastic

Note: The figure shows the changes in trade (in %, solid lines) and value added trade (in %, dashed lines) for the TTIP scenario of deep trade integration. Within EU trade is represented by blue lines, total trade by maroon lines for the respective manufacturing sector.
Figure 9: Changes in trade and value added trade within EU and total, continued

Note: The figure shows the changes in trade (in %, solid lines) and value added trade (in %, dashed lines) for the TTIP scenario of deep trade integration. Within EU trade is represented by blue lines, total trade by maroon lines for the respective manufacturing sector.
Table 1: Gravity estimates manufacturing with different depth of integration

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Note: The table shows gravity estimates for manufacturing sectors with importer and exporter fixed effects as in (19). Standard errors (in parantheses) are heteroskedasticity-robust. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively. The coefficient on ln(1+tariff) is the parameter estimate of −1/θ and the coefficient on the FTA dummy is the parameter estimate for δ/θ. The dummy for shallow, middle and deep FTAs is classified with data on the depth of FTAs from Dür et al. (2014), which ranges from 0 to 7 and where the shallow FTA dummy switches to one for depth>= 0, the middle FTA dummy for depth>= 2, and the deep FTA dummy switches to one for depth>= 4. I.e., the shallow dummy gives the effect of having an FTA, the middle/deep dummy gives the additional effect of having a middle/deep agreement, respectively. To save space, other gravity controls are not reported.
Table 2: Gravity estimates for the service sectors with depth of FTA

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<th>(22)</th>
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<tr>
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Note: The table shows gravity estimates for service sectors with importer and exporter fixed effects as in (19). Standard errors (in parentheses) are heteroskedasticity-robust. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively. The dummy for shallow and deep FTAs is classified with data on the depth of FTAs from which ranges from 1 to 5, where the shallow FTA dummy switches to one for depth>= 1 and the deep FTA dummy switches to one for depth>= 4. I.e., the shallow dummy gives the effect of having an FTA, the deep dummy gives the additional effect of having a deep agreement.
Table 3: Gravity estimates for the service sectors with depth of FTA, continued

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<tr>
<td>Shallow FTA</td>
<td>0.970***</td>
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Note: The table shows gravity estimates for service sectors with importer and exporter fixed effects as in (19). Standard errors (in parentheses) are heteroskedasticity-robust. *, ** and *** indicate statistical significance at the 10, 5 and 1% level, respectively. The dummy for shallow and deep FTAs is classified with data on the depth of FTAs from which ranges from 1 to 5, where the shallow FTA dummy switches to one for depth >= 1 and the deep FTA dummy switches to one for depth >= 4. I.e., the shallow dummy gives the effect of having an FTA, the deep dummy gives the additional effect of having a deep agreement. ISIC sector 95 “Private Households with Employed Persons” not included in the estimations because there are no trade flows reported.
Table 4: Simulated changes of real income from TTIP

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<td>Deep</td>
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Note: * Member countries of the proposed Transatlantic Trade and Investment Partnership (TTIP).