Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Who Gains from a US–EU Free Trade Agreement? Relative Wages, Employment, and Welfare in General Equilibrium

Felix Adongo

felixado@buffalo.edu

University at Buffalo, State University of New York

Research Article

Keywords: TTIP, structural gravity model, general equilibrium, relative wages, labor market outcomes

Posted Date: August 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10069603/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Who Gains from a US–EU Free Trade Agreement? Relative Wages, Employment, and Welfare in General Equilibrium

Felix Adongo

University at Buffalo, SUNY

Abstract

This paper investigates the labor-market and welfare implications of the proposed Transatlantic Trade and Investment Partnership (TTIP) between the United States (US) and the European Union (EU) using a multi-country, multi-sector general equilibrium framework with endogenous labor mobility across sectors. Trade-cost changes associated with existing regional trade agreements (RTAs) and the hypothetical TTIP are estimated using a gravity model and subsequently incorporated into a general equilibrium framework solved in changes following the exact hat algebra approach. The analysis quantifies the effects of TTIP on relative wages, sectoral employment, consumer prices, and worker welfare across countries. The results indicate that TTIP would generate substantial gains for EU member states, particularly smaller and less-developed economies, through higher relative wages, lower consumer prices, and improved worker welfare. In contrast, the effects on the US are modest, with slight declines in relative wages but limited changes in overall welfare. Most non-member countries experience welfare losses as trade and production are diverted toward the integrated transatlantic market. The findings suggest that while TTIP would strengthen economic integration and improve labor-market outcomes within the EU, its benefits would be unevenly distributed across countries, creating winners and losers through trade diversion and changes in international competitiveness.

Keywords: TTIP; structural gravity model; general equilibrium; relative wages; labor market outcomes
JEL Classification Codes: F15; F16; F17; F14; J31

1 Introduction, Motivation, and Contribution

The proposed Transatlantic Trade and Investment Partnership (TTIP) between the United States and the European Union represented one of the most ambitious trade agreements ever contemplated, given the size of the economies involved and the breadth of policy areas under negotiation (Francois et al. (2015); European-Commission (2013); Felbermayr et al. (2015)). Although negotiations stalled in 2016, TTIP attracted considerable attention because of the economic size of its members and their central role in global trade. Proponents argued that the agreement would deepen transatlantic integration, stimulate economic growth, and generate substantial gains for workers and consumers (Francois et al. (2015)). On the other hand, critics emphasized adjustment costs, distributional concerns, and potential trade diversion from non-member countries (Capaldo (2014); Raza et al. (2014)). Given the scale of the proposed

agreement, understanding its implications for wages, employment, and welfare remains an important policy question.

While a large literature has documented the trade-creating effects of regional trade agreements (RTAs) (Bergstrand et al. (2015); Baier and Bergstrand (2004); Baier and Bergstrand (2007); Baier et al. (2019)), much less is known about how major trade agreements such as TTIP affect labor-market outcomes once economy-wide adjustments are taken into account. Trade integration alters relative prices, production patterns, and comparative advantage, leading to changes in the allocation of labor across sectors and the distribution of gains from trade (Helpman and Krugman (1987); Hakobyan and McLaren (2016); Autor et al. (2013)).

Given the unprecedented economic size of the US and the EU and their central roles in global trade, assessing the effects of TTIP requires a general equilibrium framework capable of capturing economy-wide adjustments beyond changes in bilateral trade flows. Such a framework is essential because the agreement would not only alter trade costs but also affect relative wages, sectoral employment, consumer prices, and worker welfare through changes in production patterns and resource allocation. Moreover, the scale of TTIP implies that its effects would extend well beyond member countries, generating important spillovers and trade-diversion effects for non-members. Consequently, a general equilibrium analysis is necessary to fully understand how the gains and losses from transatlantic integration would be distributed across countries and sectors in the global economy. This paper contributes to the literature by quantifying these effects and evaluating the labor-market and welfare consequences of TTIP for both member and non-member economies.

Evaluating these broader effects requires a framework capable of capturing the economy-wide adjustments generated by large trade agreements such as TTIP. Because changes in trade costs affect not only bilateral trade flows but also production patterns, labor allocation, consumer prices, and welfare across countries, partial-equilibrium approaches provide only a limited picture of the consequences of integration. Structural gravity models with solid micro-foundation have therefore become the leading approach for conducting general equilibrium trade-policy analysis (Anderson and Yotov (2016); Yotov et al. (2016); Anderson and Van Wincoop (2003); Head and Mayer (2014)).

The structural gravity framework has evolved substantially over the past four decades. Building on the Armington assumption of product differentiation by country of origin, Anderson (1979) first provided a micro-founded gravity equation linking bilateral trade flows to trade costs. Anderson and Van Wincoop (2003) subsequently established gravity as a fully specified general equilibrium system by introducing multilateral resistance terms. Later developments expanded the framework to incorporate alternative sources of comparative advantage and market structure. For example, Eaton and Kortum (2002) introduced technological differences as a source of Ricardian comparative advantage, while Caliendo and Parro (2015) incorporated firm heterogeneity and fixed export costs. More recently, Melitz (2008) extended the framework to a multi-sector environment with input-output linkages, and Anderson and Yotov (2016) developed a sectoral Armington gravity model well suited for evaluating trade-policy counterfactuals and their effects on wages, employment, and welfare. Together, these contributions have established structural gravity as the workhorse framework for quantitative trade-policy analysis.

Despite their differences in underlying assumptions and mechanisms, an important result in the quantitative trade literature is that the welfare gains from trade can often be summarized by a small set of sufficient statistics. In particular, Arkolakis et al. (2012) demonstrate that a broad class of trade models, including Armington, Ricardian, and firm-heterogeneity frame-

works, generate equivalent welfare formulas under certain conditions. Consequently, the choice of a structural gravity framework is typically guided not by differences in aggregate welfare predictions, but by the specific objectives and institutional features of the analysis. Given the focus of this study on relative wages, sectoral employment allocation, and worker welfare, a sectoral-Armington framework provides a particularly suitable setting for examining the labor-market consequences of TTIP and the distribution of gains and losses across countries.

Beyond its theoretical appeal, the Armington-based structural gravity framework has become a widely used tool for quantitative trade-policy analysis. A key advantage of the framework is its ability to translate estimated changes in trade costs into counterfactual predictions for trade flows, prices, and welfare under alternative policy scenarios. As emphasized by Costinot and Rodríguez-Clare (2014), quantitative trade models provide a tractable laboratory for evaluating the consequences of trade-policy changes that cannot be directly observed in the data. Building on this insight, Dekle et al. (2007) demonstrate how exact hat algebra can be used to solve counterfactual equilibria using observed trade shares and trade-cost shocks, thereby avoiding the need to estimate many unobservable structural parameters. More recently, structural gravity models have been extensively employed to evaluate the effects of trade agreements, tariffs, and other trade-policy interventions in general equilibrium settings (Yotov et al., 2016; Anderson and Yotov (2016)). These developments make the sectoral-Armington framework particularly well suited for analyzing the potential labor-market and welfare effects of TTIP, a policy experiment that was proposed but never implemented.

The existing literature on TTIP can broadly be divided into three strands. The first strand employs computable general equilibrium models to evaluate the effects of TTIP on trade, output, income, and welfare. Studies such as Francois et al. (2015) and Berden and Francois (2015) generally predict positive gains for member countries arising from lower trade barriers and deeper economic integration. A second strand uses structural gravity and quantitative trade models to estimate the effects of TTIP on trade flows, real income, and welfare in a general equilibrium setting (Felbermayr et al., 2015; Aichele et al. (2014); Egger et al. (2015)). These studies exploit the theoretical consistency and empirical tractability of structural gravity models to conduct counterfactual policy analysis, but their primary focus remains on aggregate trade and welfare outcomes. A third strand examines the broader macroeconomic and distributional implications of TTIP, emphasizing employment, income distribution, and adjustment costs (Capaldo (2014); Raza et al., 2014). While these studies provide important insights into the potential consequences of transatlantic integration, relatively little attention has been devoted to the labor-market mechanisms through which trade agreements affect economic outcomes. In particular, existing research offers limited evidence on how TTIP would influence relative wages, sectoral employment allocation, and worker welfare once labor is allowed to reallocate across sectors in response to changes in trade costs.

This paper contributes to the literature in three ways. First, it shifts attention from the trade and welfare effects of TTIP to its labor-market consequences by examining how changes in trade costs affect relative wages, sectoral employment allocation, and worker welfare. Second, it employs a sectoral-Armington general equilibrium framework with endogenous labor mobility across sectors, allowing the analysis to capture labor-market adjustments that are often overlooked in standard trade-policy evaluations. Third, the paper provides a comprehensive assessment of the distribution of gains and losses from transatlantic integration by quantifying the effects of TTIP on both member and non-member countries.

The empirical implementation proceeds in two stages. First, I estimate the trade effects of

RTAs and the counterfactual TTIP policy using an empirical gravity model estimated by Poisson pseudo-maximum likelihood (PPML) following Santos Silva and Tenreyro (2006). The gravity specification incorporates exporter-time, importer-time, and country-pair fixed effects to control for multilateral resistance terms, time-varying country-specific factors, unobserved bilateral trade costs, and potential policy endogeneity (Anderson and Yotov (2016); Anderson and Van Wincoop (2003); Baier and Bergstrand (2007); Bergstrand et al. (2015)). The estimated coefficients are then used to recover the implied changes in bilateral trade costs associated with RTAs and TTIP. In the second stage, these trade-cost changes are fed into a multi-country, multi-sector Armington general equilibrium model under a wage-endowment framework with endogenous labor allocation across sectors.

Following Dekle et al. (2007), the model is solved in exact hat algebra, i.e., in changes, allowing the counterfactual equilibrium to be computed without requiring the estimation of unobservable structural parameters in the model. Because labor is assumed to move freely across sectors within each country, wage differentials across sectors are eliminated in equilibrium. Workers reallocate toward sectors offering higher returns until a common wage prevails throughout the economy. Consequently, the model yields country-level changes in relative wages, while sectoral adjustments occur through changes in employment allocation rather than sector-specific wage differences (Dekle et al. (2007); Caliendo and Parro (2015)). Relative wages, sectoral employment, consumer prices, and worker welfare are determined by solving the market-clearing conditions of the model, where labor demand equals labor supply across sectors and countries. This approach links the estimated trade effects of RTAs and TTIP to their broader labor-market and welfare consequences through the general equilibrium adjustments induced by changes in trade costs.

The empirical procedure is applied to a panel of bilateral trade data covering 60 developed and emerging economies and nine manufacturing sectors over the period 1986–2018. The estimated trade effects are used to recover the implied changes in bilateral trade costs under both existing RTAs and the hypothetical TTIP. These trade-cost shocks are then combined with bilateral trade shares, labor compensation, employment data, expenditure shares, and sectoral production relationships to solve a multi-country, multi-sector general equilibrium system with endogenous labor mobility. The results reveal substantial heterogeneity in the labor-market effects of trade integration. Relative wages increase in 35 countries, with gains reaching 93% in Malta, 60.2% in Luxembourg, and 58.2% in Cyprus, while larger economies such as the United States and Canada experience declines of 29.2% and 8.8%, respectively. Consistent with trade theory, the analysis uncovers a strong negative relationship between country size and wage gains, suggesting that smaller and developing economies benefit disproportionately from trade integration.

The counterfactual TTIP simulations reveal substantial heterogeneity in labor-market outcomes across countries. While the agreement generates only modest effects for the US, where relative wages decline by about 24% compared to Australia, it produces sizeable gains for many EU member states, including Cyprus (60%), Ireland (48%), and Estonia (40%), with all EU countries experiencing higher relative wages. In contrast, many non-member countries experience wage losses due to trade diversion, particularly economies with strong trade links to the US, highlighting that the gains from transatlantic integration are concentrated among members and come partly at the expense of excluded economies. The results indicate that TTIP generates substantial welfare gains for EU member states through higher relative wages and lower consumer prices, with worker welfare increasing by more than 30% in countries such

as Slovenia, Lithuania, Cyprus, Slovakia, and Latvia. The gains from TTIP are partly offset by adverse spillovers on non-member countries. Several economies with strong trade ties to the United States experience declines in relative wages and welfare due to trade diversion, while consumer prices increase by as much as 5.6% in Singapore and welfare falls by approximately 2% in Mexico. These findings suggest that the benefits enjoyed by TTIP members come partly at the expense of excluded economies.

The remainder of the paper is organized as follows. Section (2) gives a succinct review of the sectoral-Armington general equilibrium model under a wage-endowment framework. Section (3) describes the data and its sources. Section (4) presents the empirical gravity model, estimation strategy, and estimates the changes in trade cost associated with existing RTAs. Section (5) presents the setup for estimating the hypothetical TTIP trade effect in a gravity model and constructs changes in trade costs associated with TTIP. Section (6) contains a brief calibration of the general equilibrium model and reports the general equilibrium effects of RTAs and TTIP on relative wages, sectoral employment, consumer prices, and worker welfare. Section (7) concludes.

2 Sectoral-Armington Model Environment

Consider a world of N countries and K sectors. In each sector, k, each country produces a good that is distinguishable by the place of origin and is tradeable to the rest of the world. Country i has labor in sector k, $\{L_i^k\}, i = 1,2,...,N$, and $k = 1,2,...,K$, and the total endowment of labor, which is the sum of labor across all sectors within a country, is $\bar{L}_i$. Labor is assumed to be internationally immobile but domestically mobile across sectors. For simplicity, the production function that is used in producing country i's good in sector k is given by:

$$F\left(A_i^k, L_i^k\right) = Q_i^k = A_i^k L_i^k \tag{1}$$

Here, A_i^k is the k sector's technology factor productivity of country i. From equation (1), producing one unit of output requires $1/A_i^k$ units of labor. The cost incurred from producing one additional unit of a good is given by w_i/A_i^k, where $w_i > 0$ is the wage received by labor in country i. Because L_i^k are endogenously determined by allowing labor mobility across sectors, wages are equalized across sectors, $w_i^1 = w_i^2 = \ldots = w_i^K$ for each country i. The value of domestic production denoted by Y_i^k in an economy is the value of the output, Q_i^k, at the domestic price p_i^k, which is the price of sector k's good at the factory gate, i.e., producer country i's price in the producer country without accounting for trade frictions. There are positive bilateral trade costs $t_{ij}^k \geq 1$, i.e., the bilateral trade cost of shipping sector k goods from country i to country j. Consumers in country j pay a delivered price $p_{ij}^k = p_i^k t_{ij}^k$, which is defined as the factory-gate price p_i^k marked up by bilateral trade costs, t_{ij}^k.[1] Markets are competitive, so the price at the factory gate is equal to the marginal cost of production, w_i/A_i^k. Consumers in destination

[1] Samuelson (1952) refers to t_{ij}^k as the ice-berg trade costs. To ship one unit of a good to destination j, country i must ship more than one unit of the good. A portion of the ice-berg melts, shipping goods from the origin to the destination. This implies $t_{ij}^k \geq 1$ with $t_{ij}^k = 1$ when the origin and destination countries are the same.

country j pay the delivered price given by equation (2).

$$p_{ij}^k = \left(\frac{w_i}{A_i^k}\right) t_{ij}^k \tag{2}$$

From the aspect of demand, consumer preferences are assumed to be homothetic, identical across all the N countries and K sectors, and approximated by a constant elasticity of substitution (CES) utility function of the country goods by sector, nested within a Cobb-Douglas utility function of the sectors for the destination country j in equation (3):

$$U_j = \prod_{k=1}^{K} \left[\left(\sum_i \left(\gamma_i^k\right)^{\frac{1-\sigma_k}{\sigma_k}} \left(c_{ij}^k\right)^{\frac{\sigma_k-1}{\sigma_k}} \right)^{\frac{\sigma_k}{\sigma_k-1}} \right]^{\alpha_k}, \tag{3}$$

where $\sigma_k > 1$ is the elasticity of substitution amongst different varieties of goods in sector k. α_k represents the Cobb-Douglas expenditure share on goods from each sector, which implies that $\sum_k \alpha_k = 1$. c_{ij}^k is country j's consumption of varieties of sector k goods shipped from i. $\gamma_i^k > 0$ is the CES preference parameter. According to Larch and Yotov (2016), it is a country-specific technology that enables some countries to produce more desirable goods than other countries.

2.1 Maximization of Consumer Preference

A representative consumer in country j maximize the CES Cobb-Douglas preference in equation (3) subject to the budget constraint in equation (4).

$$\sum_k \sum_i p_{ij}^k c_{ij}^k = \sum_k w_j L_j^k \tag{4}$$

Equation (4) implies that total expenditure on goods from all sectors in country j given by $\sum_k w_j L_j^k$ is equal to the total spending on varieties of goods in all sectors from all countries, including j itself. The right-hand side represents total income, and the left-hand side represents total spending. Maximizing the CES Cobb-Douglas utility in equation (3) subject to the budget constraint in equation (4), yields the Marshallian demand function or expenditure on sector k goods shipped from i to j:

$$X_{ij}^k = \left(\frac{\gamma_i^k p_{ij}^k}{P_j^k}\right)^{1-\sigma_k} \alpha_k \sum_k w_j L_j^k, \tag{5}$$

where X_{ij}^k is the expenditure on goods of sector k shipped from i to j. P_j^k is the CES price index, which aggregates the prices of goods from different countries within the same sector k, and is defined by:

$$P_j^k = \left(\sum_i \left(\gamma_i^k p_{ij}^k\right)^{1-\sigma_k} \right)^{\frac{1}{1-\sigma_k}} \tag{6}$$

Substitute out p_{ij}^k in equation (5) with equation (2) to obtain equation (7).

$$X_{ij}^k = \left(\frac{\gamma_i^k w_i t_{ij}^k}{A_i^k P_j^k}\right)^{1-\sigma_k} \alpha_k \sum_k w_j L_j^k \tag{7}$$

Equation (7) captures several intuitive economic relations. First, it shows a direct relationship between country j's demand for sector k goods from origin country i, X_{ij}^k, and the total expenditure in country j on goods from sector k, $\alpha_k \sum_k w_j L_j^k$. This relationship reflects the fact that bigger economies consume more of all varieties in sector k and vice versa, which underscores the importance of the size of countries and how it directly impacts trade flows as asserted by Tinbergen (1962).

Second, given that the elasticity of substitution amongst varieties of goods in sector k, $\sigma_k > 1$, there is an inverse relationship between X_{ij}^k and the delivered prices, $\left(w_i / A_i^k\right) t_{ij}^k$. This reflects the law of demand in which consumers in j decrease their demand for goods from i if the delivered prices increase. The price at the factory gate, w_i / A_i^k does not play a crucial role in this relationship. The mark-up of delivered price over the price at the factory-gate depends on the ice-berg trade costs t_{ij}^k. The relationship between X_{ij}^k and the delivered prices is intuitive because the demand of i's goods in j decreases in response to an increase in the cost of shipment. This relationship also affirms Tinbergen's assertion that distance and other trade costs drive a wedge between the trading pair and diminish the likelihood of trade.

Finally, there is a direct relationship between X_{ij}^k and the price index, P_j^k, which explains the idea of substitution effects and the concept of trade diversion. The more expensive the goods from the rest of the world are, the more consumers in country j will substitute away from them toward cheaper goods produced in country i. This relationship explains the concept of relative production efficiency, which induces trade patterns of countries, thereby resulting in trade diversion. The last two relationships depend on the value of the elasticity of substitution within sector k, σ_k. Larch and Yotov (2016) assert that the trade diversion effects, which are induced by the substitution of more expensive goods with cheaper goods, are amplified when bigger values of σ_k are used. Feasible values of σ_k based on the literature (see for a detailed discussion Anderson and Van Wincoop (2004)) are within 2 and 12; the typical value is 5 (Head and Mayer (2014)), and the standard value is 7 (Anderson et al. (2018)).

2.2 Baseline Equilibrium Condition

From the relationships between X_{ij}^k and the delivered prices and the CES price index, X_{ij}^k can be described as a trade flow of sector k good i to j. It is j's demand for sector k goods produced in i. The goods market-clearing condition in equation (8) equates origin country i's production of the good in sector k to destination country j's demand for sector k goods. The labor market clearing condition in equation (9) equates the sum of labor for all sectors to the total labor endowment for each country i.

$$Y_i^k = \sum_j X_{ij}^k \tag{8}$$

$$\sum_k L_i^k = \bar{L}_i \tag{9}$$

Substitute equation (7) into equation (8) and replace Y_i^k with $w_i L_i^k$ and obtain equation (10).

$$w_i L_i^k = \sum_j \left(\frac{\gamma_i^k w_i t_{ij}^k}{A_i^k P_j^k} \right)^{1-\sigma_k} \alpha_k \sum_k w_j L_j^k \tag{10}$$

Substituting equation (6) into the expression for P_j^k yields the market-clearing condition in

terms of the model's unknown parameters.

$$w_i L_i^k = \sum_j \frac{\left(\frac{\gamma_i^k w_i t_{ij}^k}{A_i^k}\right)^{1-\sigma_k} \alpha_k \sum_{k'} w_j L_j^k}{\sum_{i'} \left(\frac{\gamma_{i'}^k w_{i'} t_{i'j}^k}{A_{i'}^k}\right)^{1-\sigma_k}} \tag{11}$$

To evaluate the effects of RTAs and the counterfactual TTIP policy, the market-clearing condition is next expressed under the counterfactual equilibrium. Following Dekle et al. (2007), the model is solved in changes, where bilateral trade costs are shocked according to the estimated trade effects obtained from the gravity model. The counterfactual market-clearing condition links changes in trade costs to changes in wages, sectoral employment, prices, and welfare, while ensuring that labor demand equals labor supply in each country. Solving this system yields the new equilibrium allocation of labor and production, allowing the general equilibrium effects of TTIP on relative wages, employment, prices, and worker welfare to be quantified.

2.3 Counterfactual Equilibrium: Solving in Changes

A key advantage of this approach is that it expresses the counterfactual equilibrium relative to the observed baseline equilibrium, allowing parameters that are invariant to the policy experiment, such as production technology parameters A_i^k and CES preference parameters, γ_i^k, to cancel out. As a result, the analysis can focus directly on how trade-cost changes induced by TTIP affect relative wages, sectoral employment allocation, consumer prices, and worker welfare without requiring the estimation of many unobservable structural parameters. Consider the trade equilibria for the goods and labor markets in equations (11) and (9), respectively.

$$w_i^e L_i^{ke} = \sum_j \frac{\left(\frac{\gamma_i^k w_i^e t_{ij}^{ke}}{A_i^k}\right)^{1-\sigma_k} \alpha_k \sum_{k'} w_j^e L_j^{ke}}{\sum_{i'} \left(\frac{\gamma_{i'}^k w_{i'}^e t_{i'j}^{ke}}{A_{i'}^k}\right)^{1-\sigma_k}} : e = \begin{cases} b: & \text{baseline} \\ c: & \text{counterfactual} \end{cases}$$

$$\sum_k L_i^{ke} = \bar{L}_i : e = \begin{cases} b: & \text{baseline} \\ c: & \text{counterfactual} \end{cases}$$

Let the wage, employment, and trade costs in the baseline equilibrium where TTIP is not imposed be w_i^b, L_i^{kb}, and t_{ij}^{kb} respectively. Let the wage, employment, and trade costs in the counterfactual equilibrium where TTIP is imposed be w_i^c, L_i^{kc}, and t_{ij}^{kc} respectively. Therefore, the changes in trade costs, wages, and employment in response to imposing a trade agreement between the US and the EU are given by t_{ij}^{kc}/t_{ij}^{kb}, w_i^c/w_i^b, and L_i^{kc}/L_i^{kb} correspondingly. Solving the equilibrium conditions in changes yields equations (12) and (13).

$$w_i^b L_i^{kb} \hat{w}_i \hat{L}_i^k = \sum_j \frac{S_{ij}^{kb} \left(\hat{w}_i \hat{t}_{ij}^k\right)^{1-\sigma_k} \left(\alpha_k \sum_{k'} w_j^b L_j^{kb} \hat{w}_j \hat{L}_j^{k'}\right)}{\sum_{i'} S_{ij}^{kb} \left(\hat{w}_{i'} \hat{t}_{i'j}^k\right)^{1-\sigma_k}} \tag{12}$$

$$\sum_k L_i^{kb} \hat{L}_i^k = \bar{L}_i \tag{13}$$

where $S_{ij}^{kb} = \frac{\left(\frac{\gamma_i^k w_i^b}{A_i^k}\right)^{1-\sigma_k} \left(t_{ij}^{kb}\right)^{1-\sigma_k}}{\sum_{i'} \left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}}$. See the Appendix for the full derivation of the equilibrium in changes. $\hat{w}_i = w_i^c / w_i^b$, $\hat{w}_j = w_j^c / w_j^b$, $\hat{L}_i^k = L_i^{kc} / L_i^{kb}$, $\hat{L}_j^{kb} = L_j^{kc} / L_j^{kb}$, and $\hat{t}_{ij}^k = t_{ij}^{kc} / t_{ij}^{kb}$

Equation (12) determines the counterfactual wage changes $\hat{w}_i$ and sectoral employment changes $\hat{L}_i^k$ that are consistent with changes in trade costs. Given the trade-cost shocks $\hat{t}_{ij}^k$, bilateral expenditure shares adjust, causing some sectors and countries to expand while others contract. As demand shifts across sectors, labor demand changes accordingly. Equation (13) ensures that the total labor employed across all sectors equals the country's fixed labor endowment. Since labor is mobile across sectors, workers move from contracting sectors to expanding sectors until labor demand equals labor supply. The two equations are solved simultaneously. Equation (12) determines how trade-cost changes affect sectoral labor demand, while Equation (13) imposes the constraint that the country's total labor supply remains fixed. The equilibrium wage $\hat{w}_i$ adjusts until labor-market clearing holds, yielding counterfactual changes in relative wages, sectoral employment allocation, and ultimately consumer prices and worker welfare.

3 Data

The dataset covers 60 countries from 1986 to 2018 and includes a mix of advanced, emerging, and selected developing economies. The sample contains all 27 European Union (EU) member states, 38 members of the Organization for Economic Cooperation and Development (OECD), and several developing economies, including Argentina, Bangladesh, Indonesia, Morocco, and Uruguay. Collectively, these countries account for approximately 85% of global exports and 86% of global GDP during the sample period, making the dataset highly representative of world trade and economic activity. Following Cheng and Wall (2005), I employ four-year intervals rather than annual data to allow sufficient time for trade flows to adjust to policy changes. The analysis therefore uses observations for 1986, 1990, 1994, 1998, 2002, 2006, 2010, 2014, and 2018. The year 2022 is excluded due to the unavailability of wage and sectoral employment data.

Bilateral trade data are obtained from the United Nations COMTRADE database and aggregated to the 1-digit Standard International Trade Classification (SITC) level. The analysis focuses on nine broad sectors: chemicals, food, machinery, metals, minerals, textiles, vehicles, wood and paper products, and other manufacturing. Aggregation at the 1-digit level reduces the prevalence of zero trade flows and facilitates comparisons across major industries. Trade flows are measured as free-on-board (FOB) export values in current US dollars.

Data on wages and sectoral employment are sourced from the United Nations Industrial Development Organization (UNIDO) INDSTAT 2 database (ISIC Revision 4), which provides consistent information on employment, wages and salaries, output, and value added across manufacturing industries. The 2-digit ISIC classification can be readily mapped into the nine SITC sectors used in the analysis, making it more suitable than higher-digit industrial classifications for constructing a consistent multi-country panel.

Information on regional trade agreements (RTAs) is obtained from the World Trade Organization's RTA database. The sample includes 127 active RTAs involving countries in the

dataset, including major agreements such as the EU, NAFTA (USMCA), ASEAN Free Trade Area, the European Free Trade Association, and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. RTAs formed after 2018 or involving countries outside the sample are excluded from the analysis.

4 Estimation of RTA Trade Effects

4.1 Empirical Specification of Gravity

Following Anderson and Yotov (2016), I add the empirical gravity model by incorporating two binary indicators that distinguish RTAs formed between country pairs with high and low most-favored-nation (MFN) import tariffs. The motivation is that the trade effects of RTAs may depend on the level of pre-existing trade barriers. As argued by Anderson and Yotov (2016), trade agreements are likely to generate larger trade responses among countries with initially high MFN tariffs because tariff reductions produce greater declines in import costs and larger changes in relative prices. These changes stimulate import demand and strengthen bilateral trade flows. To capture this heterogeneity, the gravity specification allows the effects of RTAs to vary according to the MFN tariff environment prevailing before the agreement. The resulting empirical model is presented in equation (14).

$$X_{ij,t}^k = exp\left(\sum_{m=0}^{L} \beta_m^k RTA_{ij,(t-4m)} + \sum_{S\in(L,H)} \beta_S^k RTA_MFN_S_{ij,t}^k + \lambda_{i,t}^k + \mu_{j,t}^k + \pi_{ij}^k\right)\epsilon_{ij,t}^k \quad (14)$$

$RTA_{ij,t}$ is a binary variable that equals one if there is a trade agreement between i and j at time t, and zero otherwise. The contemporaneous effect of RTAs on trade flow between country pair i and j at time t is represented by β_0^k, i.e., when $m = 0$. The terms $RTA_{ij,(t-4)}$, $RTA_{ij,(t-8)}$, ..., $RTA_{ij,(t-4L)}$ capture the effects of RTAs on trade flow in the subsequent periods (four years, eight years, and so on), with their corresponding coefficients β_4^k, β_8^k, ..., β_L^k. The sum $\sum_{m=0}^{L}\beta_m^k$ represents the cumulative trade effect of RTAs, while $\sum_{m=1}^{L}\beta_m^k$ reflects the post-enactment trade effects of RTAs (Magee (2008)).

$RTA_MFN_L_{ij,t}^k$ is a sector-specific binary variable that equals one when an RTA is formed between a pair with a previously low MFN tariff, and zero otherwise. The term $RTA_MFN_H_{ij,t}^k$ is another sector-specific binary variable that equals one when an RTA is formed between a pair with a previously high MFN tariff, and zero otherwise.[2] The terms β_L^k and β_H^k are the coefficients associated with the low and high tariff categories, respectively.

The term $\lambda_{i,t}^k$ represents the exporter-time fixed effect, which accounts for both observed and unobserved factors specific to the exporting country i and changes over time t, capturing the outward multilateral resistances. Similarly, $\mu_{j,t}^k$ is the importer-time fixed effect, which controls for both observed and unobserved factors that are specific to the importing country j and time t, representing the inward multilateral resistances. These two high-dimensional fixed effects control for country- and time-specific factors such as technological differences, shifts in consumer preferences, population growth, natural disasters, and macroeconomic policy

[2]If the MFN tariff on the imported good is 5% or below, it is classified as a low tariff. If the MFN import tariff exceeds 10%, it is classified as a high tariff. If the MFN tariff is between 5% and 10% inclusive, it is classified as a medium tariff. The binary variable for medium tariffs is dropped and serves as the reference group, against which the other two variables are compared.

shocks that can influence trade. π_{ij}^k is the country-pair fixed effect, which absorbs all variables, both observed and unobserved, that change between the two countries but remain constant over time, such as geographical distance, shared borders, colonial ties, and cultural or political similarities. Finally, $\epsilon_{ij,t}^k$ is the idiosyncratic multiplicative error term, capturing unobserved trade cost factors that are specific to the country pair and vary over time.

4.2 Identification Challenges

Equation (14) addresses key identification challenges in estimating the effects of RTAs on trade flows. First, the issue of zero trade flows and the concern over heteroskedastic trade data are resolved by estimating the gravity model in its multiplicative form using the PPML estimator, rather than log-linearizing and using ordinary least squares (see Santos Silva and Tenreyro (2006) and Santos Silva and Tenreyro (2010)). Second, the potential endogeneity of RTAs and the two-way causality between RTAs and trade flows are tackled by including country-pair fixed effects, π_{ij}^k, in a panel data setting (Magee (2008), Bergstrand et al. (2015), and Yotov et al. (2016)). The country-pair fixed effects are crucial for isolating the bilateral trade cost effects in the absence of RTAs. These fixed effects capture both observable and unobservable bilateral trade cost factors that are constant over time. Third, to address unobservable multilateral resistance terms, as well as output, expenditure, and other time-varying factors, the model includes exporter-time and importer-time fixed effects (Anderson and Van Wincoop (2003) and Baier and Bergstrand (2001)). To account for the gradual phase-out of RTAs, which typically occurs after about a decade of implementation (Baier and Bergstrand (2007)), the model allows RTAs to phase in over time, capturing the evolution of their trade effects (Magee (2008) and Bergstrand et al. (2015)). This also reflects the gradual adjustment of economic agents to the new conditions created by the implementation of RTAs (Anderson and Yotov (2016)). Finally, in response to Cheng and Wall (2005)'s argument that trade flows do not adjust instantaneously to changes in trade policies, such as the formation of RTAs, I use four-year data intervals instead of pooling data over consecutive years.

4.3 Estimating the Changes in Trade Costs

To compute the changes in wages and sectoral employment at equilibrium using equations (12) and (13), we need to estimate the bilateral trade costs with and without the presence of RTAs. The ratio of bilateral trade cost estimates with RTAs to the trade cost estimates without RTAs yields the changes in trade cost estimates. Equation (15) produces the estimates of bilateral trade costs in the presence of RTAs. Equation (15) is obtained from the empirical gravity model in equation (14). It uses trade cost estimates, including estimates of country-pair fixed effects from the model in equation (14), to compute the bilateral trade costs between a country-pair. The trade cost equation is expressed in exponential form because the empirical gravity model is often log-linearized. Moreover, the exponential function ensures that the estimates of trade costs are strictly positive.

$$\left(\tilde{t}_{ij}^{k(RTAs)}\right)^{1-\sigma_k} = exp\left(\sum_{m=0}^{L} \tilde{\beta}_m^k RTA_{ij,(t-4m)} + \sum_{S\in(L,H)} \tilde{\beta}_S^k RTA_MFN_S_{ij,t}^k + \tilde{\pi}_{ij}^k\right) \tag{15}$$

$\tilde{\pi}_{ij}^k$ are the estimates of the country-pair fixed effects from an estimated empirical gravity

model. Anderson and Yotov (2016) and Egger et al. (2011) provide two-step procedures to estimate a full set of $\tilde{\pi}_{ij}^{k}$ even under the presence of zero trade flows between country pairs throughout the investigation. Estimating a full set of $\tilde{\pi}_{ij}^{k}$ is unnecessary in this setup, since they cancel out when computing changes in trade costs arising from the formation of RTAs. Equation (16) recovers the trade-cost term implied by the gravity model under a counterfactual scenario in which all RTA effects are set equal to zero. This corresponds to a world without RTAs, holding all other bilateral determinants of trade constant.[3]

$$\left(\tilde{t}_{ij}^{k(NORTAs)}\right)^{1-\sigma_k} = exp\left(\tilde{\pi}_{ij}^{k}\right) \tag{16}$$

The changes in trade costs due to RTAs are estimated using equations (15) and (16) shown below in equation (17).

$$\left(\hat{t}_{ij}^{k}\right)^{1-\sigma_k} = \frac{\left(\tilde{t}_{ij}^{k(RTAs)}\right)^{1-\sigma_k}}{\left(\tilde{t}_{ij}^{k(NORTAs)}\right)^{1-\sigma_k}} = exp\left(\sum_{m=0}^{L}\tilde{\beta}_{m}^{k}RTA_{ij,(t-4m)} + \sum_{S\in(L,H)}\tilde{\beta}_{S}^{k}RTA_MFN_S_{ij,t}^{k}\right) \tag{17}$$

5 The Counterfactual Setup: The Potential TTIP Effect

To evaluate the counterfactual effects of the TTIP, I augment the empirical gravity model with a binary indicator capturing trade integration between the US and the 27 member states of the EU. The variable, $TTIP_{ij,t}$, takes the value of one for US–EU country pairs in 2014 and 2018 and zero otherwise.[4] The corresponding gravity specification, presented in equation (18), is used to estimate the trade effects of TTIP while maintaining all existing RTAs. Thus, the counterfactual experiment assesses the incremental impact of introducing TTIP on top of the prevailing network of regional trade agreements.

$$X_{ij,t}^{k} = exp\left(\sum_{m=0}^{L}\beta_{m}^{k}RTA_{ij,(t-4m)} + \sum_{S\in(L,H)}\beta_{S}^{k}RTA_MFN_S_{ij,t}^{k} + \beta_{TTIP}^{k}TTIP_{ij,t} + \lambda_{i,t}^{k} + \mu_{j,t}^{k} + \pi_{ij}^{k}\right)\epsilon_{ij,t}^{k} \tag{18}$$

The term β_{TTIP}^{k} is the coefficient associated with the TTIP binary variable, which is estimated from equation (18). Equation (19) gives the estimated trade-cost component implied by the gravity model under the TTIP counterfactual.

$$\left(\tilde{t}_{ij}^{k(TTIP)}\right)^{1-\sigma_k} = exp\left(\sum_{m=0}^{L}\tilde{\beta}_{m}^{k}RTA_{ij,(t-4m)} + \sum_{S\in(L,H)}\tilde{\beta}_{S}^{k}RTA_MFN_S_{ij,t}^{k} + \tilde{\beta}_{TTIP}^{k}TTIP_{ij,t} + \tilde{\pi}_{ij}^{k}\right) \tag{19}$$

The estimates of trade costs in a world without TTIP are obtained by equation (15), i.e., removing the term $\tilde{\beta}_{TTIP}^{k}TTIP_{ij,t}$ in equation (19). Therefore, the changes in trade costs associated with TTIP are obtained by taking the ratio of equation (19) to equation (15), as shown in

[3] In this section, the hat notation represents estimated values, which differ from its usage in the previous section, where it indicated changes in those estimates.

[4] The counterfactual analysis focuses on 2014 and 2018 because these years correspond to the period in which TTIP was actively negotiated and widely discussed as a major trade-policy initiative. Since negotiations formally began in 2013 and effectively stalled after 2016, these benchmark years provide a natural setting for evaluating the potential economic effects of the agreement under contemporary global trade conditions.

equation (20).

$$\left[\left(\hat{t}_{ij}^{k}\right)^{TTIP}\right]^{1-\sigma_k} = \frac{\left(\tilde{t}_{ij}^{k(TTIP)}\right)^{1-\sigma_k}}{\left(\tilde{t}_{ij}^{k(NOTTIP)}\right)^{1-\sigma_k}} = exp\left(\tilde{\beta}_{TTIP}^{k} TTIP_{ij,t}\right) \tag{20}$$

The change in trade costs associated with the TTIP policy is recovered by exponentiating the product of the TTIP indicator and its estimated trade elasticity obtained from the structural gravity model in equation (18). This procedure converts the estimated trade effect of TTIP into an implied trade-cost shock that can be introduced into the general equilibrium model. The same approach is used to construct trade-cost changes for other trade agreements, including the EU, NAFTA, and other major RTAs.

6 Calibration of the General Equilibrium Model

6.1 Parameterization and Calibration

Having recovered the trade-cost changes associated with RTAs and the hypothetical TTIP policy, the next step is to solve the sectoral Armington general equilibrium model in changes. Following Dekle et al. (2007), the model is expressed in exact hat algebra and requires several key inputs in addition to the estimated trade-cost shocks. These include the country-and sector-specific Cobb-Douglas expenditure shares, α_k, which capture the allocation of expenditure across sectors. These Cobb-Douglas expenditure shares are estimated from observed trade flows by dividing sector-level imports by total imports for each country-year pair, ensuring that sectoral shares sum to unity across the nine manufacturing sectors. The sectoral elasticity of substitution parameters. σ_k, which govern the substitutability of goods from different countries within each sector. According to Anderson and Van Wincoop (2004) and Anderson et al. (2018), 6 is the standard value of σ_k. We also need data on the baseline bilateral trade shares, S_{ij}^{kb}, which are obtained from trade flows, and data on sectoral wages, w_i^b, and employment, L_i^{kb}, that characterize the initial equilibrium. Together, these inputs allow the market-clearing conditions to be solved under the counterfactual trade-cost scenarios, yielding the resulting changes in relative wages, sectoral hiring, consumer prices, and welfare across countries.

With the trade-cost changes recovered from the sector-specific RTA and TTIP estimates, and the corresponding values of the Cobb-Douglas expenditure shares, elasticity of substitution parameters, bilateral trade shares, baseline wages, and sectoral employment, the sectoral-Armington general equilibrium model can be solved in changes. The estimated trade-cost shocks are introduced into the equilibrium system to evaluate how trade integration affects labor-market outcomes and welfare across countries. I first quantify the general equilibrium effects of existing RTAs on relative wages, sectoral employment, consumer prices, and worker welfare. I then conduct a counterfactual analysis of TTIP by introducing the estimated TTIP trade-cost changes while maintaining all existing RTAs in force. This approach allows the comparison of outcomes under the prevailing trade-policy environment with those under a hypothetical transatlantic integration scenario, thereby isolating the incremental effects of TTIP on member and non-member countries.

6.2 The GE Effect of RTAs on Relative Wages and Sectoral Employment

Wages are relative prices, and relative prices are only determined up to a scale. This means that if all wages in the economy were doubled, nothing real would change because only the ratios of wages across countries matter. Consequently, the general equilibrium system cannot uniquely determine the absolute level of wages and requires one country's wage to be fixed as a reference point, or numeraire, to anchor the solution. To facilitate interpretation and ensure identification of the equilibrium solution, Austria is chosen as the numeraire country, and its wage is normalized to one. As a result, the reported wage changes should be interpreted as changes relative to Austrian wages, with values above (below) one indicating wage gains (losses) relative to Austria. Countries with missing information on baseline wages or sectoral employment are excluded from the equilibrium calculations for the corresponding year.

Table (1) shows the estimated trade effects of RTAs combining all sectors. Table (2) disaggregates the sectors into nine. All tables and figures in this paper can be found in the Appendix. Table (3) reports the general equilibrium effects of RTAs on relative wages and sectoral employment in 2006. The results reveal substantial heterogeneity across countries. Relative wages increase in 35 of the countries in the sample, with gains ranging from 0.4% in Switzerland to 93% in Malta. Several smaller European economies experience particularly large gains, including Cyprus (58.2%), Luxembourg (60.2%), and Malta (93%), while developing economies such as Chile (43.6%) and Uruguay (51.4%) also benefit substantially. In contrast, relative wages decline in 19 countries. The largest losses are concentrated among major economies, with Canada experiencing an 8.8% decline and the US recording the largest reduction at 29.2%. Other large economies, including Germany, the United Kingdom, France, Italy, Japan, China, Russia, Brazil, Spain, and India, also experience notable declines in relative wages.

A striking pattern emerging from the results is the strong negative relationship between relative wage changes and country size. Smaller and developing economies generally experience larger wage gains, whereas larger and more advanced economies exhibit smaller gains or relative wage losses. This relationship is illustrated in Figure (1) and formally examined in Table (4), which reveals a statistically significant negative association between relative wage changes and GDP across all years considered in the analysis. For example, in 1998, a 1% increase in GDP is associated with a 0.113% decline in relative wages, suggesting that larger economies tend to experience smaller wage gains, or larger wage losses, from trade integration than smaller economies. At the extremes, Malta, one of the smallest economies in the sample, records among the largest wage gains, while the United States, the largest economy, experiences the largest relative wage decline.

These findings are consistent with standard trade theory. Trade integration allows smaller and developing economies to benefit from greater specialization in labor-intensive activities, increased productivity, and stronger labor demand, leading to relatively large wage gains. In contrast, larger and more advanced economies, which tend to specialize in capital- and technology-intensive sectors, experience more modest wage responses. The results therefore suggest that the labor-market benefits of RTAs are distributed unevenly across countries, with smaller economies generally experiencing the largest relative wage improvements. Changes in employment are examined at the sectoral level under the assumption of intersectoral labor mobility. The results reveal substantial heterogeneity across countries and industries, suggesting that RTAs affect labor allocation by altering comparative advantage and sectoral competitiveness. Unlike the wage results, which display a clear negative relationship with country size, employment adjustments vary considerably across sectors and countries.

Employment gains are concentrated in sectors such as chemicals, food processing, metals, and vehicle manufacturing, particularly among labor-abundant and emerging economies. In contrast, employment declines are more common in several advanced economies and in sectors characterized by increasing automation and capital intensity. The metal sector, for example, exhibits strong employment growth in labor-abundant countries, while the vehicle sector benefits from production fragmentation and global value chains that redistribute manufacturing activity across countries. The textiles and wood sectors display more mixed outcomes. Despite being traditionally labor-intensive, textile employment has declined in many countries, possibly reflecting increasing automation and standardization of production processes. Similarly, employment changes in wood and paper manufacturing vary across countries, likely due to differences in technological adoption and capital intensity. Overall, the findings suggest that RTAs generate substantial sectoral labor reallocation, with employment outcomes shaped by comparative advantage, productivity growth, technological change, and outsourcing. Similar patterns are observed in 2010, 2014, and 2018, indicating that these effects are broadly persistent over time.

6.3 General Equilibrium Effect of TTIP on the US

Table (5) compares the general equilibrium effects of the counterfactual TTIP and the existing NAFTA arrangement on relative wages and sectoral employment in the US for 2014 and 2018. Columns (1) and (3) report the estimated outcomes under TTIP, while columns (2) and (4) present the corresponding results under NAFTA. Panel I summarizes the effects of the two trade agreements on US relative wages, whereas Panel II reports employment changes across the nine manufacturing sectors. In all cases, wages are measured relative to Australia, whose wage is normalized to unity.

It is important to note that the TTIP counterfactual is evaluated in the presence of all existing RTAs, meaning that the agreement is introduced on top of the prevailing trade-policy environment. The results indicate that, had TTIP been implemented in 2014, the relative wage of US workers would have fallen by 23.7% relative to Australian workers. Under the existing NAFTA arrangement, the corresponding decline is slightly smaller at 23.4%. Although the difference is modest, it suggests that US workers fare marginally better under NAFTA than under the TTIP counterfactual. A similar pattern emerges in 2018, with relative wages declining under both scenarios and NAFTA outperforming TTIP by approximately 0.3%. Overall, the results suggest that TTIP would provide little additional benefit to US workers beyond those already generated by existing trade agreements. Relative to Australia, the decline in US wages is slightly larger under TTIP than under NAFTA, implying that the gains from deeper transatlantic integration accrue primarily to EU member states rather than to the US. Consequently, from the perspective of relative wages, the combination of TTIP and existing RTAs appears somewhat less favorable for US workers than maintaining the existing NAFTA framework alone.

Panel II reports the sectoral employment effects of TTIP and NAFTA in the US. The results indicate that TTIP generates slightly larger employment gains than NAFTA in a number of sectors where the US enjoys a strong comparative advantage. In the chemical sector, employment increases by approximately 119% under TTIP, compared with 118.3% under NAFTA in 2014. The advantage of TTIP over NAFTA amounts to 0.7% in 2014 and widens to 1.2% by 2018. Similar patterns are observed in the food sector, where employment gains under TTIP exceed those under NAFTA by 1.1% in 2014 and 0.9% in 2018. Employment in the wood and paper

sector also rises under TTIP, reflecting the relatively strong competitive position of US producers in these industries. Relative to NAFTA and other existing RTAs, TTIP generates approximately 0.5% more employment growth in this sector.

By contrast, employment outcomes are slightly more favorable under NAFTA in the machinery, minerals, textiles, and vehicle sectors. One possible explanation is that, with the exception of textiles, these industries are relatively capital-intensive and benefit from well-established production networks with geographically proximate trading partners. Canada and Mexico possess production structures that are closely integrated with those of the United States, particularly in machinery, vehicles, and mineral-based industries, allowing firms to take advantage of lower transportation costs and more efficient cross-border supply chains. As a result, these sectors perform marginally better under the existing NAFTA framework than under the TTIP counterfactual. Overall, the results suggest that TTIP would modestly reallocate employment toward sectors in which the US possesses stronger export competitiveness, particularly chemicals, food processing, and wood products. At the same time, the agreement appears to provide relatively smaller gains in several capital-intensive industries that are already deeply integrated with North American production networks. Although the differences between TTIP and NAFTA are generally modest, the findings indicate that TTIP would complement rather than fundamentally alter the sectoral employment effects generated by existing trade agreements.

6.4 General Equilibrium Effect of TTIP on the EU

Table (6) reports the general equilibrium effects of the counterfactual TTIP on relative wages and employment across EU member states in 2014 and 2018 and compares these outcomes with those generated by the existing EU trade regime. Columns (1) and (4) present the results under TTIP for 2014 and 2018, respectively, while columns (2) and (5) report the corresponding outcomes under the existing EU trade policy. Columns (3) and (6) show the incremental effects of TTIP, calculated as the difference between the TTIP and EU scenarios. In all cases, wages are expressed relative to Australia, whose wage is normalized to unity.

The TTIP simulations reveal substantial heterogeneity in wage outcomes across EU member states. Germany experiences the largest decline in relative wages, with wages falling by 19.1% relative to Australian workers. Other large EU economies also record wage declines, including France (-9.6%), Italy (-7.7%), Spain (-2.3%), and Poland (-0.5%). In contrast, several smaller EU economies experience sizeable gains. Cyprus records the largest increase in relative wages at 60%, followed by Ireland (48%), Estonia (40%), and Latvia, Slovenia, and Slovakia, each of which experiences gains of approximately 38%. These results suggest that the benefits of TTIP are concentrated among smaller EU economies, while the larger member states experience comparatively weaker wage performance. Consistent with findings from Table (3), these results suggest a negative relationship between relative wage changes and country size. Larger economies like Germany tend to see larger declines in relative wages, while smaller economies like Cyprus experience the greatest gains. Malta and Luxembourg are excluded from the 2014 analysis due to missing data on baseline wages, employment, or both.

Under the existing EU trade regime, German workers experienced a 19.8% decline in relative wages compared to Australian workers in 2014, representing the largest wage reduction among EU member states. In contrast, Cyprus and Ireland emerged as the primary beneficiaries, each recording a 44.4% increase in relative wages. More broadly, the results indicate that relative wage gains tend to be larger in smaller and less-developed EU economies than in the more

advanced member states. This pattern is consistent throughout the analysis and likely reflects differences in factor endowments. Advanced economies are generally more capital-abundant and therefore rely less intensively on labor in production, resulting in weaker labor-demand responses to trade integration. By comparison, smaller and relatively labor-abundant economies experience stronger increases in labor demand, translating into larger relative wage gains.

Column (3) reports the incremental effects of TTIP relative to the existing EU trade policy. The results show that all EU member states would experience higher relative wages under TTIP, with gains ranging from 0.7% in Germany to 28.9% in Slovenia in 2014. Thus, relative to the existing trade regime, Slovenian workers would enjoy nearly a 29% improvement in relative wages under the TTIP counterfactual. These findings suggest that TTIP would generate additional labor-market benefits for all EU member states beyond those already provided by existing RTAs, particularly EU trade agreements. Although the magnitude of the gains is somewhat smaller in 2018, reflecting increased competition and changing trade conditions, relative wages remain uniformly higher under TTIP than under the existing EU trade framework.

In summary, the TTIP trade policy appears to benefit EU workers, with relative wage gains ranging from nearly 1% for German workers to about 29% for Slovenian workers in 2014. On the other hand, US workers could experience a marginal decline in relative wages. This could be because EU countries are more export-driven, which leads to greater production expansion and higher wage increases in export sectors compared to the US, which is more import-driven. Employment in the US may see modest growth in labor-intensive sectors but could decline slightly in most capital-intensive sectors. If TTIP focuses more on liberalizing trade in labor-intensive sectors and less on capital-intensive ones, it could boost employment growth between the US and the EU. However, the implementation of TTIP could pose challenges for labor markets in non-member countries, affecting relative wages and employment growth outside the agreement.

6.5 General Equilibrium Effect of TTIP on Non-Member Countries

The results indicate that non-member countries generally experience adverse labor-market effects under the TTIP counterfactual, particularly those with strong pre-existing trade linkages to the US. Costa Rica emerges as the most adversely affected economy, with relative wages declining by 16.3%, followed closely by Singapore with a 15.5% reduction. Significant wage losses are also observed in the Philippines, Malaysia, and South Korea, where relative wages fall by between 13% and 15%. These outcomes are consistent with the trade-diversion effects associated with large regional trade agreements. As trade barriers between the US and the EU are reduced, a portion of trade and production is redirected away from existing non-member partners toward TTIP members. As a result, the wages of workers in export-driven sectors in these non-member countries could decrease due to lower productivity in these sectors. Consequently, countries that rely heavily on access to the US market experience weaker export demand, reduced labor demand, and lower relative wages. The findings therefore suggest that the gains enjoyed by TTIP members would come partly at the expense of several non-member economies that are closely integrated into US trade networks.

Among the 11 non-member countries that experienced gains in relative wages in 2014, only three saw significant increases above 10%, including New Zealand with a 10.2% gain, Peru with 16.5%, and Chile with 24.2%. These gains are consistent with trade theory. One possible explanation is that these non-member countries may not be major trade partners with either

the US or the EU, allowing them to benefit from trade diversion by increasing their exports to other non-members. This could lead to an improvement in the relative wages of their workers in export-led sectors.

Although wage gains for member countries decreased from 2014 to 2018, the number of non-member countries that experienced gains dropped from 11 in 2014 to just 5 in 2018. This suggests that trade diversion intensified over time, with more countries losing out as a result. Chile, Peru, and Iceland experience wage gains between 12% and 15%. Similar to 2014, the diversion of US trade to EU countries harms workers in many non-member countries. For instance, workers in Bangladesh face a nearly 36% decline in relative wages, while workers in Costa Rica, a major US trading partner in Central America, see a 27.4% decrease. In addition, workers in Canada and Mexico, both US trade partners under NAFTA, experience wage declines of 3.1% and 4.3%, respectively. Wage changes among non-EU countries in Europe are mixed. Workers in Switzerland experience a mild decline of 6.2% in relative wages, and Norwegian workers face a marginal decrease. These results could be attributed to trade diversion, where EU members shift trade away from non-EU European destinations to the US, affecting relative wages in those non-EU countries.

6.6 Welfare Implications of TTIP

Worker welfare is measured using real wages. Specifically, the welfare effect of RTAs is captured by the proportional change in the utility of workers in country j, denoted by $\hat{U}_j$, which is defined as the ratio of utility under TTIP regime, U_j^c, to utility in the baseline scenario without the implementation of TTIP, U_j^b. Intuitively, this measure reflects changes in workers' purchasing power by accounting for both wage changes and movements in consumer prices. The resulting welfare statistic is formally defined in equation (21).

$$\hat{U}_j = \frac{U_j^c}{U_j^b} = \frac{w_j^c / \prod_k \left(P_j^{k\alpha_k}\right)^c}{w_j^b / \prod_k \left(P_j^{k\alpha_k}\right)^b} = \frac{\hat{w}_j}{\prod_k \hat{P}_j^{k\alpha_k}}, \tag{21}$$

where $\hat{P}_j^{k\alpha_k}$ is defined by:

$$\hat{P}_j^{k\alpha_k} = \left[\sum_{i=1}^{N} S_{ij}^{kb} (\hat{w}_j \hat{t}_{ij}^k)^{1-\sigma_k}\right]^{\frac{\alpha_k}{1-\sigma_k}} \tag{22}$$

$\hat{w}_j = \frac{w_j^c}{w_j^b}, \hat{P}_j^{k\alpha_k} = \frac{\left(P_j^{k\alpha_k}\right)^c}{\left(P_j^{k\alpha_k}\right)^b}, \hat{t}_{ij}^k = \frac{t_{ij}^{kc}}{t_{ij}^{kb}}$, and S_{ij}^{kb} is a bilateral trade share in the baseline.

Using the values of the bilateral trade share, S_{ij}^{kb}, changes in relative wages across countries, solved in equilibrium as $\hat{w}_j$, changes in trade costs, $\hat{t}_{ij}^k$, the CES, elasticity of substitution, σ_k, which is 6, and the Cobb-Douglas consumption expenditure share, α_k, the consumer price index for all countries in the sample, $\hat{P}_{jk}^{\alpha_k}$, is estimated using equation (22).

Table (8) reports the effects of existing RTAs and the counterfactual TTIP on consumer prices and worker welfare in 2014 and 2018. Consistent with the previous simulations, TTIP is evaluated in a setting where all existing RTAs remain in force. Column (1) presents the effects of RTAs on consumer prices in 2014. Among the 52 countries in the sample, China experienced the largest reduction in consumer prices, with its consumer price index declining by 23.8%. Significant price declines are also observed in several advanced economies, including a 21.9%

reduction in the US and a 7.3% reduction in Italy. By contrast, approximately two-thirds of EU member states experienced increases in consumer prices, ranging from 0.8% in Romania to 14.6% in Cyprus.

Column (2) reports the corresponding welfare effects. Welfare declines are observed in only 12 countries, including Germany (-6.2%), France (-4.6%), and both the US and Italy (-2.5%). Since welfare is measured by real wages, improvements occur when gains in relative wages outweigh changes in consumer prices. The largest welfare gains are recorded in Qatar (122%) and Costa Rica (79.5%). In addition, 20 EU member states experienced welfare improvements, reflecting favorable movements in wages and consumer prices. Overall, nearly 80% of the countries in the sample record positive welfare gains. These findings suggest that RTAs generally enhance worker welfare by promoting employment and wage growth, increasing purchasing power, and expanding consumer access to a wider variety of goods at lower effective prices.

Comparing TTIP with the existing RTA framework, column (4) shows that 21 of the 27 EU member states experienced lower consumer prices under TTIP. The largest reductions occurred in Cyprus (14%), Slovenia, Slovakia, and Latvia (about 13%), while Italy recorded a modest decline of 0.8%. In contrast, consumer prices in Poland and Germany were nearly 1% higher under TTIP than under the existing RTAs. Most non-member countries experienced higher consumer prices, with Singapore recording an increase of 5.6%. These results suggest that TTIP would benefit members through lower trade barriers, greater competition, and economies of scale, while non-members would face relatively higher trade costs and reduced competitiveness.

The reductions in consumer prices under TTIP translate into welfare improvements for all EU member states, as reported in column (5). By lowering the cost of consumption and increasing relative wages, the agreement raises real wages and enhances overall worker welfare throughout the EU. The largest gains are concentrated among smaller and less-developed member states, with Slovenia, Lithuania, Cyprus, Slovakia, and Latvia each recording welfare increases exceeding 30%. In contrast, the welfare gains accruing to larger and more advanced economies are comparatively modest. These results are consistent with the earlier wage findings and suggest that smaller economies benefit disproportionately from deeper transatlantic integration through stronger labor-market responses and greater improvements in purchasing power.

The welfare effects on non-member countries are considerably less favorable. Most non-members experience welfare losses under the TTIP counterfactual, reflecting the adverse consequences of trade diversion. Singapore records one of the largest welfare declines, while several other economies closely integrated with US and EU markets also experience reductions in worker welfare. By contrast, the effects on NAFTA members are relatively limited. Mexico experiences a welfare decline of approximately 2%, while Canada records virtually no change. The muted impact on these countries likely reflects the preferential market access and well-established production linkages already provided by NAFTA, which help cushion the negative effects of trade diversion. Overall, the results suggest that while TTIP would generate substantial welfare gains for EU member states, particularly smaller economies, these benefits would come partly at the expense of several excluded economies whose trade and production activities are displaced by deeper transatlantic integration.

The scatterplots in Figure (3) of Appendix B further illustrate the effects of TTIP on member countries. In 2014, consumer prices under TTIP were lower than under the existing RTA framework for all members except the US, Germany, France, and Italy, where prices were slightly higher. Nevertheless, worker welfare was consistently higher under TTIP across all member

countries. Similar patterns emerged in 2018, with lower consumer prices and higher welfare observed for almost all TTIP members. Figure (4) presents the corresponding results for non-member countries. Unlike member countries, the effects are more heterogeneous. While some non-members benefited from lower prices and higher welfare, particularly in 2014, these gains became less pronounced in 2018. Overall, TTIP generates substantial benefits for member countries by improving worker welfare and lowering consumer prices relative to the existing RTA framework. However, these gains are accompanied by welfare losses in several non-member countries, reflecting the trade-diverting effects of exclusion from the agreement.

7 Conclusion

This paper examines the potential effects of the Transatlantic Trade and Investment Partnership (TTIP) on relative wages, sectoral employment, and worker welfare within a multi-country, multi-sector general equilibrium framework. By incorporating a labor-technology production structure into a sectoral Armington model of Anderson and Yotov (2016), the analysis captures how changes in trade costs induced by trade agreements and TTIP affect labor-market outcomes through changes in production, specialization, and labor allocation. The results indicate that trade integration generates heterogeneous effects across countries. Smaller and developing economies tend to experience larger gains in relative wages and welfare, while advanced economies generally record smaller gains or relative wage declines. These differences reflect variations in productivity, factor endowments, and comparative advantage, which shape the distribution of gains from trade across countries.

The paper's primary contribution is to evaluate the labor-market and welfare implications of TTIP. The results suggest that TTIP would generate substantial gains for many EU member states, particularly smaller and more export-oriented economies, through higher relative wages and improvements in worker welfare. Although the US experiences more modest welfare gains and slight declines in relative wages compared with its existing trade arrangements, TTIP is associated with increased employment in several labor-intensive sectors, indicating potential benefits through labor reallocation and job creation. The analysis further reveals important third-country effects. Many non-member countries experience reductions in relative wages and welfare as trade is diverted toward TTIP members, although a small number of countries benefit from indirect trade-creation opportunities.

Overall, the findings demonstrate that TTIP would have significant distributional consequences beyond its effects on trade flows. The agreement would reshape relative wages, alter sectoral employment patterns, and redistribute welfare gains across member and non-member countries. While the largest benefits accrue to EU economies, particularly smaller member states, the broader results highlight the importance of accounting for labor-market adjustments and third-country effects when evaluating large-scale trade agreements. More generally, the analysis underscores the value of general equilibrium approaches for understanding how trade integration influences wages, employment, and worker welfare in an increasingly interconnected global economy.

Funding Declaration

The author received no financial support for the research, authorship, and/or publication of this article.

References

Aichele, R., Felbermayr, G. J., and Heiland, I. (2014). Going deep: The trade and welfare effects of ttip.

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. The American economic review, 69(1):106–116.

Anderson, J. E., Larch, M., and Yotov, Y. V. (2018). Geppml: General equilibrium analysis with ppml. The World Economy, 41(10):2750–2782.

Anderson, J. E. and Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. American economic review, 93(1):170–192.

Anderson, J. E. and Van Wincoop, E. (2004). Trade costs. Journal of Economic literature, 42(3):691–751.

Anderson, J. E. and Yotov, Y. V. (2016). Terms of trade and global efficiency effects of free trade agreements, 1990–2002. Journal of International Economics, 99:279–298.

Arkolakis, C., Costinot, A., and Rodríguez-Clare, A. (2012). New trade models, same old gains? American Economic Review, 102(1):94–130.

Autor, D. H., Dorn, D., and Hanson, G. H. (2013). The china syndrome: Local labor market effects of import competition in the united states. American economic review, 103(6):2121–2168.

Baier, S. L. and Bergstrand, J. H. (2001). The growth of world trade: tariffs, transport costs, and income similarity. Journal of international Economics, 53(1):1–27.

Baier, S. L. and Bergstrand, J. H. (2004). Economic determinants of free trade agreements. Journal of international Economics, 64(1):29–63.

Baier, S. L. and Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? Journal of international Economics, 71(1):72–95.

Baier, S. L., Yotov, Y. V., and Zylkin, T. (2019). On the widely differing effects of free trade agreements: Lessons from twenty years of trade integration. Journal of International Economics, 116:206–226.

Berden, K. and Francois, J. (2015). Quantifying non-tariff measures for ttip. Rule-makers or rule-takers, pages 97–137.

Bergstrand, J. H., Larch, M., and Yotov, Y. V. (2015). Economic integration agreements, border effects, and distance elasticities in the gravity equation. European Economic Review, 78:307–327.

Caliendo, L. and Parro, F. (2015). Estimates of the trade and welfare effects of nafta. The Review of Economic Studies, 82(1):1–44.

Capaldo, J. (2014). The trans-atlantic trade and investment partnership: European disintegration, unemployment and instability. Technical report, GDAE, Tufts University.

Cheng, I. H. and Wall, H. J. (2005). Controlling for heterogeneity in gravity models of trade and integration.

Costinot, A. and Rodríguez-Clare, A. (2014). Trade theory with numbers: Quantifying the consequences of globalization. In Handbook of international economics, volume 4, pages 197–261. Elsevier.

Dekle, R., Eaton, J., and Kortum, S. (2007). Unbalanced trade. American Economic Review, 97(2):351–355.

Eaton, J. and Kortum, S. (2002). Technology, geography, and trade. Econometrica, 70(5):1741–1779.

Egger, P., Francois, J., Manchin, M., and Nelson, D. (2015). Non-tariff barriers, integration and the transatlantic economy. Economic Policy, 30(83):539–584.

Egger, P., Larch, M., Staub, K. E., and Winkelmann, R. (2011). The trade effects of endogenous preferential trade agreements. American Economic Journal: Economic Policy, 3(3):113–143.

European-Commission (2013). Investment partnership: The economic analysis explained. Technical report, Technical Report. European Commission.

Felbermayr, G., Heid, B., Larch, M., and Yalcin, E. (2015). Macroeconomic potentials of transatlantic free trade: A high resolution perspective for europe and the world. Economic Policy, 30(83):491–537.

Francois, J., Manchin, M., Norberg, H., Pindyuk, O., and Tomberger, P. (2015). Reducing transatlantic barriers to trade and investment: An economic assessment. Technical report, Working paper.

Hakobyan, S. and McLaren, J. (2016). Looking for local labor market effects of nafta. Review of Economics and Statistics, 98(4):728–741.

Head, K. and Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In Handbook of international economics, volume 4, pages 131–195. Elsevier.

Helpman, E. and Krugman, P. (1987). Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy. MIT press.

Larch, M. and Yotov, Y. V. (2016). General equilibrium trade policy analysis with structural gravity.

Magee, C. S. (2008). New measures of trade creation and trade diversion. Journal of International Economics, 75(2):349–362.

Melitz, M. J. (2008). International trade and heterogeneous firms. In The New Palgrave dictionary of economics, pages 1–5. Springer.

Raza, W. G., Grumiller, J., Taylor, L., Tröster, B., and von Arnim, R. (2014). Assess_ttip: assessing the claimed benefits of the transatlantic trade and investment partnership (ttip).

Samuelson, P. A. (1952). The transfer problem and transport costs: the terms of trade when impediments are absent. The Economic Journal, 62(246):278–304.

Santos Silva, J. and Tenreyro, S. (2006). The log of gravity. The Review of Economics and statistics, pages 641–658.

Santos Silva, J. and Tenreyro, S. (2010). On the existence of the maximum likelihood estimates in poisson regression. Economics Letters, 107(2):310–312.

Tinbergen, J. (1962). Shaping the world economy: Suggestions for an international economic policy. The Twentieth Century Fund.

Yotov, Y. V., Piermartini, R., Larch, M., et al. (2016). An advanced guide to trade policy analysis: The structural gravity model. WTO iLibrary.

Solving the Equilibrium in Changes: The Hat Algebra

Below, we will use $e = b$ to denote the baseline equilibrium and $e = c$ to denote any counterfactual equilibrium.

An importing country j has aggregate income $I_j = \sum_{k'} w_j^e L_j^{k'e}$. The importing country spends a share α_k of its aggregate income to import good k from all the other countries. Therefore, it spends $\alpha_k \sum_{k'} w_j^e L_j^{k'e}$ of its income on importing good k. An exporting country $i's$ income earned in the production of good k is equal to the purchases made by all the countries importing that good. Therefore, at equilibrium:

$$w_i^e L_i^{ke} = \sum_j p_{ij}^{ke} c_{ij}^{ke} = \sum_j X_{ij}^{ke} = \sum_j \left(\frac{\gamma_i^k p_{ij}^{ke}}{P_j^{ke}} \right)^{1-\sigma_k} \left(\alpha_k \sum_{k'} w_j^e L_j^{k'e} \right)$$

Substituting in for $p_{ij}^{ke} = \frac{w_i^e t_{ij}^{ke}}{A_i^k}$ and for $P_j^{ke} = \sum_{i'} \gamma_{i'}^k p_{i'j}^{ke}$, the above equation becomes:

$$w_i^e L_i^{ke} = \sum_j S_{ij}^{ke} \left(\alpha_k \sum_{k'} w_j^e L_j^{k'e} \right) \tag{A9}$$

where $S_{ij}^{ke} = \left(\frac{\gamma_i^k p_{ij}^{ke}}{P_j^{ke}} \right)^{1-\sigma_k} = \frac{\left(\frac{\gamma_i^k w_i^e}{A_i^k} \right)^{1-\sigma_k} \left(t_{ij}^{ke} \right)^{1-\sigma_k}}{\sum_{i'} \left(\frac{\gamma_{i'}^k w_{i'}^e}{A_{i'}^k} \right)^{1-\sigma_k} \left(t_{i'j}^{ke} \right)^{1-\sigma_k}}$ is the share of country $j's$ income spent on importing good k from country i.

Equation (A10) below is derived by first specifying the counterfactual equilibrium condition by replacing e with c in equation (A9).

$$w_i^c L_i^{kc} = \sum_j S_{ij}^{kc} \left(\alpha_k \sum_{k'} w_j^c L_j^{k'c} \right)$$

This expression is then reformulated in terms of equilibrium changes, defined as the ratio of counterfactual wages and labor allocations to their baseline counterparts. To get equation (A10), we multiply the left side of the above equation by $\frac{w_i^b L_i^{kb}}{w_i^b L_i^{kb}} = 1$, and we multiply each term in the parenthesis of the right-hand side by $\frac{w_j^b L_j^{kb}}{w_j^b L_j^{kb}} = 1$.

$$w_i^b L_i^{kb} \left(\frac{w_i^c}{w_i^b} \right) \left(\frac{L_i^{kc}}{L_i^{kb}} \right) = \sum_j S_{ij}^{kc} \left(\alpha_k \sum_{k'} w_j^b L_j^{kb} \frac{w_j^c}{w_j^b} \frac{L_j^{k'c}}{L_j^{kb}} \right) \tag{A10}$$

Equation (A10) is a clearing of the labor market for sector k in country i under the counterfactual scenario of no RTA, which is expressed in both the baseline and counterfactual variables. The left-hand side represents counterfactual income generated by sector k in country i. The right-hand side represents total demand for sector k goods from all countries j under the counterfactual scenario. We also write S_{ij}^{kc} as follows:

$$S_{ij}^{kc} = \frac{\left(\frac{\gamma_i^k w_i^c}{A_i^k}\right)^{1-\sigma_k} \left(t_{ij}^{kc}\right)^{1-\sigma_k}}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^c}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kc}\right)^{1-\sigma_k}\right]} = \frac{\left(\frac{\gamma_i^k w_i^b}{A_i^k}\right)^{1-\sigma_k} \left(t_{ij}^{kb}\right)^{1-\sigma_k} \left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k} \left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k}}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k} \left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k} \left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]}$$

Multiplying the numerator and denominator of the above equation by

$$\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right],$$

We get:

$$S_{ij}^{kc} = \frac{\left(\frac{\gamma_i^k w_i^b}{A_i^k}\right)^{1-\sigma_k} \left(t_{ij}^{kb}\right)^{1-\sigma_k} \left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k} \left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k}}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right]} \times \frac{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right]}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k} \left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k} \left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]}$$

Note that $S_{ij}^{kb} = \frac{\left(\frac{\gamma_i^k w_i^b}{A_i^k}\right)^{1-\sigma_k} \left(t_{ij}^{kb}\right)^{1-\sigma_k}}{\sum_{i'}\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}}$, and then note that:

$$S_{ij}^{kc} = S_{ij}^{kb} \left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k} \left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k} \times \frac{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right]}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k} \left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k} \left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]}$$

Divide the numerator and the denominator of the above equation by

$$\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right]$$

$$S_{ij}^{kc} = S_{ij}^{kb} \left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k} \left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k} \times \frac{1}{\sum_{i'}\left[\frac{\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k} \left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k} \left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}}{\sum_{i'}\left[\left(\frac{\gamma_{i'}^k w_{i'}^b}{A_{i'}^k}\right)^{1-\sigma_k} \left(t_{i'j}^{kb}\right)^{1-\sigma_k}\right]}\right]}$$

$$S_{ij}^{kc} = S_{ij}^{kb} \left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k} \left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k} \times \frac{1}{\sum_{i'}\left[S_{ij}^{kb} \left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k} \left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]}$$

$$S_{ij}^{kc} = \frac{S_{ij}^{kb}\left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k}\left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k}}{\sum_{i'}\left[S_{ij}^{kb}\left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k}\left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]} \tag{A11}$$

Substitute out S_{ij}^{kc} in the counterfactual equilibrium in equation (A10) with equation (A11) and simplify to obtain the following:

$$w_i^b L_i^{kb}\left(\frac{w_i^c}{w_i^b}\right)\left(\frac{L_i^{kc}}{L_i^{kb}}\right) = \sum_j \frac{S_{ij}^{kb}\left(\frac{w_i^c}{w_i^b}\right)^{1-\sigma_k}\left(\frac{t_{ij}^{kc}}{t_{ij}^{kb}}\right)^{1-\sigma_k}\left(\alpha_k \sum_{k'} w_j^b L_j^{kb}\frac{w_j^c}{w_j^b}\frac{L_j^{k'c}}{L_j^{kb}}\right)}{\sum_{i'}\left[S_{ij}^{kb}\left(\frac{w_{i'}^c}{w_{i'}^b}\right)^{1-\sigma_k}\left(\frac{t_{i'j}^{kc}}{t_{i'j}^{kb}}\right)^{1-\sigma_k}\right]}$$

Let $\hat{w}_i = \frac{w_i^c}{w_i^b}$, $\hat{w}_j = \frac{w_j^c}{w_j^b}$, $\hat{L}_i^k = \frac{L_i^{kc}}{L_i^{kb}}$, $\hat{L}_j^k = \frac{L_j^{kc}}{L_j^{kb}}$, and $\hat{t}_{ij}^k = \frac{t_{ij}^{kc}}{t_{ij}^{kb}}$

$$w_i^b L_i^{kb}\hat{w}_i\hat{L}_i^k = \sum_j \frac{S_{ij}^{kb}\left(\hat{w}_i\right)^{1-\sigma_k}\left(\hat{t}_{ij}^k\right)^{1-\sigma_k}\left(\alpha_k \sum_{k'} w_j^b L_j^{kb}\hat{w}_j\hat{L}_j^{k'}\right)}{\sum_{i'}\left(S_{ij}^{kb}\left(\hat{w}_{i'}\right)^{1-\sigma_k}\left(\hat{t}_{i'j}^k\right)^{1-\sigma_k}\right)} \tag{A12}$$

The labor market clearing condition in the counterfactual scenario is given by:

$$\sum_k L_i^{kc} = \bar{L}_i$$

The sum of the labor in all sectors of an economy k is equal to the total labor endowment, $\bar{L}_i$. Multiplying the left side of the above equation by $\frac{L_i^{kb}}{L_i^{kb}} = 1$ and rearranging we obtain equation (A13):

$$\begin{aligned}\sum_k L_i^{kc}\frac{L_i^{kb}}{L_i^{kb}} &= \bar{L}_i \\ \sum_k L_i^{kb}\hat{L}_i^k &= \bar{L}_i\end{aligned} \tag{A13}$$

Welfare Statistic

$$\hat{U}_j = \frac{U_j^c}{U_j^b} = \frac{w_j^c / \prod_k \left(P_{jk}^{\alpha_k}\right)^c}{w_j^b / \prod_k \left(P_{jk}^{\alpha_k}\right)^b} = \frac{\hat{w}_j}{\prod_k \hat{P}_{jk}^{\alpha_k}} \tag{A14}$$

The change in welfare in response to a trade policy is the change in workers' utility, which can be measured by the change in real wage. To estimate changes in wages, we need to solve for the corresponding changes in the consumer price index.

$\hat{w}_j = \frac{w_j^c}{w_j^b}$ and $\hat{P}_{jk}^{\alpha_k} = \frac{\left(P_{jk}^{\alpha_k}\right)^c}{\left(P_{jk}^{\alpha_k}\right)^b}$

$$\hat{P}_{jk}^{\alpha_k} = \frac{\left(P_{jk}^{\alpha_k}\right)^c}{\left(P_{jk}^{\alpha_k}\right)^b} = \frac{\left(\sum_i \left(\frac{\gamma_{ik} w_i^c t_{ijk}^c}{A_{ik}}\right)^{1-\sigma_k}\right)^{\frac{\alpha_k}{1-\sigma_k}}}{\left(\sum_i \left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}\right)^{\frac{\alpha_k}{1-\sigma_k}}} \tag{A15}$$

Multiplying each of the terms in the summation in the numerator of equation (A15) by $\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b / A_{ik}}{\gamma_{ik} w_i^b t_{ijk}^b / A_{ik}}\right)^{1-\sigma_k}$ and rearranging, we obtain equation (A16):

$$\hat{P}_{jk}^{\alpha_k} = \frac{\left(P_{jk}^{\alpha_k}\right)^c}{\left(P_{jk}^{\alpha_k}\right)^b} = \frac{\left[\sum_i \left(\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k} \left(\frac{\gamma_{ik} w_i^c t_{ijk}^c / A_{ik}}{\gamma_{ik} w_i^b t_{ijk}^b / A_{ik}}\right)^{1-\sigma_k}\right)\right]^{\frac{\alpha_k}{1-\sigma_k}}}{\left[\sum_i \left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}\right]^{\frac{\alpha_k}{1-\sigma_k}}} \tag{A16}$$

Equation (A16) can be transformed into ratios of counterfactual to baseline variables, that is ratios of $\left(\frac{\gamma_{ik} w_i^c t_{ijk}^c}{A_{ik}}\right)^{1-\sigma_k}$ and $\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}$ and multiplied by the weighted sum $\frac{\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}}{\sum_{i'} \left(\frac{\gamma_{i'k} w_{i'}^b t_{i'jk}^b}{A_{i'k}}\right)^{1-\sigma_k}}$ to obtain equation (A17) below:

$$\left(\hat{P}_{jk}^{\alpha_k}\right)^{1-\sigma_k} = \left[\sum_i \left(\frac{\frac{\gamma_{ik} w_i^c t_{ijk}^c}{A_{ik}}}{\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}}\right)^{1-\sigma_k} \frac{\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}}{\sum_{i'} \left(\frac{\gamma_{i'k} w_{i'}^b t_{i'jk}^b}{A_{i'k}}\right)^{1-\sigma_k}}\right]^{\alpha_k} \tag{A17}$$

Where:

$$S_{ij}^{kb} = \frac{\left(\frac{\gamma_{ik} w_i^b t_{ijk}^b}{A_{ik}}\right)^{1-\sigma_k}}{\sum_{i'} \left(\frac{\gamma_{i'k} w_{i'}^b t_{i'jk}^b}{A_{i'k}}\right)^{1-\sigma_k}}$$

Therefore, the price index is given by the equation below in (A18):

$$\hat{P}_{jk}^{\alpha_k} = \left[\sum_i S_{ij}^{kb} (\hat{w}_i \hat{t}_{ijk})^{1-\sigma_k} \right]^{\frac{\alpha_k}{1-\sigma_k}} \tag{A18}$$

Note that γ_{ik} and A_{ik} cancel out in the ratio in equation (A17). $\hat{t}_{ijk} = \frac{t_{ijk}^c}{t_{ijk}^b}$ and $\hat{w}_i = \frac{w_i^c}{w_i^b}$.

Therefore, the change in welfare, i.e., the change in real wage of country i can be obtained by substituting out $\hat{P}_{jk}^{\alpha_k}$ in equation (A14) with equation (A18) to obtain equation (A19) below:

$$\hat{U}_j = \frac{\hat{w}_j}{\prod_k \left[\sum_i S_{ij}^{kb} (\hat{w}_i \hat{t}_{ijk})^{1-\sigma_k} \right]^{\frac{\alpha_k}{1-\sigma_k}}} \tag{A19}$$

RTA Trade Effect and General Equilibrium Results

Table 1: **PPML Estimates of RTA Trade Effects**

	Dependent variable is trade flows, $X_{ij,t}$			
Ind. Var.	(1)	(2)	(3)	(4)
$RTA_{ij,t}$	1.176***	0.207***	0.148***	0.289***
	(0.042)	(0.060)	(0.034)	(0.110)
$RTA_{ij,(t-4)}$			0.040	0.027
			(0.031)	(0.034)
$RTA_{ij,(t-8)}$			0.019	−0.011
			(0.015)	(0.019)
$RTA_{ij,(t-12)}$			0.023	0.019
			(0.017)	(0.017)
$RTA_{ij,(t-16)}$			0.052**	0.045*
			(0.026)	(0.025)
$RTA_{ij,(t-20)}$			0.052***	0.047***
			(0.014)	(0.014)
$RTA_{ij,(t-24)}$			−0.031	−0.039
			(0.022)	(0.021)
$RTA_{ij,(t-28)}$			−0.032	−0.123
			(0.061)	(0.078)
$RTA_MFN_L_{ij,t}$				−0.041
				(0.114)
$RTA_MFN_H_{ij,t}$				−0.891***
				(0.143)
$\sum_{m=0}^{8} RTA_{ij,(t-4m)}$			0.272***	0.254**
			(0.101)	(0.128)
Exporter-time FE	No	Yes	Yes	Yes
Importer-time FE	No	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes
N	291,600	267,507	267,507	267,507

Notes: This table reports the PPML estimates of the RTA trade effects combining all the sectors together. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are reported beneath the coefficient estimates in parentheses and are clustered at the country-pair.

Table 2: **PPML Estimates of RTAs Trade Effects by Sector**

	Dependent variable is trade flows, $X^k_{ij,t}$								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ind. Var.	Chemicals	Food	Machines	Metals	Minerals	Textiles	Vehicles	Wood	Other
$RTA_{ij,t}$	0.096	0.152**	0.367***	0.144*	−0.052	−0.469**	0.028	0.237**	0.169
	(0.081)	(0.061)	(0.120)	(0.081)	(0.104)	(0.202)	(0.152)	(0.115)	(0.108)
$\sum_{m=0}^{8} RTA_{ij,(t-4m)}$	0.585***	0.655***	−0.178	0.019	0.130	0.138	−0.185	0.176	−0.044
	(0.196)	(0.115)	(0.235)	(0.142)	(0.133)	(0.383)	(0.237)	(0.161)	(0.223)
$RTA_MFN_L^k_{ij,t}$	0.050	0.173***	−0.244**	0.156*	0.195	0.990***	0.223	−0.209	−0.026
	(0.083)	(0.064)	(0.112)	(0.084)	(0.103)	(0.216)	(0.151)	(0.118)	(0.107)
$RTA_MFN_H^k_{ij,t}$	−0.050	0.021**	−0.742***	−0.287	0.107	0.067	−0.040	−0.440**	−0.881***
	(0.127)	(0.069)	(0.175)	(0.131)	(0.133)	(0.289)	(0.177)	(0.168)	(0.299)
Exporter-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	29,723	29,641	29,709	29,698	29,599	29,692	29,640	29,707	29,692

Notes: This table reports the PPML estimates of the RTA trade effects disaggregated by sector. All the nine estimated regression models representing the nine sectors in the study control for exporter-time, importer-time, and exporter-importer fixed effects. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels respectively. Standard errors are reported beneath the coefficient estimates in parentheses and are clustered at the country-pair.

Table 3: **GE Effects of RTAs on Wages & Employment in 2006**

	$\hat{w}_i$	Change in sectoral employment ($\hat{L}_i^k$)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Country	wg.	Ch.	Fd.	Mc.	Mt.	Mn.	Tx.	Vh.	Wd.	Ot.
AUT	1.000	0.680	0.802	1.381	0.896	0.685	0.206	1.584	1.107	0.461
BEL	1.041	1.688	0.649	1.462	0.537	0.459	0.340	0.891	1.117	1.466
BGD	1.143	0.957	1.431	1.665	8.155	0.653	0.919	5.435	0.056	3.978
BGR	1.018	2.263	0.791	1.519	1.608	1.254	0.223	1.390	0.821	0.710
BRA	0.805	2.314	0.935	0.964	1.330	0.577	0.317	1.675	0.766	0.312
CAN	0.912	1.744	0.823	0.758	0.970	0.593	0.685	1.808	0.809	0.324
CHE	1.004	1.227	0.901	1.761	0.376	0.703	0.397	0.673	0.656	0.561
CHL	1.436	0.819	0.471	0.220	7.701	0.348	0.136	0.167	0.386	0.295
CHN	0.752	1.637	1.408	0.980	1.659	0.698	0.383	1.196	0.792	0.164
COL	1.099	1.092	1.479	0.623	2.196	0.944	0.528	0.550	0.493	1.200
CRI	1.868	0.071	0.222	2.337	0.030	0.066	3.582	0.082	0.025	0.201
CYP	1.582	0.406	0.208	9.588	0.302	0.304	0.601	32.21	0.093	0.088
CZE	0.978	1.281	0.978	1.329	0.865	0.726	0.105	1.182	0.855	0.451
DEU	0.750	1.537	0.991	0.849	0.938	0.746	0.426	1.315	0.788	0.491
DNK	1.006	1.064	1.297	1.294	0.671	0.752	0.777	1.016	0.559	0.658
ESP	0.815	1.850	1.086	0.986	0.908	0.801	0.478	1.400	0.729	0.475
EST	1.280	0.789	0.532	2.963	0.463	0.525	0.108	5.014	0.992	0.360
FIN	1.104	1.286	0.884	1.061	0.669	0.567	0.230	1.686	1.231	0.322
FRA	0.809	1.602	1.001	0.845	0.809	0.897	0.418	1.338	0.744	0.576
GBR	0.795	1.743	1.088	0.815	0.815	0.706	0.655	1.432	0.657	0.457
GRC	0.937	2.316	0.838	1.468	1.281	0.922	0.447	0.548	0.695	0.422
HRV	1.026	1.199	0.993	1.591	1.349	0.973	0.295	0.947	0.828	0.930
HUN	1.089	1.348	0.800	1.746	0.539	0.586	0.060	1.070	0.411	0.539
IDN	0.994	1.569	1.310	0.887	1.752	0.718	0.509	2.523	0.760	0.508
IND	0.862	2.324	0.679	0.563	1.438	0.471	0.416	1.279	0.427	3.453
IRL	1.398	2.384	0.429	1.246	0.133	0.169	0.263	0.351	0.702	0.796
ISL	1.432	1.196	1.155	1.659	0.509	0.386	0.284	2.789	0.406	0.244
ISR	1.076	1.509	0.658	1.504	0.459	0.689	0.283	0.744	0.362	2.190
ITA	0.843	1.702	1.242	0.883	0.959	0.889	0.644	1.296	0.889	0.687
JPN	0.878	1.657	0.730	0.987	1.083	0.724	0.244	1.488	0.678	0.389
KOR	1.000	1.548	0.872	0.819	0.987	0.748	0.318	0.924	0.472	5.562
LTU	1.097	3.514	0.854	2.021	0.513	0.596	0.254	0.717	0.989	0.545
LUX	1.602	0.322	0.175	2.878	0.606	0.279	0.448	5.979	1.820	2.593
LVA	1.167	1.034	0.751	1.852	0.806	1.034	0.300	0.845	1.511	0.418
MAR	1.153	1.439	0.937	1.955	0.383	0.654	1.069	0.148	0.200	0.875
MEX	1.113	0.706	0.402	2.888	0.775	0.411	0.444	1.855	0.248	0.808
MLT	1.930	0.156	0.166	3.412	0.123	0.044	0.194	0.581	0.227	0.106
MYS	1.174	1.455	1.151	1.130	0.365	0.373	1.624	0.987	0.197	1.080
NLD	1.000	1.024	0.941	1.919	0.408	0.553	0.526	0.781	0.683	0.604
NOR	1.081	1.448	0.936	1.330	1.045	0.621	0.381	0.840	0.703	1.726
NZL	1.134	1.394	1.543	0.474	1.032	0.562	0.594	0.366	0.794	0.212
PER	1.092	3.239	1.774	0.208	3.363	0.916	0.294	0.433	0.942	0.094
PHL	1.300	1.114	0.567	1.714	0.721	0.431	0.401	0.967	0.181	1.353
POL	0.875	1.867	1.099	1.178	0.927	0.806	0.147	1.201	0.840	0.561
PRT	0.961	3.026	1.165	1.933	0.817	0.758	0.365	1.394	1.128	0.477
QAT	1.819	6.472	0.198	4.143	0.096	0.063	0.177	3.940	0.199	0.148
ROM	0.859	2.375	1.265	1.606	1.296	1.192	0.164	1.287	0.839	0.528
RUS	0.785	2.636	0.973	0.413	1.579	0.587	0.280	0.801	0.703	0.523
SAU	1.129	4.887	0.942	0.894	0.331	0.242	0.222	1.136	0.526	0.130
SGP	1.413	2.269	0.340	0.854	0.162	0.357	3.983	0.267	0.289	7.918
SVK	1.201	0.421	0.521	1.559	0.209	0.320	0.121	2.978	1.090	0.759
SVN	1.106	1.030	0.955	1.715	0.795	0.753	0.246	0.819	0.876	0.733
SWE	1.012	1.134	1.136	0.954	0.954	0.714	0.263	1.195	1.213	0.189
THA	1.042	1.512	0.859	1.284	0.735	0.564	0.805	1.645	0.439	1.009
TUR	0.922	1.730	1.020	1.666	1.228	0.810	0.576	1.180	0.653	0.879
URY	1.514	0.731	0.894	1.573	0.282	0.174	0.940	0.150	0.567	8.716
USA	0.708	2.146	1.035	0.873	0.731	0.730	0.580	1.258	0.579	0.488

Notes: This table shows the general equilibrium effects of RTAs on wage and sectoral employment for all the countries in the sample in 2006. Column (1) shows the change in wage in response to the implementation of RTAs. Columns (2), (3), (4), (5), (6), (7), (8), (9), and (10) show change in sectoral employment in the Chemicals, Food, Machines, Metals, Minerals, Textiles, Vehicles, Wood-Paper, and Other metallic mineral sectors respectively. Argentina (ARG), Australia (AUS), and Hong Kong (HKG) are missing in the list of countries in my sample because of non-availability of data on either baseline wage, employment or both in 2006

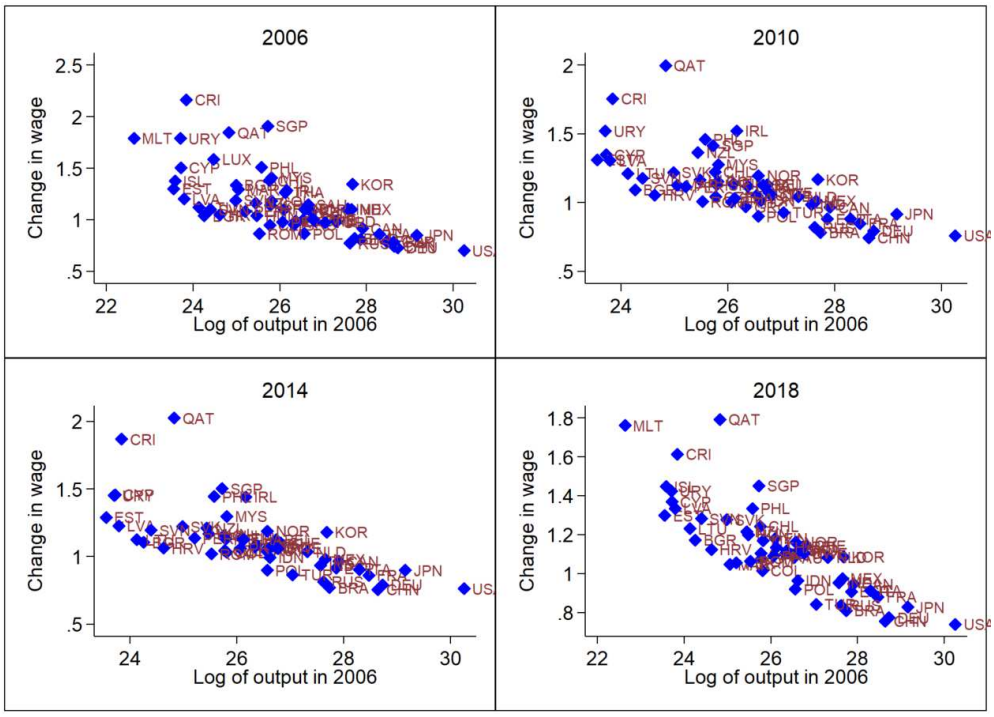


Figure 1: **Scatterplots of Relative Wages & 2006 Output**

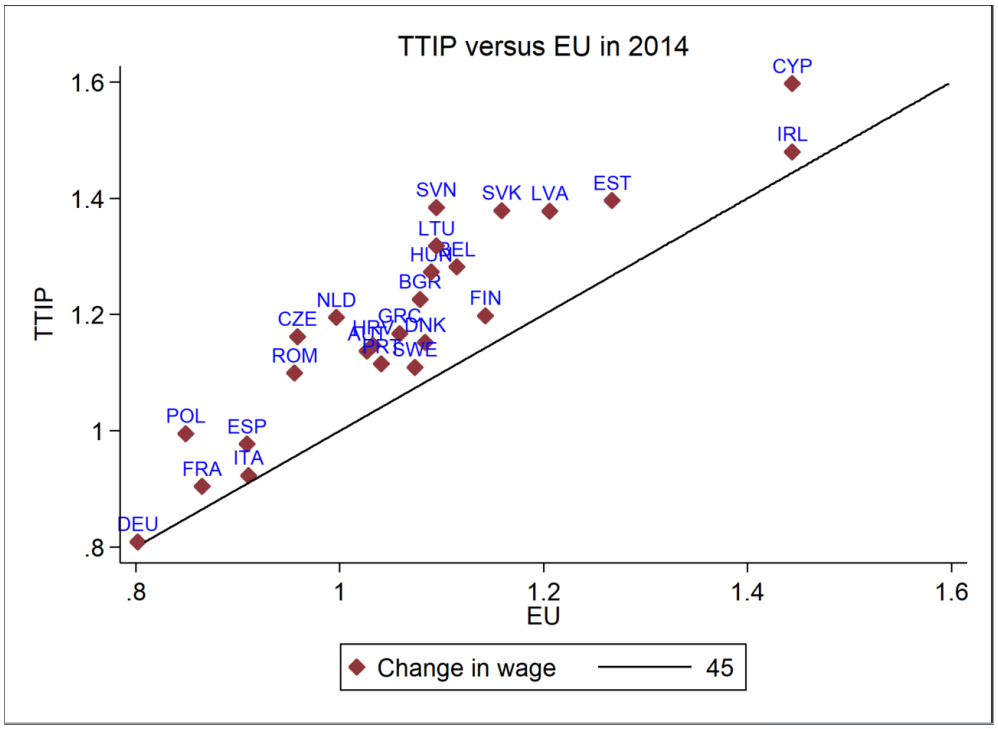


Figure 2: **Scatterplots of Gains in Relative Wages from TTIP and EU**

Table 4: **Estimates of the Effect of Country Size on Relative Wage Change**

	Dependent variable is relative change in wage					
Ind. Var.	1998	2002	2006	2010	2014	2018
Log of GDP	−0.1130***	−0.1052***	−0.1280***	−0.1091***	−0.1063***	−0.1200***
	(0.0155)	(0.0137)	(0.0169)	(0.0146)	(0.0156)	(0.0136)
Constant	3.9521***	3.6861***	4.4499***	4.0195***	3.9630***	4.4004***
	(0.4106)	(0.3632)	(0.4577)	(0.4052)	(0.4365)	(0.4094)
R^2	0.5465	0.5418	0.5714	0.4684	0.4177	0.1025
N	56	57	57	53	52	55

Notes: This table displays the OLS estimates of the effect of relative wages (from the GE estimation) on the GDP size of the countries for six different years from 1998 to 2018. Heteroskedastic robust standard errors are reported beneath the coefficient estimates in parentheses. The different sample sizes across years is because the number of countries omitted due to data non-availability on baseline wages and employment are different across years. *** indicate statistical significance at the 1% level.

Table 5: **GE RTA Effects on Wages & Employment of the US**

	2014 TTIP (1)	2014 NAFTA (2)	2018 TTIP (3)	2018 NAFTA (4)
	Panel I: Change in wage, $\hat{w}_{US}$			
wage	0.763	0.767	0.713	0.716
	Panel II: Change in sectoral employment, $\hat{L}^k_{US}$			
Chemical	2.190	2.183	1.994	1.982
Food	1.126	1.115	1.057	1.048
Machines	0.732	0.747	0.790	0.808
Metals	0.638	0.632	0.672	0.667
Minerals	0.600	0.604	0.620	0.627
Textiles	0.377	0.403	0.395	0.410
Vehicles	1.291	1.294	1.332	1.337
Wood-Paper	0.622	0.617	0.644	0.636
Other	0.493	0.490	0.504	0.501

Notes: This table displays the general equilibrium effects of TTIP and NAFTA on wage and sectoral employment of the US in 2014 and 2018. Panel I shows the wage effect and Panel II shows the effect on employment across all the 9 sectors. Columns (1) and (2) show the effect of TTIP and NAFTA on US wage and employment in 2014. Columns (3) and (4) show the effect of TTIP and NAFTA on US wage and employment in 2018.

Table 6: **GE RTA Effects on Wages of EU Members**

	2014			2018		
	TTIP	EU	Diff.	TTIP	EU	Diff.
Country	(1)	(2)	(3)	(4)	(5)	(6)
AUT	1.137	1.027	0.110	1.052	0.979	0.073
BEL	1.282	1.115	0.167	1.202	1.038	0.164
BGR	1.226	1.079	0.147	1.156	1.038	0.118
CYP	1.597	1.444	0.153	1.412	1.273	0.139
CZE	1.162	0.959	0.203	1.069	0.902	0.167
DEU	0.809	0.802	0.007	0.761	0.753	0.008
DNK	1.152	1.084	0.068	1.094	1.040	0.054
ESP	0.977	0.909	0.068	0.911	0.848	0.063
EST	1.396	1.267	0.129	1.277	1.148	0.129
FIN	1.198	1.143	0.055	1.163	1.120	0.043
FRA	0.904	0.865	0.039	0.867	0.832	0.035
GRC	1.167	1.059	0.108	1.096	1.016	0.080
HRV	1.147	1.033	0.114	1.099	0.983	0.116
HUN	1.273	1.090	0.183	1.145	1.002	0.143
IRL	1.480	1.444	0.036	——	——	——
ITA	0.923	0.911	0.012	0.883	0.883	0.000
LTU	1.318	1.095	0.223	1.251	1.102	0.149
LVA	1.378	1.206	0.172	1.323	1.208	0.115
MLT	——	——	——	1.723	1.544	0.179
NLD	1.195	0.997	0.198	1.114	0.947	0.167
POL	0.995	0.849	0.146	0.909	0.787	0.122
PRT	1.115	1.041	0.074	1.043	0.979	0.064
ROM	1.099	0.956	0.143	1.011	0.885	0.126
SVK	1.379	1.159	0.220	1.263	1.141	0.122
SVN	1.384	1.095	0.289	1.306	1.055	0.251
SWE	1.109	1.074	0.035	1.069	1.051	0.018

Notes: This table displays the general equilibrium effect of TTIP and EU on wages of the EU members in my sample in 2014 and 2018. Columns (1) and (2) show the effects of TTIP and EU, respectively, in 2014, and Column (3) shows the difference in effect between the two RTAs, i.e., the effect of TTIP minus the EU in 2014. Columns (4) and (5) show the effects of TTIP and EU, respectively, in 2018, and Column (6) shows the difference in effect between the two RTAs, i.e., the effect of TTIP minus the EU in 2018. Malta (MLT) is missing in the list of EU countries in my sample because of the non-availability of data on either baseline wage, employment, or both in 2014. Republic of Ireland (IRL) is missing in the list of EU countries in my sample because of the non-availability of data on either baseline wage, employment, or both in 2018. In both years, Luxembourg (LUX) is missing in both years because of the same reason.

Table 7: **TTIP Effect on Wages of Non-Member Countries**

	2014			2018		
	RTAs	TTIP	Diff.	RTAs	TTIP	Diff.
Country	(1)	(2)	(3)	(4)	(5)	(6)
AUS	1.000	1.000	0.000	1.000	1.000	0.000
BGD	——	——	——	5.152	4.793	−0.359
BRA	0.769	0.784	0.015	0.811	0.796	−0.015
CAN	0.966	0.972	0.006	0.947	0.916	−0.031
CHE	1.101	1.100	−0.001	1.144	1.082	−0.062
CHL	1.157	1.399	0.242	1.244	1.364	0.120
CHN	0.757	0.773	0.016	0.757	0.743	−0.014
COL	1.031	1.028	−0.003	1.016	1.000	−0.016
CRI	1.870	1.707	−0.163	1.614	1.340	−0.274
IDN	0.994	0.992	−0.002	0.965	0.920	−0.045
IND	0.937	0.842	−0.095	0.954	0.788	−0.166
ISL	——	——	——	1.449	1.601	0.152
ISR	1.129	1.138	0.009	1.079	1.040	−0.039
JPN	0.899	0.906	0.007	0.829	0.805	−0.024
KOR	1.182	1.057	−0.125	1.087	0.952	−0.135
MAR	——	——	——	1.047	1.043	−0.004
MEX	0.980	0.974	−0.006	0.975	0.932	−0.043
MYS	1.299	1.163	−0.136	1.170	1.037	−0.133
NOR	1.190	1.208	0.018	1.163	1.157	−0.006
NZL	1.211	1.313	0.102	1.216	1.237	0.021
PER	1.137	1.302	0.165	1.056	1.203	0.147
PHL	1.444	1.299	−0.145	1.336	1.120	−0.216
QAT	2.026	1.959	−0.067	1.793	1.653	−0.140
RUS	0.814	0.816	0.002	0.838	0.806	−0.032
SAU	1.077	1.077	0.000	1.120	1.072	−0.048
SGP	1.503	1.348	−0.155	1.453	1.280	−0.173
THA	1.126	1.049	−0.077	1.136	0.999	−0.137
TUR	0.866	0.887	0.021	0.843	0.855	0.012
URY	1.452	1.411	−0.041	1.425	1.383	−0.042

Notes: This table displays the general equilibrium effect of TTIP on wages of the non-member countries in my sample in 2014 and 2018. Columns (1) and (2) show the effects of all RTAs and TTIP correspondingly in 2014, and Column (3) shows the difference in effect between the two, i.e., effect of TTIP minus effect of all RTAs in 2014. Columns (4) and (5) show the effects of all RTAs and TTIP correspondingly in 2018, and Column (6) shows the difference in effect between the two, i.e., effect of TTIP minus effect of all RTAs in 2018. Bangladesh (BGD), Iceland (ISL), and Morocco (MAR) are missing in the list of non-member EU countries in my sample because of non-availability of data on either baseline wage, employment or both in 2014. Argentina (ARG), United Kingdom (GBR), and Hong Kong (HKG) are missing in the list of non-member EU countries in my sample because of non-availability of data on either baseline wage, employment or both in both years.

Table 8: **TTIP Effect of Workers' Welfare**

	2014					2018				
	P_{rtas}	W_{rtas}	P_{ttip}	W_{ttip}	$W_{Diff.}$	P_{rtas}	W_{rtas}	P_{ttip}	W_{ttip}	W_{diff}
Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
AUS	0.922	1.085	0.935	1.069	−0.016	0.934	1.071	0.898	1.113	0.042
AUT	1.027	1.019	0.941	1.208	0.189	0.993	1.091	0.904	1.164	0.073
BEL	1.085	1.036	0.985	1.301	0.265	1.042	1.092	0.946	1.271	0.179
BGD	—	—	—	—	—	5.152	1.000	4.793	1.000	0.000
BGR	1.079	1.025	1.000	1.226	0.201	1.077	1.089	0.964	1.199	0.110
BRA	0.774	0.994	0.791	0.992	−0.002	0.805	1.008	0.795	1.001	−0.007
CAN	0.853	1.132	0.859	1.132	0.000	0.849	1.116	0.816	1.122	0.006
CHE	1.058	1.041	0.947	1.162	0.121	0.995	1.150	0.900	1.202	0.052
CHL	0.940	1.230	0.950	1.472	0.242	1.033	1.203	0.968	1.410	0.207
CHN	0.762	0.994	0.779	0.993	−0.001	0.760	0.996	0.747	0.995	−0.001
COL	0.978	1.054	0.944	1.089	0.035	0.964	1.054	0.909	1.101	0.047
CRI	1.042	1.795	1.025	1.665	−0.130	1.039	1.554	0.983	1.363	−0.191
CYP	1.146	1.274	1.006	1.586	0.312	1.132	1.210	0.983	1.437	0.227
CZE	0.994	1.052	0.944	1.232	0.180	0.973	1.135	0.900	1.188	0.053
DEU	0.844	0.938	0.853	0.948	0.010	0.816	0.950	0.798	0.954	0.004
DNK	1.060	1.026	0.976	1.180	0.154	1.013	1.104	0.933	1.172	0.068
ESP	0.940	0.973	0.943	1.036	0.063	0.919	0.988	0.887	1.027	0.039
EST	1.058	1.219	0.988	1.412	0.193	1.043	1.245	0.968	1.320	0.075
FIN	1.066	1.066	1.037	1.156	0.090	1.045	1.130	0.994	1.170	0.040
FRA	0.902	0.954	0.904	1.000	0.046	0.908	0.970	0.863	1.004	0.034
GRC	1.068	1.002	1.031	1.132	0.130	1.061	1.039	0.974	1.125	0.086
HRV	1.118	0.950	1.007	1.139	0.189	1.102	1.021	0.957	1.149	0.128
HUN	1.063	1.099	0.971	1.311	0.212	1.022	1.174	0.918	1.248	0.074
IDN	0.921	1.079	0.943	1.052	−0.027	0.912	1.058	0.889	1.034	−0.024
IND	0.924	1.013	0.845	0.996	−0.017	0.929	1.027	0.792	0.995	−0.032
ISL	—	—	—	—	—	1.092	1.326	1.026	1.561	0.235
IRL	1.085	1.330	1.067	1.387	0.057	—	—	—	—	—
ISR	0.994	1.136	0.984	1.156	0.020	0.976	1.106	0.916	1.135	0.029
ITA	0.927	0.975	0.918	1.006	0.031	0.919	0.994	0.875	1.009	0.015
JPN	0.885	1.016	0.892	1.015	−0.001	0.828	1.001	0.805	1.001	0.000
KOR	1.106	1.068	0.982	1.077	0.009	1.008	1.078	0.908	1.048	−0.030
LTU	1.094	1.028	0.982	1.341	0.313	1.065	1.157	0.940	1.330	0.173
LVA	1.135	1.082	1.009	1.366	0.284	1.105	1.209	0.972	1.362	0.153
MAR	—	—	—	—	—	0.842	1.244	0.922	1.131	−0.113
MEX	0.855	1.146	0.865	1.126	−0.020	0.839	1.163	0.810	1.151	−0.012
MLT	—	—	—	—	—	1.121	1.571	0.936	1.840	0.269
MYS	0.973	1.335	0.986	1.180	−0.155	0.945	1.238	0.926	1.120	−0.118
NLD	0.978	1.059	0.934	1.280	0.221	0.962	1.127	0.907	1.229	0.102
NOR	1.060	1.123	1.003	1.204	0.081	1.007	1.154	0.951	1.216	0.062
NZL	1.037	1.168	1.037	1.266	0.098	1.005	1.211	0.985	1.255	0.044
PER	1.060	1.072	1.062	1.227	0.155	0.981	1.076	1.016	1.184	0.108
PHL	0.997	1.448	1.030	1.260	−0.188	1.015	1.316	0.917	1.221	−0.095
POL	0.928	0.969	0.937	1.061	0.092	0.914	1.007	0.874	1.040	0.033
PRT	1.094	0.969	0.996	1.120	0.151	1.064	1.025	0.937	1.113	0.088
QAT	0.913	2.220	0.922	2.124	−0.096	0.918	1.953	0.882	1.873	−0.080
ROM	1.008	1.011	0.981	1.120	0.109	1.003	1.061	0.916	1.105	0.044
RUS	0.820	0.993	0.825	0.989	−0.004	0.837	1.002	0.807	0.999	−0.003
SAU	0.922	1.168	0.928	1.160	−0.008	0.959	1.168	0.923	1.162	−0.006
SGP	0.884	1.700	0.940	1.434	−0.266	0.875	1.660	0.923	1.387	−0.273
SVK	1.083	1.129	0.959	1.438	0.309	1.075	1.188	0.932	1.355	0.167
SVN	1.093	1.093	0.957	1.446	0.353	1.048	1.224	0.917	1.424	0.200
SWE	1.029	1.030	0.998	1.112	0.082	1.015	1.090	0.952	1.123	0.033
THA	0.963	1.169	0.955	1.099	−0.070	0.964	1.178	0.909	1.100	−0.078
TUR	0.868	0.998	0.881	1.006	0.008	0.858	0.983	0.847	1.010	0.027
URY	1.101	1.319	1.043	1.354	0.035	0.852	1.673	0.794	1.742	0.069
USA	0.781	0.975	0.787	0.970	−0.005	0.761	0.974	0.734	0.970	−0.004

Notes: This table displays the general equilibrium effect of TTIP on consumer prices and welfare of workers of member and non-member countries for 2014 and 2018. For all the RTAs in my study, Columns (1) and (6) display the change in consumer price index for both years and Columns (2) and (7) display the change in welfare for both years. For the TTIP policy, Columns (3) and (8) display the change in consumer price index for both years and Columns (4) and (9) display the change in welfare for both years. Finally, for 2014 and 2018, Columns (5) and (10) display the difference in the change in welfare between the TTIP policy and all RTAs. Republic of Ireland (IRL) is missing in 2018 while Bangladesh (BGD), Iceland (ISL), Morocco (MAR), and Malta (MLT) are missing in 2014.

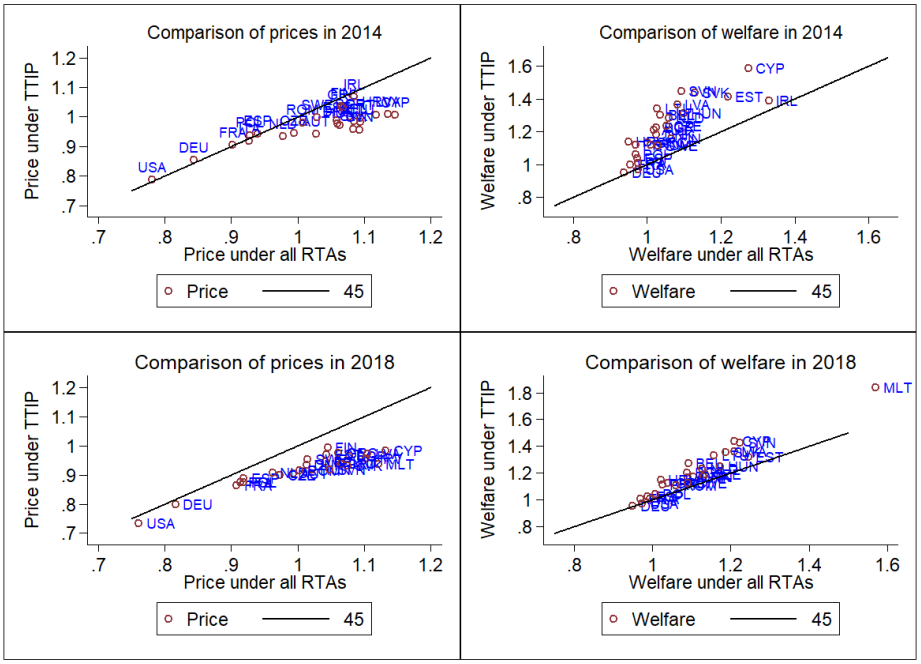


Figure 3: **TTIP Effects on Welfare and Price Index of Member Countries**

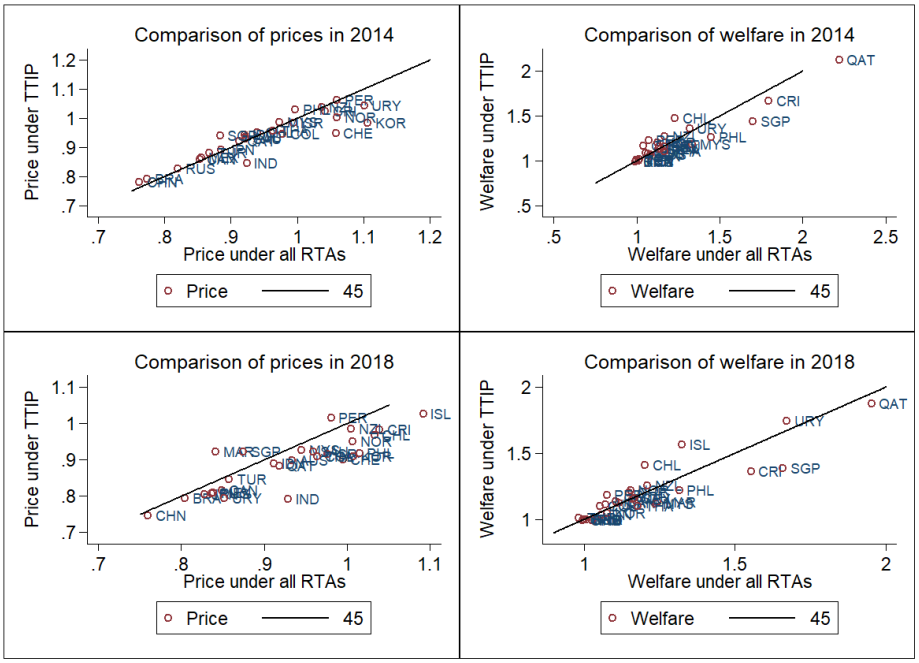


Figure 4: **TTIP Effects on Welfare and Price Index of Non-Member Countries**

Table 9: **List of Countries**

Abbr.	Country	Abbr.	Country	Abbr.	Country	Abbr.	Country
ARG	Argentina	DEU	Germany	ISR	Israel	PHL	Philippines
AUS	Australia	DNK	Denmark	ITA	Italy	POL	Poland
AUT	Austria	ESP	Spain	JPN	Japan	PRT	Portugal
BEL	Belgium	EST	Estonia	KOR	Rep. of Korea	QAT	Qatar
BGD	Bangladesh	FIN	Finland	LTU	Lithuania	ROM	Romania
BGR	Bulgaria	FRA	France	LUX	Luxembourg	RUS	Russia
BRA	Brazil	GBR	United Kingdom	LVA	Latvia	SAU	Saudi Arabia
CAN	Canada	GRC	Greece	MAR	Morocco	SGP	Singapore
CHE	Switzerland	HKG	Hong Kong	MEX	Mexico	SVK	Slovakia
CHL	Chile	HRV	Croatia	MLT	Malta	SVN	Slovenia
CHN	China, P.R.	HUN	Hungary	MYS	Malaysia	SWE	Sweden
COL	Colombia	IDN	Indonesia	NLD	The Netherlands	THA	Thailand
CRI	Costa Rica	IND	India	NOR	Norway	TUR	Turkiye
CYP	Cyprus	IRL	Rep. of Ireland	NZL	New Zealand	URY	Uruguay
CZE	Czech Rep.	ISL	Iceland	PER	Peru	USA	United States

Notes: This table displays the list of the full names of the countries against their abbreviated forms used in the results.