Tariff Reductions, Heterogeneous Firms, and Welfare: Theory and Evidence for 1990–2010 *

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Abstract

We construct a new, global tariff dataset, and apply it to a multi-sector quantitative trade model with heterogeneous firms, including nearly all countries of the world. The impact of the Uruguay Round tariff reductions over 1990–2010 are analyzed, as well as the further cuts in Preferential tariffs and the impact of moving to complete free trade. We find that the Uruguay Round tariff cuts led to large welfare gains (2%–3% relative to 1990 for the world, higher in Emerging and Developing countries), but that Preferential tariff cuts led to only small further gains (0%–1%). Surprisingly, the hypothetical movement to free trade leads to the greatest gains (5% relative to 1990, almost 10% in Emerging and Developing countries), which implies that there is strong scope for gains from future multilateral tariff reductions, especially for Emerging and Developing economies. These gains are large relative to prior estimates in the literature and we attribute about nearly one-half of our measured gains to selection effects in our heterogeneous-firm model, which are influenced by the scale of production and by two-tier Armington aggregation.

Keywords: trade policy, monopolistic competition, gains from trade, input-output linkages, multilateralism, bilateralism.

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1 Introduction

Tariffs have fallen substantially around the globe since 1990. A significant share of this decline was due to MFN tariff reductions, principally those phased in after the 1994 Uruguay Round. Other trade agreements under the WTO have also been important. To give just one example, the Information Technology Agreement (ITA) of 1997 phased out tariffs on those products by 2000, with some tariffs continuing to 2005.[1] Though rare, there were also some substantial unilateral MFN tariff cuts, as in India in 1991–92. At the same time, there were numerous Preferential Trade Agreements (PTAs) to eliminate tariffs between specific countries. To assess the impact of all these tariff cuts, a relatively new literature emphasizing quantitative models and drawing on recent trade theory has arisen.

In this paper, we expand on this literature by introducing tariffs into a quantitative model that has three features which have been studied individually or in pairs, but not combined into a single quantitative model: monopolistic competition with the free entry of heterogeneous firms, as in Melitz (2003) and Chaney (2008); input-output linkages within and between economies; and the widest possible set of economies (179), for which we document tariff changes over a long time span. This is achieved by calibrating a multi-sector Melitz-Chaney model using the the Eora multi-region input-output database (Lenzen et al. 2012, 2013), which includes nearly every country of the world, including small island economies.[2] With this goal in mind, our new tariff data are broader and more detailed than those previously collected, so the tariff database accompanying this paper is also an important contribution in its own right.[3]

Policy experiments and main results We implement three policy experiments. First, in a "Uruguay Round" experiment, we aim to quantify the effects of actual MFN tariff cuts from 1990 to 2010, which includes all the major cuts during the Uruguay Round and a few others.[4] We do so by using the model to evaluate the economic effects of the observed change in Most Favored Nations (MFN) tariffs for countries at the product level from 1990 to 2010, focusing on the trade, entry, and welfare impacts.

We then go beyond this first experiment and evaluate the impact of all actual observed changes in tariffs, namely both MFN *and* preferential tariffs, over the same period; we refer to this model experiment as "Uruguay Round + Preference." After that, we look to the future and consider a further counterfactual scenario, asking if there are any further potential gains in the world today from zeroing all tariffs, a hypothetical experiment we refer to as "Free Trade."

[1]See the description of the ITA in Feenstra, Mandel, Reinsdorf and Slaughter (2013).

[2]See note 33 for countries omitted from the quantitative analysis.

[3]We unify tariff schedules from four different sources. With more than 1 million observations per year in the 1980s, rising to 2 million by the 2000s, with our tariff data we can perform tariff policy experiments which could not be explored before now.

[4]For simplicity, we refer to this entire set of MFN tariff cuts as the "Uruguay Round", though it includes tariff liberalization that occurred prior to 1994 during the negotiations of that round, and also the ITA, for example, which occurred during and after the implementation of that round.

We find that the Uruguay Round tariff cuts led to substantial welfare gains (around 3% relative to 1990 for the world, higher in Emerging and Developing countries), but that other preferential tariff cuts led to only small further gains (0%–1%). Perhaps surprisingly, a further move to free trade leads to even greater gains (5% relative to 1990, almost 10% in Emerging and Developing countries). Thus, we find: (1) the distribution of actual and potential gains across richer and poorer countries are quite different, and overall much larger in the poorer group; (2) the actual gains realized since 1990 have been substantial but still larger potential gains remain unrealized.

In this regard, we must also note that our estimated gains from the Uruguay Round, and from the move to Free Trade, turn out much larger in comparison with existing literature, as we discuss in the next section. Why is this the case?

We attribute these larger gains-from-trade impacts to four features of our quantitative model. First, by including input-output linkages for realism, it is known that the gains from tariff removal are enhanced (see below). Second, also for realism, we build two-tier Armington aggregation into our model, which means that the elasticity of substitution between the bundle of goods from each country is lower than the elasticity between varieties within a country: this feature also raises the gains from tariff removal. Third, we argue that the entry and selection of firms in a heterogeneous firm model *interact* with the first two reasons to bring larger gains from tariff removal. We develop a novel decomposition of welfare to demonstrate this result, and we attribute nearly one-half of the large gains from tariff removal to the new selection effects that are present in our model. The fourth reason, which we have already noted, is that we include many Emerging and Developing countries in our analysis, unlike prior studies, and it is for these countries that we observe the largest gains from actual and potential tariff removal, thereby pulling up the average gains.

To sum up, our paper builds a new, highly-granular tariff dataset and uses it in a quantitative model to perform policy experiments that evaluate the gains from actual past trade liberalization and possible future gains yet to be realized. Our findings imply that there is strong scope for gains from future multilateral tariff reductions, especially for Emerging and Developing economies which gain the most from the reallocation of firms across sectors. In the following subsection we put these results in the context of recent literature. The theoretical model and decomposition of welfare is developed in section 2; the tariff dataset is described in section 3; the quantitative model is calibrated in section 4 and results are presented in section 5. Further conclusions are discussed in section 6, while many details are relegated to the Online Appendix.

Literature review We situate our paper relative to an extensive prior literature.

The first papers to examine *ad valorem* tariffs in a quantitative Melitz-Chaney model were Balistreri, Hillberry and Rutherford (2011) and Costinot and Rodríguez-Clare (2014 [hereafter CR]), and both use multi-sector models with an input-output structure between sectors and a restricted number of (mostly large) countries.[5] The former authors examined the consequences of a global

[5]The former authors model a single aggregate heterogeneous-firm sector with additional competitive sectors based

50% reduction in tariffs (or a 50% reduction in fixed costs) in their quantitative model, and they find substantial effects on firm entry and therefore on product variety. CR examine the gains from trade and the costs of a 40% uniform worldwide tariff (or just imposed by the United States). The entry of firms and their selection is influenced by the scale of each sector, leading to the "scale effects" that these authors identify.[6] In an initial case without input-output linkages, CR find that the 40% worldwide tariff reduces average country welfare by 1.1% under perfect competition, and only slightly more under imperfect competition (falling by 1.4% under a Krugman model and 1.2% under the Melitz model). But in the presence of intermediate inputs, the costs of a 40% worldwide tariff are notably larger: average country welfare falls by 2.5% under perfect competition, 5.3% in the Krugman model, and 7.0% or nearly three times larger in the Melitz model than under perfect competition, and 1.7 percentage points or 32% larger with heterogeneous firms than with homogeneous firms.[7] They attribute these larger welfare effects to "stronger scale effects under models of monopolistic competition with firm-level heterogeneity" (p. 233).

So an important result from this quantitative literature is that the gains from trade and costs of the tariffs are considerably amplified in the presence of input-output linkages and monopolistic competition with heterogeneous firms. The same result had been found by Balistreri, Hillberry and Rutherford (2011), to an even greater extent.[8] The theoretical result that the gains from trade are higher in the presence of input-output linkages was also recognized by Arkolakis, Costinot, and Rodríguez-Clare (2013 [henceforth ACR], pp. 115–116), who analyzed such a linkage in a one-sector model. They argue that with traded intermediate goods lowering the marginal costs of production, this linkage will increase the gains from trade even under perfect competition,[9] and there are *additional* gains under monopolistic competition if the fixed costs of entry or exporting also depend on the traded intermediate goods. In our model we will assume that the fixed costs of entry and exporting use only labor, but nevertheless, we will find very substantial gains from tariff removal in the presence of input-output linkages.

The next quantitative model with heterogeneous firms — and the first to examine the actual Uruguay Round tariff cuts over the 1994–2000 period — was Spearot (2016), who included a set

on the Global Trade Analysis Project (GTAP) (Dimaranan, 2006), with the country data aggregated into 12 regions. CR use the World Input-Output Database (WIOD) (Timmer, 2012; Timmer et al. 2015), which has 27 EU countries and 13 other major countries. While these cover a large part of world output and trade, many smaller countries of the world are omitted.

[6]Entry effects in the CR model are examined by Felbermayr, Jung, and Larch (2015), who make the distinction between applying tariffs to the variable production cost of imports versus applying them to the revenue-cost of imports, inclusive of markups. In Appendix A we find that there are some notable theoretical differences in these two cases: in particular, regarding whether changes in tariffs affect entry in a one-sector model. We believe that modeling tariffs as applying to the revenue-cost of imports is the realistic choice that matches customs practices, and is also a theoretically parsimonious benchmark case, so we will focus only on that case here.

[7]See Costinot and Rodríguez-Clare (2014), Table 4.3, p. 232.

[8]They find (p. 95) that "Taking the simple-average welfare change across regions the Melitz structure indicates welfare gains from liberalization that are four times larger than in a standard trade policy simulation [with perfect competition]".

[9]The importance of the input-output structure under perfect competition was also recognized by Yi (2003), Melitz and Redding (2014) and Caliendo and Parro (2015).

of 69 countries in his analysis, including some small countries. His model does not incorporate intermediate inputs, however, but has trade in final goods only, and it is based on quadratic preferences similar to Melitz and Ottaviano (2008).[10] He finds that while the majority of countries benefited from the 1994–2000 tariff cuts, those benefits were skewed towards developing countries; in contrast, the benefits from zeroing all tariffs from their 2000 levels would be skewed towards advanced countries. Significantly, in his model, only about one-half of countries benefit from both multilateral tariff cuts (i.e., going from 1994 to 2000 levels and then from 2000 levels to free trade), and few countries benefit from *unilateral* tariff cuts starting from 2000 levels (though the countries that do gain include India, Japan, Korea, and the United States). These results are very much in line with the conventional optimal tariff argument, whereby starting with low tariffs (i.e., below the optimum), countries do not gain from further unilateral reductions in their tariffs.

The first version of our paper appeared as Caliendo, Feenstra, Romalis, and Taylor (2015), and it combined — in one setting — several features of the above papers: monopolistic competition with free entry of heterogeneous firms; multiple sectors with input-output linkages; the addition of two-tier Armington aggregation to the model; and the analysis of Uruguay-era MFN tariff cuts over a wide set of countries. We believe that all three of these elements jointly contribute to obtaining our results here concerning the large gains from tariff removal and the importance of firm selection to generating these gains. Specifically, if there is only one sector, then entry is fixed in the Melitz-Chaney model regardless of tariffs.[11] With multiple sectors but no input-output linkages, we show in section 2.7 that our formula for the decomposition of welfare is identical to that used by ACR (p. 114), which allows for changes in entry. When we introduce tariffs then there is naturally an added impact of tariff revenue on income and welfare, and in addition, changes to the scale of industries especially in the presence of input-output linkages. Crucially, as we show, that can then bring about added gains due to selection and entry, and the change in domestic shares also leads to greater gains due to selection in the presence of two-tier Armington aggregation. Furthermore, we will see that those kinds of additional gains are most apparent for Emerging and Developing economies, so using a dataset that includes the widest range of countries — including many smaller countries — is important.

We emphasize that the gains from the Uruguay Round tariffs cuts and from free trade that we obtain are considerably larger than previous literature. From Spearot (2016), the average per-country gains from all tariff cuts – including the Uruguay Round, other MFN tariffs changes and all Preferential tariffs – over the 1994–2000 period are just 0.63%, and the further gains from the complete removal of tariffs from 2000 are 0.67%.[12] That compares with our own average per-country gains of 3.2% from Uruguay Round and all other MFN tariffs over 1990-2010, and 3.6%

[10]Spearot (2016) relies on a quadratic utility function, but because he does not assume an outside good, he argues that the results are similar to using a CES utility function.

[11] This result is obtained in a one sector Melitz-Chaney model with fixed factor supply, provided that tariff revenue is redistributed to consumers (see Appendix A).

[12]These simple averages are obtained from the columns in Spearot (2016, Table 6, p. 158).

when also including Preferential tariffs, with a further 5.1% gain per country from the movement to free trade (so 8.7% in total). While Spearot has 69 countries we use 179, with many of the additional countries being Emerging and Developing nations that experience the greatest gains. Furthermore, while only about one-half of the countries in his sample benefit from the complete removal of tariffs starting at their 1994 levels, all but 6 countries in our sample gain from the complete removal of tariffs starting from their 1990 levels.[13]

As we have noted above, Spearot (2016) does not incorporate input-output linkages, so this is a principal reason why he finds smaller welfare effects than we do from actual tariff removal. But we can also contrast our results with CR, who find a per-country average loss of 7.0% in their multisector Melitz-Chaney model with input-output linkages, but that is from applying a uniform worldwide tariff of 40%, a tariff-wedge more than twice as large as we observe in our 1990 baseline. Instead, we find *higher* per-country gains of 8.7% from the complete removal of tariffs starting from their *smaller* actual level in 1990, when the average *ad valorem* tariff over our sample is only 15%. Of course, using actual data in our case, the 1990 tariffs that we start with were not uniform, and this may amplify welfare gains that we obtain.[14]

There are two other lines of literature that indirectly support — empirically or theoretically — our conclusion that the forces of reallocation across firms, via selection, entry, and exit, is important in explaining the large gains from tariff removal. On the empirical side, there is a patchwork of country case studies — Pavcnik (2002) for Chile; Trefler (2004) for Canada; Hsieh and Klenow (2009) for China and India; Cherkashin, Demidova, Kee; and Krishna (2015) for Bangledesh — that generally support the conclusions that the presence of too-many small plants will lower industry productivity and that significant tariff reductions are accompanied by exit in import-competing industries (and entry in export industries) which can raise productivity. This general conclusion is reinforced by the theoretical findings in Bernard, Redding and Schott (2007, p. 31), who argue that in a multi-sector Melitz model "…falling trade costs induce reallocations of resources both within and across industries and countries. These reallocations generate substantial job turnover in all sectors, spur relatively more creative destruction in comparative advantage industries than in comparative disadvantage industries, and magnify *ex ante* comparative advantage to create additional welfare gains from trade." We feel that our quantitative results are very consistent with these empirical and theoretical findings.[15]

A second line of literature concerns optimal tariffs under monopolistic competition. In revisions to our working paper leading up to Caliendo, Feenstra, Romalis, and Taylor (2021), we numerically solved for the optimal uniform tariffs of each country (assuming no tariffs imposed

[13]The average loss of those six countries is 2.9%, while the average gains of the other 173 countries is 9.1%.

[14]A second reason for larger welfare gains from tariff removal in our paper as compared to CR is that we introduce two-tier Armington aggregation, i.e., a lower elasticity of substitution between home and foreign varieties than between varieties within a country (see Feenstra, Luck, Obstfeld, and Russ 2018). Specifically, we use the "Rule of Two" for the ratio of these two elasticities (see Hillberry and Hummels, 2013), as explained in section 4.

[15]Broader evidence on the entry of firms into export markets is analyzed by Eaton, Kortum, and Kramarz (2004, 2011) and Fernandes et al. (2019).

by the others) and found that they were negative for some countries. This outcome can arise because the tariffs are second-best instruments when used in the absence of other domestic policies to correct the monopoly distortions, as has been further established in other theoretical literature, as discussed in Caliendo, Feenstra, Romalis, and Taylor (2021).[16] We do not analyze analyze optimal tariffs in this paper, but the fact that they can be negative provides one explanation for the large welfare gains from moving to free trade that we find for certain countries, i.e. some of these countries could gain from a further reduction in tariffs from free trade, to apply trade subsidies.

2 Model

Consider a world with M countries, indexed by i and j. There is a mass of L_i agents in each country i. There are S sectors indexed by s and s'. Agents consume nontradable finished goods from all sectors. The finished goods in turn are produced with intermediate goods from different sources, either traded or nontraded. Finished goods are also used as materials, i.e., inputs, for the production of intermediate goods, along with raw labor. Intermediate goods producers in sector s have heterogenous productivities φ (which, following convention, we will also use as an index for each producer, or firm). Specifically, upon entry, for which it pays a fixed cost, a firm's φ is drawn from the known distribution of productivities $G_s(\varphi)$, where we assume that $G_s(\varphi) = 1 - \varphi^{-\theta_s}$ follows a Pareto distribution with coefficient $\theta_s > 0$. We further impose the standard condition that $\theta_s + 1 > \sigma_s$, where σ_s is the elasticity of substitution of intermediate varieties defined later, so as to ensure that average aggregate productivity under constant elasticity of substitution (CES) aggregation is well defined.

In addition to fixed entry costs, the intermediate goods producers face fixed operating costs, and costs of trading, in all markets. As regards trading costs, traded intermediate goods are subject to two types of bilateral trade frictions. First, as is conventional there is an iceberg trade cost in the *ad valorem* form $\tau_{ji,s} - 1 > 0$ of shipping goods from j to i, where we assume $\tau_{ii,s} = 1$ for all i, s. Second, we introduce the *ad valorem* tariff $t_{ji,s}$ which is applied to the *revenue cost* of imports from j to i, where we assume that $t_{ii,s} = 0$ for all i, s. Intermediate goods producers decide how much to supply to the domestic market and how much to supply abroad. Intermediate producers in sector s and country j pay a fixed operating cost $f_{ji,s}$ in order to produce goods for market i, and we make the standard assumption that home operation is less costly than export operation, so that $f_{ii,s} < f_{ji,s}$ for all $j \neq i$. As a result of these fixed costs, less efficient producers of intermediate goods do not find it profitable to supply certain markets, and some do not operate even in the home market. We denote by $\varphi^*_{ji,s}$ the cutoff or threshold productivity level such that all firms in

[16]Theoretical contributions here include, among others, Haaland and Venables (2016); Beshkar and Lashkaripour (2020); Costinot, Rodríguez-Clare, and Werning (2020), Lashkaripour and Lugovsky (2020); and Lashkaripour (2021). Recently, Balistreri and Tarr (2022) analyze a quantitative model with input-output linkages under the Armington, Krugman, and Melitz market structures, for both global tariff cuts and optimal tariffs (which they find are low under monopolistic competition).

each sector s and country j with $\varphi < \varphi^*_{ji,s}$ are not active in exporting to country i, or not active in the home market, in the case where $\varphi < \varphi^*_{ii,s}$.

Denote by $N_{j,s}$ the mass of entering firms in equilibrium in each sector s and country j. By virtue of the Pareto distribution, the number of firms/products actually sold in sector s, from country j, into market i is the the total number of entering firms times the mass of firms above the relevant threshold, which is given by $N_{j,s}\left[1 - G_s\left(\varphi^*_{ji,s}\right)\right] = N_{j,s}\,{\varphi^*_{ji,s}}^{-\theta_s}$.

We assume that agents have Cobb-Douglas preferences where $\alpha_{i,s}$ are the expenditure shares on consumed goods $C_{i,s}$ (see Appendix B.1). Agents derive income from two sources, labor income and rebated tariff revenue, and firm profits will be equal to zero by an assumption of free entry. We let I_i represent the income of the agents in country i, and $P_{i,s}$ is the price of finished good s in country i.

2.1 Finished goods producers

Finished goods are produced with a nested CES production function: the upper-level distinguishes home and foreign inputs, with an elasticity of substitution of $\omega_s > 1$ between these two groups; and the lower-level is defined over varieties of home and varieties of foreign intermediate inputs, with an elasticity of substitution $\sigma_s > \omega_s$ between varieties within each group.[17]

The home demand for home intermediates of variety φ sold in sector s in country i is given by

$$q_{ii,s}(\varphi) = \left(\frac{p_{ii,s}(\varphi)}{P_{ii,s}}\right)^{-\sigma_s}\left(\frac{P_{ii,s}}{P_{i,s}}\right)^{-\omega_s}\frac{Y_{i,s}}{P_{i,s}}, \tag{1}$$

where $Y_{i,s} = P_{i,s}Q_{i,s}$ is the value of output of the finished good s in i, and $P_{ii,s}$ is the CES price index for home intermediate inputs in sector s.

Likewise, home demand for imported intermediates sold from country $j \neq i$ in country i is

$$q_{ji,s}(\varphi) = \left(\frac{p_{ji,s}(\varphi)}{P^F_{i,s}}\right)^{-\sigma_s}\left(\frac{P^F_{i,s}}{P_{i,s}}\right)^{-\omega_s}\frac{Y_{i,s}}{P_{i,s}}, \tag{2}$$

where $p_{ji,s}(\varphi)$ is the tariff-inclusive price paid by the importer, $P^F_{i,s}$ is the CES price index of foreign intermediate inputs, *inclusive of tariffs.* Finally, with these results, we can derive the aggregate CES prices index $P_{i,s}$ over all varieties,

$$P_{i,s} = \left[\left(P_{ii,s}\right)^{1-\omega_s} + \left(P^F_{i,s}\right)^{1-\omega_s}\right]^{\frac{1}{1-\omega_s}}. \tag{3}$$

[17] This nested structure is also used by Feenstra, Luck, Obstfeld, and Russ (2018). We use this nested structure here because Kucheryavyy, Lyn, and Rodríguez-Clare (2016) have shown the potential for corner solutions in multi-sector monopolistic competition models. That potential is offset by adding the extra upper-level curvature in the nested CES structure.

2.2 Intermediate goods producers

The marginal cost of producing a differentiated input for a firm with productivity $\varphi_s = 1$ in sector s in country i is given by

$$x_{i,s} \equiv \left(\frac{w_i}{1-\gamma_{i,s}}\right)^{1-\gamma_{i,s}} \prod_{s'=1}^{S} \left(\frac{P_{i,s'}}{\gamma_{i,s's}}\right)^{\gamma_{i,s's}}, \tag{4}$$

where: $\gamma_{i,s's} \geq 0$ is the cost share of inputs from sector s' used by sector s (input-output coefficients); $\gamma_{i,s} \equiv \sum_{s'=1}^{S} \gamma_{i,s's} < 1$ is the cost share of all intermediate inputs; and $1 - \gamma_{i,s} > 0$ is the share of value added (here, labor costs) in the total cost of production. This input cost index contains information on prices from all sectors in the economy and, clearly, the input cost directly affects production decisions in all sectors. This feature is a key distinction of our model, as compared to a one-sector model or a multi-sector model without input-output linkages.

Profit maximization Consider the profit maximization problem of supplying an intermediate input to market j for a firm with productivity φ. Profits are given by

$$\pi_{ij,s}(\varphi) = \max_{p_{ij,s}(\varphi)\geq 0} \left\{ \frac{p_{ij,s}(\varphi)}{1+t_{ij,s}}\, q_{ij,s}(\varphi) - \frac{x_{i,s}}{\varphi}\, \tau_{ij,s}\, q_{ij,s}(\varphi) - w_i\, f_{ij,s} \right\}, \tag{5}$$

subject to (2). The control variable in this problem is $\frac{p_{ij,s}(\varphi)}{1+t_{ij,s}}$, the net-of-tariff price received by the exporting firm. As we can see, this price differs from the tariff-inclusive price $p_{ij,s}(\varphi)$ paid by the importer, and means that the sales revenue $p_{ij,s}\, q_{ij,s}$ is *divided by* the tariff factor $1 + t_{ij,s}$ in order to obtain producer revenue in (5). Note that the quantity sold by the firm is $\tau_{ij,s}\, q_{ij,s}(\varphi)$ because of the iceberg trade costs. So the costs of production $(x_{i,s}/\varphi)\, q_{ij,s}$ are *multiplied by* the iceberg trade costs $\tau_{ij,s}$ to obtain the costs in (5).

These are subtle but very important details. This discussion shows how the tariffs and iceberg trade costs enter the profit equation in slightly different ways, and follows from our assumption that the *ad valorem* tariff is applied to the sales revenue. In contrast, if the tariff was applied to only the costs of the imported product then the costs $(x_{i,s}/\varphi)\, q_{ij,s}$ would be multiplied by the product of the iceberg trade costs and the tariff factor, $\tau_{ij,s}\,(1 + t_{ij,s})$ in (5), so that the tariffs and iceberg costs would enter the firm's problem symmetrically.[18] We will see that this distinction between how tariffs and iceberg costs are modeled makes an important difference to the zero-profit-cutoff productivity that we solve for below.

The quantity demanded for imported inputs is then a function of this price plus the tariff,

[18] See Appendix A for a discussion of this alternative way of modeling "cost-based" tariffs, and a comparison to the "revenue-based" tariff that we adopt here in the main text.

relative to the import price index of all intermediates in sector s in destination market i. Thus,

$$\frac{p_{ij,s}(\varphi)}{1+t_{ij,s}} = \frac{\sigma_s}{\sigma_s - 1}\frac{x_{i,s}\,\tau_{ij,s}}{\varphi}, \tag{6}$$

$$q_{ij,s}(\varphi) = \left(\frac{\sigma_s}{\sigma_s - 1}\frac{x_{i,s}\,\tau_{ij,s}}{\varphi}\right)^{-\sigma_s} \frac{P_{j,s}^{F(\sigma_s-\omega_s)}\,P_{j,s}^{\omega_s-1}\,Y_{j,s}}{\left(1+t_{ij,s}\right)^{\sigma_s}}. \tag{7}$$

The profits for sector s in country i from selling to market $j \neq i$ are given by the markup minus one, times unit cost pre-tariff, times output, less fixed costs:

$$\pi_{ij,s}(\varphi) = \frac{x_{i,s}\,\tau_{ij,s}\,q_{ij,s}(\varphi)}{(\sigma_s - 1)\varphi} - w_i\,f_{ij,s}\,. \tag{8}$$

The price $p_{ii,s}(\varphi)$ and quantity $q_{ii,s}(\varphi)$ of goods selling to the home market are obtained by using $t_{ij,s} = 0$, $\tau_{ij,s} = 1$, and by replacing the import price index $P_{i,s}^F$ with the home price index $P_{ii,s}$ in the above expressions.

2.3 Selection and entry

Zero cutoff profit condition Given the presence of fixed operating costs, there exits a threshold level of productivity such that a firm in a given sector makes zero profit. Using the equilibrium conditions for prices and quantities derived before, the *zero cutoff profit* (ZCP) level of productivity in sector s for export sales $(i \neq j)$ is determined by $\pi_{ij,s}\left(\varphi_{ij,s}^*\right) = 0$, namely

$$\varphi_{ij,s}^* = \left(\frac{\sigma_s}{\sigma_s - 1}\right)\left(\frac{\sigma_s\,w_i\,f_{ij,s}\,(1+t_{ij,s})}{Y_{j,s}\,P_{j,s}^{F(\sigma_s-\omega_s)}\,P_{j,s}^{\omega_s-1}}\right)^{\frac{1}{\sigma_s-1}} x_{i,s}\,\tau_{ij,s}\,(1+t_{ij,s})\,. \tag{9}$$

Note that a reduction in the tariff level affects the ZCP condition in a way that is different from a reduction in iceberg trade costs. This follows from our assumption that tariffs are applied to the sales value of the import, as discussed above. In practice, this means that a reduction in actual tariffs acts in the ZCP condition very similarly to a *joint reduction* in iceberg trade costs and in fixed costs.[19] The gains from tariff reduction will take into account this implicit reduction in fixed costs, which will encourage the entry of exporters and increase export variety, as we show below.

Another feature of (9) that deserves attention is that the output $Y_{j,s}$ of sector s in country j appears in the denominator on the right. With country i exporting to country j in that sector, a higher output means that exporters can spread their fixed costs over greater sales, which therefore

[19] In contrast, if tariffs are applied only to the costs of imported products, then they would have exactly the same effect on the zero-cutoff-profit condition as do iceberg trade costs $\tau_{ij,s}$, and would appear only as multiplying those trade costs above (i.e., as in the final terms in (9)). Under our maintained assumption that tariffs are applied to the sales revenue, they have the "extra" impact of effectively reduced fixed costs, too.

allows more firms to self-select into exporting. We therefore refer to the presence of $Y_{j,s}$ in (9) as a *selection effect*, and we will find that it enters our later equations, too.

Free entry As noted earlier, firms pay a fixed cost of entry $f^E_{i,s}$ in each sector, in units of labor, in order to allow them to take a draw from the known distribution of productivities $G_s(\varphi)$. Free entry implies that expected profits of firms have to equal entry costs in sector s and country i.

Using the equilibrium conditions (8) and (9), and the analogous conditions for the home market, and given the assumption of a Pareto distribution of productivities, we end up with the following equilibrium condition

$$\sum_{j=1}^{M} f_{ij,s}\, {\varphi^*_{ij,s}}^{-\theta_s} = \frac{\theta_s - \sigma_s + 1}{\sigma_s - 1} f^E_{i,s}\,, \tag{10}$$

which relates the ZCP levels of productivities to the fixed operating and entry costs $f_{ij,s}$ and $f^E_{i,s}$.

2.4 Price index

We define the average productivity level of the firms making intermediate goods in sector s sold in i and sourced from j as

$$\tilde{\varphi}_{ji,s} = \left(\int_{\varphi^*_{ji,s}}^{\infty} \varphi^{\sigma_s - 1}\, \mu_{ji,s}(\varphi)\, d\varphi \right)^{\frac{1}{\sigma_s - 1}}, \tag{11}$$

where $\mu_{ji,s}(\varphi) = g_s(\varphi) / \left[1 - G_s\left(\varphi^*_{ji,s}\right)\right]$ is the conditional distribution of productivities (that is, conditional on the variety φ being actively produced for this $\{i, j, s\}$ combination). Then using (3) and (6) we obtain

$$\begin{aligned} P_{i,s} \;=\; & \left\{ \left({\varphi^*_{ii,s}}^{-\theta_s} N_{i,s} \right)^{\frac{1-\omega_s}{1-\sigma_s}} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x_{i,s}}{\tilde{\varphi}_{ii,s}} \right)^{1-\omega_s} \right. \\ & \left. + \left[\sum_{j \neq i}^{M} \left({\varphi^*_{ji,s}}^{-\theta_s} N_{j,s} \right) \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x_{j,s}\, \tau_{ji,s}\, \left(1 + t_{ji,s}\right)}{\tilde{\varphi}_{ji,s}} \right)^{1-\sigma_s} \right]^{\frac{1-\omega_s}{1-\sigma_s}} \right\}^{\frac{1}{1-\omega_s}}, \end{aligned} \tag{12}$$

where ${\varphi^*_{ji,s}}^{-\theta_s} = \left[1 - G_s\left(\varphi^*_{ji,s}\right)\right]$ is the probability that an entering firm in country j actually exports to market i, so that the number of products actually sold are $N_{ji,s} \equiv {\varphi^*_{ji,s}}^{-\theta_s} N_{j,s}$.

2.5 Trade balance and market clearing

To close the model, we need to ensure that all entities obey their budget constraints, markets clear, and trade is balanced.

Expenditure shares Recall that $Y_{i,s} = P_{i,s}\, Q_{i,s}$ is the value of the output of the finished good s in country i, made entirely from intermediate goods, these being either imported or produced domestically. Hence, this value of output equals the total expenditure on those intermediate goods.

Let $\lambda_{ji,s}$ denote the share of country's i total expenditure in sector s on intermediate goods from market j. In this share, integrating over sales of all varieties of s from j to i yields the numerator, and summing over all markets j gives the denominator. Using the conditions (6), (7), (11), and (12) we can obtain the following expression for the expenditure share on domestic inputs

$$\lambda_{ii,s} = {\varphi^{*}_{ii,s}}^{-\theta_s}\, N_{i,s} \left(\frac{\sigma_s}{\sigma_s - 1}\, \frac{x_{i,s}}{\tilde{\varphi}_{ii,s}\, P_{ii,s}} \right)^{1-\sigma_s} \left(\frac{P_{ii,s}}{P_{i,s}} \right)^{1-\omega_s}, \tag{13}$$

and on imported inputs

$$\lambda_{ji,s} = {\varphi^{*}_{ji,s}}^{-\theta_s}\, N_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1}\, \frac{\tau_{ji,s}\, x_{j,s}\, (1 + t_{ji,s})}{\tilde{\varphi}_{ji,s}\, P^F_{i,s}} \right)^{1-\sigma_s} \left(\frac{P^F_{i,s}}{P_{i,s}} \right)^{1-\omega_s}. \tag{14}$$

Sectoral trade flows We now solve for sectoral exports and imports and impose balanced trade.

Consider sector s imports first. The total expenditure by country j on country i intermediate goods is given by $\lambda_{ij,s} Y_{j,s}$. Due to the presence of tariffs, not all of this expenditure reaches producers in country j. The tariff-adjusted expenditure in country j on goods produced in country i, or exports from i to j, is $E_{ij,s} \equiv \frac{\lambda_{ij,s}}{1+t_{ij,s}} Y_{j,s}$.

Of course, that term is identical to imports arriving in j from i. Therefore, total *exports* from country i, *not* including goods that are sold domestically, are given by

$$E_{i,s} \;\equiv\; \sum\nolimits_{j \neq i} E_{ij,s} \;=\; \sum\nolimits_{j \neq i} \frac{\lambda_{ij,s}}{1 + t_{ij,s}} Y_{j,s}\,, \tag{15}$$

and total *imports* are given by $\sum\limits_{j \neq i} E_{ji,s} = \sum\limits_{j \neq i} \frac{\lambda_{ji,s}}{1+t_{ji,s}} Y_{i,s}$.

Now that we have derived the sectoral trade flows, we define the trade balance condition,

$$\sum\nolimits_{s=1}^{S} \sum\nolimits_{j \neq i} \frac{\lambda_{ji,s}}{1 + t_{ji,s}} Y_{i,s} \;=\; \sum\nolimits_{s=1}^{S} \sum\nolimits_{j \neq i} \frac{\lambda_{ij,s}}{1 + t_{ij,s}} Y_{j,s}\,. \tag{16}$$

Goods market equilibrium We can also define sectoral, $T_{i,s}$, and total, T_i, tariff revenue as $T_i = \sum_{s=1}^{S} T_{is} = \sum_{s=1}^{S} \sum_{j \neq i} t_{ji,s}\, E_{ji,s}$. With that, the expenditure on finished goods from sector s by households in country i is given by $\alpha_{i,s}\, I_i$, where I_i is total income consisting of labor income plus this redistributed tariff revenue, $I_i = w_i\, L_i + T_i$.

The total value of production of all intermediate goods in sector s in country i is given by $\frac{\sigma_s - 1}{\sigma_s} \sum_{j=1}^{M} \frac{\lambda_{ij,s}}{1+t_{ij,s}} Y_{j,s}$; namely, the net-of-tariff value of sector s goods that are sold locally and abroad adjusted by markups. Given the input-output coefficients, a share $\gamma_{i,s's}$ of this gross production is then spent on intermediate inputs from sector s'. Therefore, the materials from sector s' demanded in sector s for the production of intermediate goods is then given by $\gamma_{i,s's}\frac{\sigma_s-1}{\sigma_s}\sum_{j=1}^{M}\frac{\lambda_{ij,s}}{1+t_{ij,s}}Y_{j,s}$.

We can then obtain the total demand for the output of sector s of country i, which goes to both consumers as finished goods and to firms for intermediate use, and which must equal total supply of that finished output:

$$Y_{i,s} \;=\; \alpha_{i,s}\left(w_i\,L_i + T_i\right) \;+\; \sum_{s'=1}^{S}\widetilde{\gamma}_{i,ss'}\sum_{j=1}^{M}\frac{\lambda_{ij,s'}}{1+t_{ij,s'}}Y_{j,s'}\,. \tag{17}$$

To explain this specification, recall that fixed costs are paid in units of labor. Then the value of output net of markups in each sector, $\left(\frac{\sigma_{s'}-1}{\sigma_{s'}}\right)Y_{j,s'}$, equals the value of intermediate inputs used in their production, and these generate demand for the output $Y_{i,s}$ used as materials to produce those intermediate inputs. We define the combined parameters

$$\widetilde{\gamma}_{i,ss'} \equiv \gamma_{i,ss'}\left(\frac{\sigma_{s'}-1}{\sigma_{s'}}\right)$$

to reflect the demand generated in sector s' for the output from sector s.

2.6 Firm entry and product variety

To close the model we need to tackle selection and entry, solving for the mass of firms $N_{i,s}$ entering in country i and sector s, and the productivity cutoffs $\varphi^*_{ij,s}$ for the varieties produced for market j.

To solve for product variety, use (9) for $i \neq j$ and the average value $\tilde{\varphi}_{ij,s}$, substituting into (14) we obtain an equation governing the cutoffs $\varphi^*_{ij,s}$,

$$\lambda_{ij,s} = {\varphi^*_{ij,s}}^{-\theta_s}\,N_{i,s}\left(\frac{\sigma_s\,w_i\,f_{ij,s}\,(1+t_{ij,s})}{Y_{j,s}}\right)\left(\frac{\theta_s}{\theta_s+1-\sigma_s}\right). \tag{18}$$

Next, multiplying this equation by $Y_{j,s}/\left(1+t_{ij,s}\right)$, summing over j and making use of (15) and (10), we obtain an expression for total domestic plus international sales of intermediate inputs in sector s by country i,

$$E_{ii,s}+E_{i,s} \;=\; \sum_{j=1}^{M}{\varphi^*_{ij,s}}^{-\theta_s}\,N_{i,s}\left(\frac{\sigma_s\,w_i\,f_{ij,s}}{\theta_s+1-\sigma_s}\right) \;=\; N_{i,s}\,w_i\,f^E_{i,s}\left(\frac{\theta_s\,\sigma_s}{\sigma_s-1}\right),$$

from which we can obtain an equation governing the mass of entrants $N_{i,s}$, namely

$$N_{i,s} = \left(E_{ii,s}+E_{i,s}\right)\Big/\left[w_i\,f^E_{i,s}\left(\frac{\theta_s\,\sigma_s}{\sigma_s-1}\right)\right]. \tag{19}$$

Thus, entry is tightly linked to the total domestic plus international sales of intermediate inputs $(E_{ii,s}+E_{i,s})$.

2.7 Decomposition of the change in utility

Our final step is to solve for changes in the price index and utility of country i due to changes in *ad valorem* tariffs or trade costs. For convenience when comparing to the existing literature, let us initially focus on the case where $\omega_s = \sigma_s$, so that domestic and foreign varieties all substitute with the elasticity σ_s. In addition, we initially choose the wage of country i as the numeraire, $w_i \equiv 1$.

Substituting (9) into (18) and differentiating, we readily obtain

$$\underbrace{\frac{d\lambda_{ii,s}}{\lambda_{ii,s}} - \frac{dN_{i,s}}{N_{i,s}}}_{\text{entry-adjusted domestic share}} = \theta_s \left(\frac{dP_{i,s}}{P_{i,s}} - \sum_{s'=1}^{S} \gamma_{i,ss'} \frac{dP_{i,s'}}{P_{i,s'}} \right) + \left(\frac{\theta_s}{\sigma_s - 1} - 1 \right) \frac{dY_{i,s}}{Y_{i,s}}. \tag{20}$$

The term on the left of this equation is the change in what we henceforth denote an "entry-adjusted domestic share", i.e., the ratio $\lambda_{ii,s}/N_{i,s}$. In a Krugman model with homogeneous firms, entry equals domestic product variety, and so this term is readily shown to be the determinant of the sector s price index that combines domestic varieties and imports. To see this, let us start with the price index of domestic varieties. We have normalized the wage at unity and we will ignore intermediate inputs for the moment, so we treat marginal costs as unity. With domestic varieties of $N_{i,s}$, the effective domestic price is simply $N_{i,s}^{-1/(\sigma_s-1)}$, which adjusts the number of varieties by the exponent shown to reflect the gains from variety and the drop in the effective domestic price. Now let us incorporate import varieties. Feenstra (1994) argues that these "new" varieties will further reduce the overall price index in sector s according to the domestic share of expenditure $\lambda_{ii,s}$ raised to the exponent $1/(\sigma_s - 1)$. Therefore the overall price becomes $(\lambda_{ii,s}/N_{i,s})^{1/(\sigma_s-1)}$.

For the Melitz model with heterogeneous firms, the mass of entering firms $N_{i,s}$ is no longer equal to domestic product variety, because some firms drop out due to selection. Nevertheless, ACR (p. 114) argue that with multiple sectors, the domestic price index in sector s is obtained by dividing the domestic share by employment in each sector, obtaining $\lambda_{ii,s}/L_{i,s}$. But employment in each sector is proportional to entry, as they note,[20] so the entry-adjusted domestic share $\lambda_{ii,s}/N_{i,s}$ is proportional to $\lambda_{ii,s}/L_{i,s}$. These adjusted domestic shares are now raised to the exponent $1/\theta_s$ to obtain the overall price index for sector s. This is more general than the ACR formula for the price index in a one-sector model, which is $\lambda_{ii,s}^{1/\theta_s}$, because entry remains fixed in the one sector model even with changes in tariffs.[21] As ACR state (p. 114): "in a multisector environment, the supply of labor in each sector is no longer inelastic: foreign shocks may lead to changes in sector-level employment with consequences for the measure of goods that can be produced... This is the key idea behind our generalized formula."

Thus, the use of the entry-adjusted domestic share term as we defined it above — in either the Krugman or the Melitz-Chaney models — is well-motivated from the existing literature. And, very clearly, these results also illustrate the equivalence of the formulas for the gains from trade in

[20] See Appendix B.4.

[21] See note 11 and Appendix A.

the two models once we set θ_s in the Melitz model equal to $\sigma_s - 1$ in the Krugman model. Because of the similarity of these formulas obtained in the absence of intermediate inputs, we will refer to these as "generic gains" from trade that can arise in either model.[22]

Now let us incorporate input-output linkages. We can determine the change in the price index for sector s, $d \ln P_{i,s}$, by inverting (20). For convenience, let us simplify our model for the moment by supposing that the input-output matrix is diagonal with $\gamma_{i,ss'} = 0$ for $s \neq s'$, so that $\gamma_{i,ss} = \gamma_{i,s}$. Then we can solve for the change in the sector s price index from (20) as

$$\frac{dP_{i,s}}{P_{i,s}} = \underbrace{\frac{1}{\theta_s \, (1 - \gamma_{i,s})}}_{\text{roundabout}} \left[\underbrace{\frac{d\lambda_{ii,s}}{\lambda_{ii,s}} - \frac{dN_{i,s}}{N_{i,s}}}_{\text{entry-adjusted domestic share}} - \underbrace{\left(\frac{\theta_s}{\sigma_s - 1} - 1 \right)}_{\text{selection}} \underbrace{\frac{dY_{i,s}}{Y_{i,s}}}_{\text{scale}} \right]. \tag{21}$$

The first term on the right of this equation is precisely the change in the entry-adjusted domestic share that we have already discussed. Its impact on the domestic price index is amplified by the presence of roundabout production, with $\gamma_{i,s} > 0$. The second term on the right reflects the change in output of the finished good in sector i, or the "scale effect". The coefficient of this term, $\left(\frac{\theta_s}{\sigma_s - 1} - 1\right)$, reflects selection in the presence of heterogeneous firms.[23] It is important to recognize, however, that if there are no input-output linkages so that $\gamma_{i,s} = 0$ and the finished goods are sold only to consumers, then even in the presence of heterogeneous firms this scale effect can fail to operate. To see this, recall that we are assuming Cobb-Douglas preferences so that the share of each final good in consumption is fixed. In a model with iceberg trade costs but no tariffs, and with the wage normalized at $w_i = 1$ as we have assumed, then total income is also fixed at L_i. So in that case, the output of the finished good in each sector is fixed, which explains why the second term in (21) does not appear in ACR (2013) when multiple sectors are considered in the absence of input-output linkages. When we add tariffs then tariff revenue will influence demand and the scale of each industry, and we show now that scale is also influenced by the presence of input-output linkages, as in Costinot and Rodríguez-Clare (2014).

With exports given by (15) and domestic sales of intermediate goods equal to $E_{ii,s} = \lambda_{ii,s} Y_{i,s}$, the market clearing condition (17) is rewritten in general as

$$Y_{i,s} = \alpha_{i,s} \, (w_i \, L_i + T_i) + \sum\nolimits_{s'=1}^{S} \widetilde{\gamma}_{i,ss'} \, (E_{ii,s'} + E_{i,s'}) \, . \tag{22}$$

The first term is the sector s finished good that is delivered to consumers, while the second term

[22] We stress that the *source* of these generic gains are quite different in the Krugman and Melitz models, however. In the Krugman model, our discussion above has emphasized the gains from domestic and imported product variety. But in the Melitz model, the "generic gains" are due at least in part to the selection of firms, as emphasized by Melitz and Redding (2015). Of course, "generic gains" of this form can also arise in the Armington and other competitive models, as emphasized by ACR, but in those cases there is no entry, so the entry-adjustment part of the formula does not arise.

[23] di Giovanni and Levchenko (2013) consider the case where $\theta_s \to \sigma_s - 1$ so the selection effect nearly vanishes. In that case, they argue that the gains from trade depend on the intensive margin of very large firms.

is the sector s finished good that is delivered to firms across all sectors s' as an input into their production of intermediates. In general, we define

$$R_{i,s} \equiv \sum_{s'=1}^{S} \widetilde{\gamma}_{i,ss'} \frac{(E_{ii,s'} + E_{i,s'})}{Y_{i,s}} = 1 - \frac{\alpha_{i,s}\,(L_i + T_i)}{Y_{i,s}}, \tag{23}$$

as the fraction of the value of each finished good that is delivered to firms, or one minus the fraction delivered to consumers. For a final good that is *only* used by consumers, we have $R_{i,s} = 0$.

Now making use of our simplifications that $\gamma_{i,ss'} = 0$ for $s \neq s'$ and also $w_i \equiv 1$, using free entry in (19) we can totally differentiate (22) to obtain the change in output

$$\frac{dY_{i,s}}{Y_{i,s}} = (1 - R_{i,s})\frac{dT_i}{L_i + T_i} + R_{i,s}\,\frac{dN_{i,s}}{N_{i,s}}\,. \tag{24}$$

We see that changes in output are determined by the changes in tariff revenue and entry. The marginal impact of entry depends on whether the sector is mainly producing final goods (so that $R_{i,s} \to 0$) or mainly producing intermediate inputs (so that $R_{i,s} \to 1$): entry has a greater impact on welfare in the latter case, where more intermediate inputs are being produced.

The overall change in welfare is obtained by differentiating the Cobb-Douglas utility function, with consumption shares $\alpha_{i,s}$ on each sector:[24]

$$\frac{dU_i}{U_i} = \frac{dT_i}{L_i + T_i} - \sum_{s=1}^{S} \alpha_{i,s} \frac{dP_{i,s}}{P_{i,s}}\,. \tag{25}$$

Substituting from (21), we obtain

$$\frac{dU_i}{U_i} = \frac{dT_i}{L_i + T_i} + \sum_{s=1}^{S} \frac{\alpha_{i,s}}{\theta_s(1-\gamma_{i,s})} \left[-\left(\frac{d\lambda_{ii,s}}{\lambda_{ii,s}} - \frac{dN_{i,s}}{N_{i,s}} \right) + \left(\frac{\theta_s}{\sigma_s - 1} - 1 \right) \frac{dY_{i,s}}{Y_{i,s}} \right]. \tag{26}$$

Finally, substituting from (24) for the change in output, we obtain

$$\begin{aligned} \frac{dU_i}{U_i} = {} & \underbrace{\frac{dT_i}{L_i + T_i}}_{\text{tariff revenue}} - \sum_{s=1}^{S} \frac{\alpha_{i,s}}{\theta_s(1-\gamma_{i,s})} \underbrace{\left(\frac{d\lambda_{ii,s}}{\lambda_{ii,s}} - \frac{dN_{i,s}}{N_{i,s}} \right)}_{\text{entry-adjusted domestic share}} \\ & + \sum_{s=1}^{S} \frac{\alpha_{i,s}}{\theta_s(1-\gamma_{i,s})} \underbrace{\left(\frac{\theta_s}{\sigma_s - 1} - 1 \right)}_{\text{selection}} \left[R_{i,s} \underbrace{\frac{dN_{i,s}}{N_{i,s}}}_{\text{entry}} + (1 - R_{i,s}) \underbrace{\frac{dT_i}{L_i + T_i}}_{\text{tariff revenue}} \right]. \end{aligned} \tag{27}$$

The first term appearing on the right of (26) is just the direct impact on welfare from the change in tariff revenue. The second term is the change in the entry-adjusted domestic share, as we have

[24] See (37) and (38) in the Appendix.

already discussed. The third term reflects the selection effects due to scale, which includes the impact of entry and the added impact of the change in tariff revenue.

The changes in entry in (27) are endogenous, of course, except in the one-sector model where entry is fixed. In general, the full employment condition for the economy constrains the changes in sectoral entry that can occur: because entry is proportional to labor used in each sector, the changes in entry must sum to zero across sectors when weighted by the corresponding labor shares

$$\sum_s \left(\frac{L_{i,s}}{L_i}\right) \frac{dN_{i,s}}{N_{i,s}} \;=\; 0\,. \tag{28}$$

In general, the labor shares (28) differ from the weights on utility shown in (26) and (27), and so it appears possible that by using tariffs, entry can be moved in a welfare-enhancing direction. Even if the parameters θ_s and σ_s are the same across sectors, then entry into sectors with more roundabout production so that $\gamma_{i,s}$ and $1/(1-\gamma_{i,s})$ is higher in (27), or greater forward linkages so that $R_{i,s}$ is higher, will lead to greater gains that can more than offset the losses from exit in other sectors. Determining whether this pattern of entry and exit arise in practice will be one aspect of our quantitative analysis.[25]

2.8 The general case

In Appendix D we show how the terms appearing in (27) can be measured with large rather than infinitesimal changes, while allowing a general input-output matrix $\mathbf{\Gamma}_i \equiv [\gamma_{i,s's}]$ with non-zero off-diagonal elements, and also in the more general case of a two-tier Armington aggregation with $1 < \omega_s < \sigma_s$. We drop the normalization that $w_i \equiv 1$.

In this general case, we work with *real output* in each sector, $Y_{i,s}/w_i$. Denoting any variable in the original equilibrium by $z_{i,s}$ and in the equilibrium after changing tariffs by $z'_{i,s}$, we define $\hat{z}_{i,s} \equiv z'_{i,s}/z_{i,s}$ as the ratio between these two equilibria. Note that the *percentage change* between the equilibria can be measured by $\hat{z}_{i,s} - 1$. An alternative measure of the percentage change, however, is to take the natural log, obtaining $\ln \hat{z}_{i,s}$. It turns out that we need to keep track of these two different measures of the percentage change in real output, so we define their ratio as:

$$\Delta_{i,s} \equiv \frac{\ln (\widehat{Y_{i,s}/w_i})}{(\widehat{Y_{i,s}/w_i}) - 1}\,. \tag{29}$$

We can think of $\Delta_{i,s}$ as an "adjustment factor" that converts one measure of the percentage change in real output to the other. Using L'Hôpital's Rule we can see that $\Delta_{i,s} \to 1$ as $(\widehat{Y_{i,s}/w_i}) \to 1$, as would be the case for an infinitesimal change in $Y_{i,s}/w_i$. For large changes, we can readily compute the terms $\Delta_{i,s}$ for all countries and sectors using the real output in the initial and tariff-adjusted

[25] The potential benefits from expanding entry into industries with forward production linkages is an old idea in trade and development (Hirschman, 1958), and is found in modern macroeconomics, too (Jones, 2011). The decomposition in (27) shows how this idea arises from our multi-sector Melitz-Chaney model with input-output linkages.

equilibria from our quantitative model.

We state our general result for the decomposition of utility. In country i, let $\mathbf{D}$ be an operator that for a vector $z_{i,s}, s = 1, ..., S$, returns the $S \times S$ diagonal matrix $\mathbf{D}[z_{i,s}]$ with $z_{i,s}$ along the diagonal and 0 elsewhere. Also, let $\boldsymbol{\alpha}_i^T$ be a $1 \times S$ row vector of consumption shares $\alpha_{i,s}$; let $\ln \hat{\boldsymbol{\lambda}}_{ii}$, $\ln \hat{\mathbf{N}}_i$ and $\mathbf{R}_i$ denote the $S \times 1$ column vectors of the terms $\ln \hat{\lambda}_{ii,s}$, $\ln \hat{N}_{i,s}$ and $R_{i,s}$; let $\widetilde{\boldsymbol{\Gamma}}_i$ denote the $S \times S$ matrix $[\tilde{\gamma}_{i,ss'}]$; and let $\mathbf{1}_S$ be an $S \times 1$ vector of ones. Then the change in utility of country i between the two equilibria is obtained as

$$
\begin{aligned}
\ln \widehat{U}_i \quad = \quad & \ln\left(\frac{L_i + (T_i'/w_i')}{L_i + (T_i/w_i)}\right) \\
- \quad & \boldsymbol{\alpha}_i^T (\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1} \left\{ \mathbf{D}\left[\frac{1}{\theta_s}\right] \underbrace{\left(\ln \hat{\boldsymbol{\lambda}}_{ii} - \ln \widehat{\mathbf{N}}_i\right)}_{\text{entry-adjusted domestic share}} + \underbrace{\mathbf{D}\left[\frac{\sigma_s - \omega_s}{\theta_s(\omega_s - 1)}\right]}_{\text{Armington}} \ln \hat{\boldsymbol{\lambda}}_{ii} \right\} \\
- \quad & \boldsymbol{\alpha}_i^T (\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1} \underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s - 1} - 1\right)\right]}_{\text{selection}} \underbrace{\mathbf{D}\left[\frac{\sigma_s - \omega_s}{\theta_s(\omega_s - 1)}\right]}_{\text{Armington}} \ln \hat{\boldsymbol{\lambda}}_{ii} \\
+ \quad & \boldsymbol{\alpha}_i^T (\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1} \underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s - 1} - 1\right)\right]}_{\text{selection}} \mathbf{D}\left[\frac{\Delta_{i,s}}{Y_{i,s}\theta_s}\right] \widetilde{\boldsymbol{\Gamma}}_i \mathbf{D}\left[E_{ii,s} + E_{i,s}\right] \underbrace{(\widehat{\mathbf{N}}_i - \mathbf{1}_S)}_{\text{entry via scale}} \\
+ \quad & \boldsymbol{\alpha}_i^T (\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1} \underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s - 1} - 1\right)\right]}_{\text{selection}} \mathbf{D}\left[\frac{\Delta_{i,s}}{\theta_s}\right] (\mathbf{1}_S - \mathbf{R}_i) \underbrace{\left(\frac{L_i + (T_i'/w_i')}{L_i + (T_i/w_i)} - 1\right)}_{\text{tariff revenue}}.
\end{aligned}
\tag{30}
$$

2.9 Welfare gains from trade: "generic" versus "selection"

To interpret (30), on the first line we have the change in tariff revenue as in the first term of (27), but now without a normalization that $w_i \equiv 1$ and computed for large changes. On the second line, the first term is entry-adjusted domestic share, now a column vector, with each element divided by the coefficients θ_s, pre-multiplied by the Leontief inverse $(\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1}$, and then summed across sectors using consumption shares $\alpha_{i,s}$. This term appeared in the second term of (27), but here is evaluated with the full input-output structure. The second term on the second line of (30) is new and it reflects the impact of two-tier Armington aggregation, with $1 < \omega_s < \sigma_s$, so the diagonal matrix (labeled "Armington") is positive. Any fall in the domestic share brings with it greater gains with two-tier Armington, because that fall can be achieved only by a greater decline in the import price of that sector. We noted earlier that the entry-adjusted domestic share appears *generically* in the monopolistic competition model with homogeneous or heterogeneous firms, and the same is true for this Armington term on the second line.[26]

[26]To see this, recall our discussion of the Krugman model just after (20). There, the effective domestic price is $N_{i,s}^{-1/(\sigma_s-1)}$. With two-tier Armington aggregation, the "new" import varieties reduce the overall price index in sector

For these important reasons, we shall refer to the combined terms on the first and second lines as the **generic gains** from tariff removal, where it should be understood that these will include gains arising from two-tier Armington aggregation and changes in real tariff revenue. Beyond that, the remaining lines of (30) all reflect gains due to **selection effects** that arise with heterogeneous firms, which we want to highlight. In particular, note that the third line is a new element here, and it shows that the Armington term, which already played an amplifying role in the second line, *also* has an amplifying impact via selection: as the domestic share falls, the less-efficient home firms exit the market and average productivity rises, which raises welfare.

The fourth and fifth lines are much like the selection terms that appeared earlier on the second line of (27), but again converted into large changes here. They illustrate the interactions of selection with entry induced by the scale effect and with the accompanying change in tariff revenue. It will be our goal in the quantitative analysis to show how the total change in welfare due to each tariff change can be explained by the various terms in (30): the generic gains, consisting of the change in tariff revenue on the first line and all terms (including Armington) on the second line; and the gains from selection (due to the change in scale and Armington) on the final three lines.[27]

3 Data description

In order to quantify the effects of actual, and counterfactual, tariff changes we need detailed information on tariffs, as well as on production and trade flows for a large set of countries. Moreover, we are interested in understanding how both high- and low-income countries have been impacted by changes in trade policy, and this can only be done if the data have good coverage of both sets of countries. We start this section by first describing the sources and the way we obtain tariff data, and we then move on to explain the sources for production and trade flow data.

3.1 New tariff data

We build a new comprehensive, disaggregated, annual tariff dataset from 1990 to 2010. We obtain tariff schedules from four primary sources: (1) raw tariff schedules from the TRAINS and IDB databases accessed via the World Bank's WITS website as far back as 1988 for some countries; (2) manually collected tariff schedules published by the International Customs Tariffs Bureau (BITD);[28] (3) U.S. tariff schedules from the U.S. International Trade Commission from 1989 onwards (Feenstra, Romalis, and Schott 2002); and (4) the texts of preferential trade agreements

s according to the domestic share of expenditure $\lambda_{ii,s}$ raised to $1/(\omega_s - 1)$, so the overall price is $\lambda_{ii,s}^{1/(\omega_s-1)}/N_{i,s}^{1/(\sigma_s-1)}$. Expressed in log changes we obtain $\frac{1}{(\omega_s-1)} \ln \hat{\lambda}_{ii,s} - \frac{1}{(\sigma_s-1)} \hat{N}_{i,s}$. That is identical to the term in braces for sector s on the second line of (30), once we replace θ_s with $\sigma_s - 1$ and simplify using $\frac{1}{(\sigma_s-1)} + \frac{(\sigma_s-\omega_s)}{(\sigma_s-1)(\omega_s-1)} = \frac{1}{(\omega_s-1)}$.

[27]As explained in note 22, the "generic gains" from trade in the Melitz model arise at least in part from selection effects. We are therefore taking a conservative approach to measuring the contribution of selection to our quantitative results, by only counting the terms appearing in the final three rows of (30).

[28]Most tariff schedules can be fairly readily matched to the SITC classification.

primarily sourced from the WTO's website, the World Bank's Global Preferential Trade Agreements Database, or the Tuck Center for International Business Trade Agreements Database.

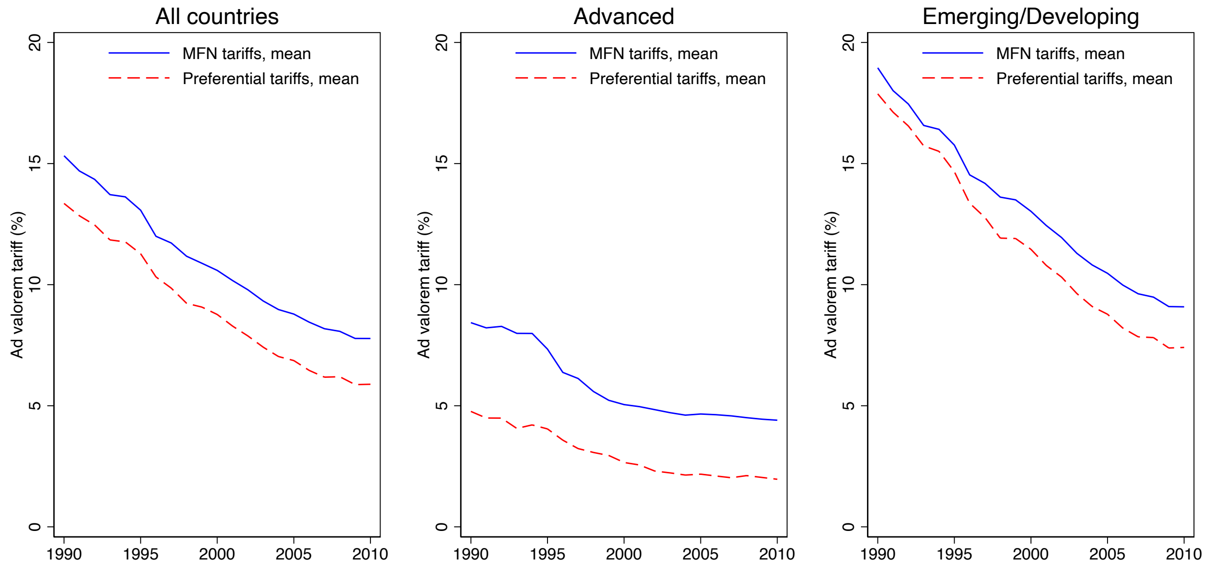
The availability of tariff schedules is documented in Data Appendix Table 1. For each country and year from 1990 to 2010 we indicate the availability of electronic tariff schedules on the World Bank's WITS platform by the letter "T" if tariffs are available. If other tariff schedules for 1988 to 2010 are available either electronically or in printed form we use the letter "B" (for example, U.S. tariffs in 1988). In many cases a tariff schedule is unavailable for a given year, especially for the 1980s and early 1990s. We often utilize tariff schedules pre-dating 1988 to help complete the database; in the column headed "BITD" we specify the year of the most recent published BITD tariff schedule that we can use. We list the preferential trade agreements in our data in Data Appendix Table 2. We separate these agreements into two broad kinds: (i) Free Trade Agreements and Customs Unions; and (ii) "Other", which includes Generalised System of Preferences schemes and Partial Scope Agreements. We commence Data Appendix Table 2 by listing the agreements in European Union tariff data; these agreements will apply to any country or territory that was a part of European Union customs territory, so that we don't have to continually re-list these agreements. For countries that joined the European Union between 1988 and 2010, we also list agreements that applied before their accession. The agreements listed for each country include agreements in the data that have since become inactive.

For the U.S., specific tariffs have been converted into *ad valorem* tariffs by dividing by the average unit value of matching imported products. Due to the difficulties of extracting specific tariff information for other countries and matching it to appropriate unit values, only the *ad valorem* component of their tariffs are used. The vast majority of tariffs are *ad valorem*. Switzerland is a key exception here, with tariffs being specific. For Swiss tariffs we use the *ad valorem* equivalent tariff calculations from the TRAINS database accessed on the World Bank's WITS website for 1990, 1993 and each year from 1995. We aggregate MFN and each non-MFN tariff program to the 4-digit SITC Revision 2 level by taking the simple average of tariff lines within each SITC code.[29]

One problem is that tariff schedules are often not available in each year, especially for smaller countries. Where there is a gap in tariff availability, we search secondary sources to help identify when significant trade policy changes were made, including WTO/GATT trade policy reviews, IMF country reports, and World Bank World Development Indicators data on tariff revenues divided by imports. We use this information to identify which available tariff schedule is the best proxy for a missing schedule. Where there is no such information, we assume that updated schedules are more likely to be available after significant tariff changes, and set missing observations equal to the nearest preceding observation. If there is no preceding observation, missing MFN tariffs are set equal to the nearest observation. Missing non-MFN tariff data (other than punitive tariffs applied in a handful of bilateral relationships) are more difficult to construct for two

[29]Multiple preferential tariffs may be applicable for trade in a particular product between two countries. Since the most favorable one may change over time, we keep track of each potentially applicable tariff program.

Figure 1: Average MFN and Preferential *ad valorem* tariff rates, by year 1990–2010



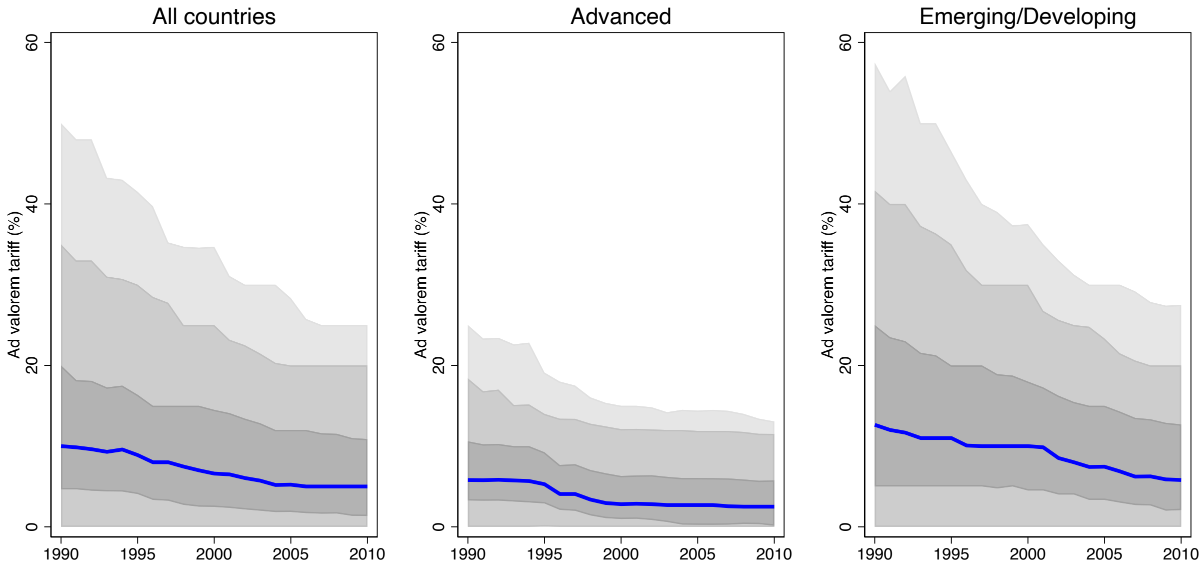
Note: 4-digit SITC level, 3 samples.

reasons: (i) they are often not published in a given tariff schedule; and (ii) preferential trade agreements have often been phased in. To address this we researched the text of over 100 regional trade agreements and Generalized System of Preferences (GSP) programs to ascertain the start date of each agreement or program and how the typical tariff preference was phased in. To simplify our construction of missing preferential tariffs we express observed preferential tariffs as a fraction of the applicable MFN tariff. We fill in missing values of this fraction based on information on how the tariff preferences were phased in. Preferential tariffs are then constructed as the product of this fraction and the MFN tariff. We keep the most favorable potentially applicable preferential tariff. We pay less attention to completing data for Partial Scope Agreements, especially those with extremely limited scope. Punitive non-MFN tariff levels tend not to change over time (though the countries they apply to do change). We replace missing punitive non-MFN observations in the same way we replace missing MFN tariff observations.

An overview of our new tariff data is shown in Figures 1 to 4. The data show, with country coverage and disaggregated detail of a kind not seen before, the remarkable impacts of the Uruguay Round on the levels and dispersion of tariffs around the world from the 1980s to the 2010s.

To start, Figure 1 plots the average (mean) *ad valorem* tariff rates, both MFN and Preferential, across all countries and all goods at the SITC 4-digit goods level, in each year from 1984 to 2011, for the full sample, the Advanced economies, and the Emerging and Developing economies. In 1990, the sample size for the calculations of these statistics is about 1 million distinct tariff lines. By the late 2000s, at the end of the period shown, the sample size in a given year is well over 2 million

Figure 2: Distributions of MFN *ad valorem* tariff rates, by year 1990–2010



Note: 4-digit SITC level, 3 samples. Percentiles shaded are 5/10/25/50/75/90/95. Median is solid blue line.

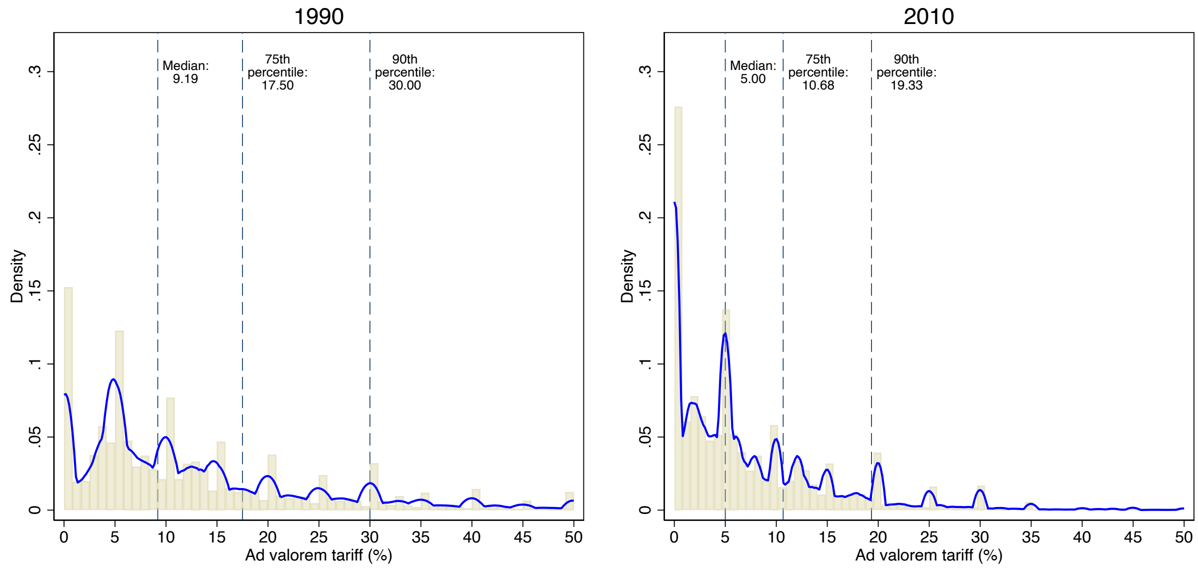
distinct tariff lines. It is clear that both types of tariffs fell over the period, by about 9 percentage points.[30]

Given the similar trends, we focus henceforth on MFN tariffs in this section. Figure 2 plots the median MFN *ad valorem* tariff at the SITC 4-digit level, in each year, for the full sample, the Advanced economies, and the Emerging and Developing economies. It also plots a fan showing 7 percentiles from 5th, 10th, 25th, . . . up to the 95th in each year to show the dispersion of tariff rates. The median is shown by the solid line. This figure shows that the Uruguay Round was followed by a dramatic reduction in the levels and dispersion of tariff rates, with these trends being more pronounced in the subsample of Emerging and Developing economies. In part this reflects the fact that these countries started with higher levels and dispersion to begin with, and so had more scope for these kinds of policy adjustments. In contrast, the Advanced countries had made much greater progress in this direction during earlier GATT rounds going back to the 1940s.

Figure 3 uses histograms and kernel density plots to show the distributions of *ad valorem* tariff rates across countries and goods, for two snapshot years that we will use for our policy experiments: a pre-Uruguay 1990 sample year and a post-Uruguay 2010 sample year. The histograms are truncated at the 50% tariff level; a small number of tariffs over this level (some well over 100%) appear in both sample years for a few unusual goods and countries, but this right tail is not very

[30]Readers may wonder why the number of tariff line observations grows in the tariff database, since the number of product categories is fixed and the number of countries only grows slightly. The key reason is that we are only summarizing tariff observations where there is a matching trade observation, and the number of country-pair observations with positive trade grows substantially. Because we are ignoring zero-trade observations that might have high tariffs, this approach may lead us to understate the decline in MFN tariffs.

Figure 3: Distributions of MFN *ad valorem* tariffs, 1990 and 2010



Note: 4-digit SITC level.

representative. Within the range shown, tariff peaks at certain round numbers are clearly visible (0, 5, 10, 15, etc.), as one would expect. However, looking past those peaks, we can clearly see again the impacts of changes in tariff policy over this period. The spike at zero rises, as more zero-tariff rates appear across goods and countries, and in the strictly positive region mass is shifted from the above-20% region and into the below-20% region. In 1990, a 20% tariff line was near the 75th percentile globally; by 2010, a 20% tariff line was near the 90th percentile globally.

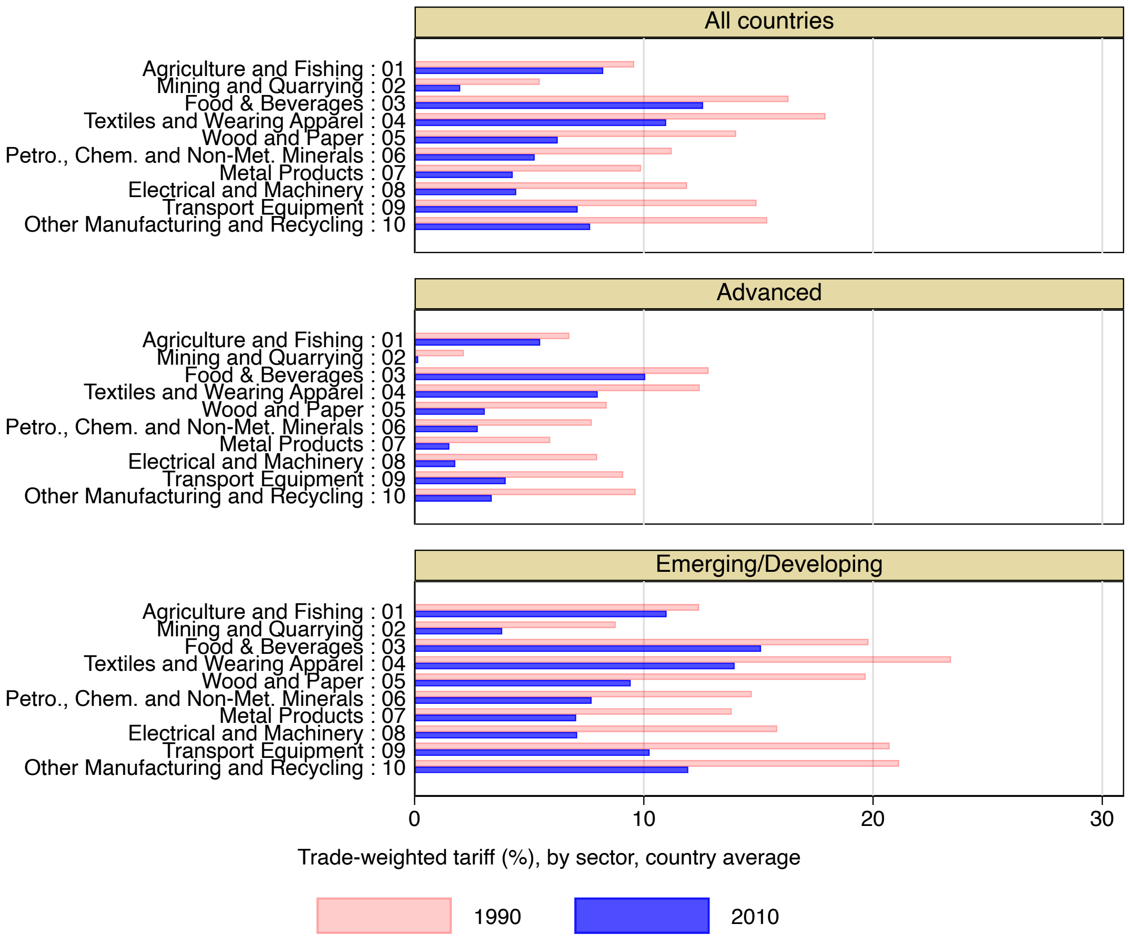
Finally, Figure 4 provides sectoral detail for tariffs aggregated up to the level of 10 tradable sectors which we use in our calibrated model.[31] This figure shows clearly that the Uruguay Round did not have a peculiar compositional impact across sectors. It lowered average tariffs pretty much across the board in all sectors, and was not just confined to some limited areas of the tradable economy. And again, the figure clearly shows the much larger scope for tariff reductions in the Emerging and Developing sample, given the relatively high tariff rates they had at the start of the period in all sectors as compared to the Advanced economies.

3.2 Production and trade data

To obtain production and trade data, we relied on Eora MRIO, a global multi-region IO database.[32] This dataset, to our knowledge, is the most comprehensive dataset available that contains information on production, trade flows and input-output (IO) tables for 190 countries, though we will

[31] Tariffs are aggregated using trade weights as discussed in Appendix E.
[32] Please refer to `http://worldmrio.com/` for more information.

Figure 4: MFN *ad valorem* tariff rates, 10 sectors, all countries, in 1990 and 2010



use data for 178 countries plus the rest of the world.[33] Six sources are used to construct these multi-region IO tables. The sources are: (1) input-output tables and production data from national statistical offices; (2) IO from Eurostat, IDE-JETRO, and OECD; (3) the UN National Accounts Main Aggregates Database; (4) the UN National Accounts Official Data; (5) the UN Comtrade international trade database; and (6) the UN Service Trade Statistics Database. For further information, refer to Lenzen et al. (2012; 2013). We use Eora MRIO to obtain data on value added shares, share of intermediate inputs in production, gross output, and total exports. These are mapped into our model concepts as explained in Appendix E.

[33] Countries omitted from our quantitative analysis because their input-output tables in Eora were judged to be unreliable are: Azerbaijan (AZE), Belarus (BLR), Guyana (GUY), Moldova (MDA), Sudan (SDN), South Sudan (SSD), and Tajikistan (TJK), while Netherlands Antilles (ANT), and Former USSR (USR) overlap with other included countries. Two other countries omitted because of missing trade data in 1990 were Liechtenstein (LIE) and the Palestine Occupied Territory (PSE).

A key advantage of this database, compared to others, is the fact that it contains information for a large set of countries (high- and low-income countries) and for the early years in the sample period we wish to study. In particular we can make use of the 1990 multi-region table with 25-sector harmonized classifications. As a reference point, in comparison with the World Input-Output Database (WIOD), we have more than three times the number of countries and account for a number of developing countries, some of them quite small. Moreover, there is no WIOD for the year 1990, the period immediately before the Uruguay Round tariff cuts. Having data as far back as 1990 allows us to take the model to the data and evaluate the effects of every single tariff reform after that period.

4 Taking the quantitative model to the data

Several issues need to be dealt with in order to take the model to the data. First, we need to find a way to infer a large set of unobservable parameters.[34] Second, we need to deal with the fact that trade is unbalanced and that our static model cannot accommodate this feature of the data. Third, we need estimates for parameters such as the trade and the home versus foreign input elasticities.

To solve the first issue, we use the equilibrium conditions of the model in relative changes, where we use the "hat" notation for the ratio of after-versus-before levels of any variable for a given perturbation: as we have already introduced, we define $\widehat{z} = z'/z$ for any variable z. It was first shown by Dekle, Eaton, and Kortum (2008) that their model could be expressed conveniently using this type of notation.[35] As we show in Appendix E, this approach allows us to condition on an observed allocation in a given baseline year and solve the model without needing estimates of fixed costs and other parameters which are not directly observable. The way we solve the second issue is by first calibrating the model with trade deficits as a residual and then use the model to net out the deficits.

Finally, solving our quantitative model requires estimates, by sector, of the elasticity of substitution across varieties σ_s, the home versus foreign input elasticity ω_s, and the Pareto shape parameter θ_s. In order to obtain estimates for the elasticity of substitution and the Pareto parameter we use the estimates from Caliendo and Parro (2015). They show that by triple differencing the gravity equation one can identify the elasticities using tariff policy variation. In the context of our model the elasticity that is estimated is given by $1 - \sigma_s \theta_s/(\sigma_s - 1)$.

In order to separately identify θ_s and σ_s we rely on estimates from the literature to obtain $\theta_s/(\sigma_s - 1)$. The two most cited studies to deal with this issue are Chaney (2008) and Eaton, Kortum, and Kramarz (2011). Chaney (2008) obtains the coefficient by regressing the log of the rank

[34] Several parameters from our model are directly observable, like value added shares and input-output coefficients. However, there are a large number of parameters, like fixed entry, production, and exports costs, that are not observed.

[35] This idea was first advanced by Dekle, Eaton, and Kortum (2008) in the context of a Ricardian trade model. Caliendo and Parro (2015) and Ossa (2014) show that one can use this method to analyze the effects of tariff policy. CR show how it works for a variety of trade models, including a multi-county, multi-industry Melitz model similar to the one we use here. We apply it with a nested CES structure with Armington and for the case of revenue-based tariffs.

Table 1: Elasticities

Sector(s)	$\frac{\sigma_s \theta_s}{\sigma_s - 1} - 1$	θ_s	σ_s
Agriculture and Fishing (1 sector)	9.11	8.4	5.8
Mining and Quarrying (1 sector)	13.53	12.8	8.3
Manufacturing Sectors (all 8 sectors)	5.55	4.8	3.7
Nontraded services (all 5 sectors)	—	3.2	2.8

of US firms according to their sales in the United States on the log of sales using Compustat data on US listed firms. Eaton, Kortum, and Kramarz (2011) use a different procedure and data on the propensity of French firms to export to multiple markets. Chaney (2008) finds that $\theta_s/(\sigma_s - 1) = 2$ from U.S. sales data, while Eaton, Kortum, and Kramarz (2011, p. 1472) find an initial estimate of $\theta_s/\,(\sigma_s - 1) = 1.75$ using French data on exporting firms. We take this latter estimate and apply it to our sectoral elasticities estimated using Caliendo and Parro (2015).

The values for the elasticities that we obtain are shown in Table 1. Note that these values imply that σ_s for the tradable sectors are 5.8, 8.3, and 3.7 respectively. We also need an elasticity for the service sector. Gervais and Jensen (2019) find that services have an elasticity of substitution that is *smaller* than for manufacturing: about three-quarters the size of the elasticity in manufacturing (though they obtain rather high values for both elasticities using accounting data).[36] Given this, we likewise adopt an elasticity of substitution in services that is three-quarters of what we use for the manufacturing sector. In particular, for services we use a value of $\sigma_s = 2.8$ and, given $\theta_s/\,(\sigma_s - 1) = 1.75$, this implies $\theta_s = 3.2$.

Finally, we need an elasticity of substitution between home and foreign goods, ω_s. Feenstra, Luck, Obstfeld, and Russ (2018) estimate micro elasticities (σ_g) and macro elasticities (ω_s) elasticities across 98 goods g, in 7 sectors s. They reject the hypothesis that $\sigma_g = \omega_s$ for most goods, but they reject the hypothesis that $\sigma_g = 2\omega_s$ for only 20 (or one-fifth) of the goods. This ratio of 2 corresponds to the "Rule of Two" that has been used in computable models (see Hillberry and Hummels, 2013). The median estimate of σ_g across all goods in 4.05, but a pooled estimate of σ_g or ω_s constrained to be equal across all goods was not made. Feenstra, Luck, Obstfeld and Russ (2018) calculate the gains from trade for all goods, however, and these gains are higher when $\omega_s < \sigma_g$: the gains relative to autarky are 1.5 when using the estimated $\omega_s < \sigma_g$, as compared to gains of 1.1 if they artificially set $\omega_g = \sigma_g$ for each good, using the estimated σ_g, so there is no two-tier Armington distinction. Now we can ask: if the median estimate of $\sigma = 4.05$ is used across *all* goods, then what *single* value of ω would be needed to obtain the same estimate of the gains from trade, i.e. 1.5? The answer turns out to be $\omega = 1.98$,[37] so that the ratio $\sigma/\omega = 4.05/1.98 = 2.05$ is obtained. So surprisingly, we arrive back to the "Rule of Two" for this ratio, which we calibrate in our quantitative model by setting $\sigma_s/\omega_s = 2$ in all sectors to obtain ω_s.

[36] This estimate comes from their working paper, Gervais and Jensen (2013).
[37] This calculation is available on request.

5 A quantitative assessment

In this section we evaluate the trade, entry, and welfare effects of the observed change in trade policy over the years 1990 to 2010. We take as our initial baseline the levels of tariffs in the year 1990, before tariffs started falling as a consequence of the Uruguay Round. We quantify the economic effects of tariff changes by performing three different exercises, as follows.

- We first impose on the model the actual changes in MFN tariffs from the year 1990 to the year 2010, holding fixed the preferential tariffs (PTA) in place in the year 1990. This exercise we think of as informative on the effects of changes principally due to multilateral negotiations, i.e., the Uruguay Round, so we label this case the "Uruguay Round" experiment.[38]

- We then go beyond the Uruguay Round effects on MFN tariffs, and aim to quantify the effects from all tariff changes, MFN together with any preferential tariffs in place in the year 2010. We refer to this last exercise as the "Uruguay Round + Preference" experiment.

- Finally, we explore whether there are any extra gains from tariff changes by moving to a world with zero tariffs, what we refer to as the "Free Trade" experiment.

Trade effects We start by showing the trade effects from the change in tariffs in our experiments. We calculate the share of total expenditure in each country on foreign goods, a model counterpart of the trade share of GDP. Figure 5 shows the change in the trade share of GDP in all countries in the world relative to the baseline in the three experiments.

The first result is that the Uruguay Round tariff reductions generated positive trade effects with a median change of about +2% of GDP, and with a quarter of countries seeing an increase of +5% or more. The effects are small in Advanced countries and very much concentrated in Emerging and Developing countries.

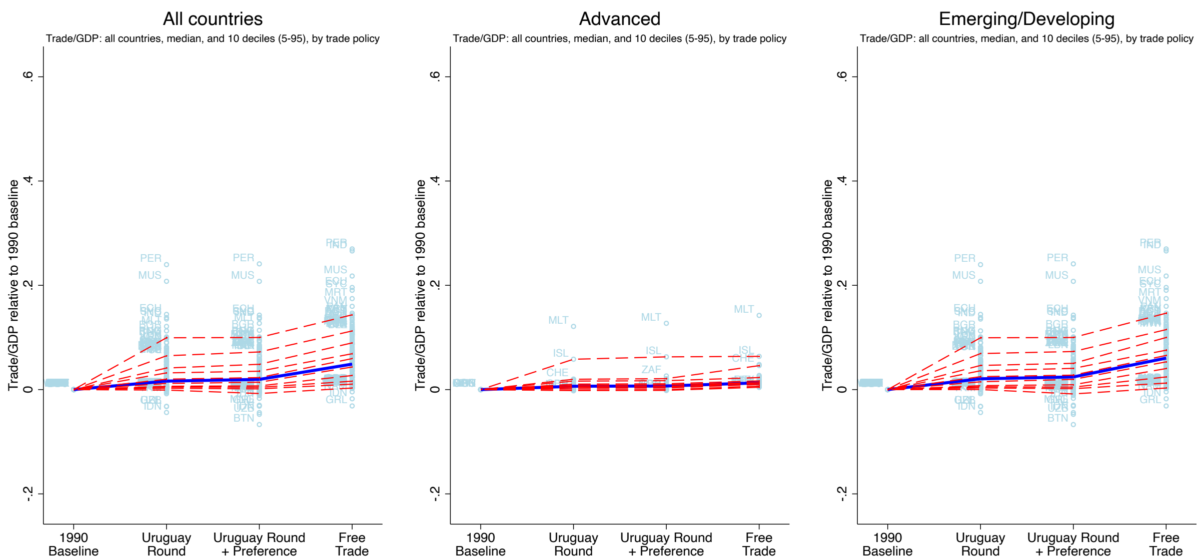
The second takeaway is that Uruguay Round + Preference does not generate a large increase in world trade relative to Uruguay Round only. This is clearly seen by comparing the median change in openness for all, or for Advanced and Emerging and Developing countries, as we move from the Uruguay Round case to the Uruguay Round + Preference. The line is flat, as it is at almost all marked deciles. Despite the cumulative number of PTA's in force increasing from 45 in 1990 to 231 in 2010,[39] the aggregate trade impact of new tariff reductions due to PTA's has been small.

Finally, note that moving to Free Trade, or zero tariffs, generates considerable trade share effects for Emerging and Developing economies, but little in the way of extra trade share effects for Advanced economies. This result unmasks the asymmetrical impact of further reducing tariffs for Emerging and Developing countries, where for the latter free trade would deliver a larger counterfactual change comparable to the effects of the Uruguay Round itself. There is considerable scope for further multilateral trade liberalisation to boost trade.

[38]Specifically, we set the 2010 tariff equal to minimum of the 1990 preferential tariff and the 2010 MFN tariff.

[39]These data are from the WTO's Regional Trade Agreements Database.

Figure 5: Trade/GDP effects from three tariff experiments, levels, medians and deciles



Note: Change in trade/GDP by country (versus 1990) under each scenario, with medians and deciles (5/15/.../95).

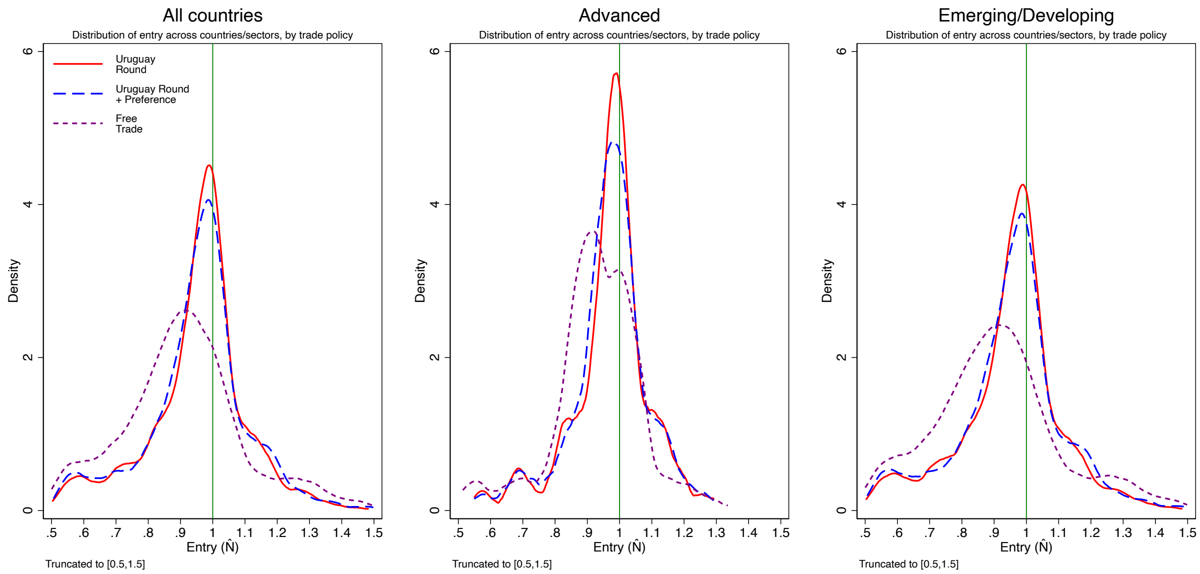
Entry effects We now discuss our findings on firm entry. Figure 6 in the left panel presents the distribution of changes in entry across all countries and sectors by trade policy relative to the 1990 baseline (normalized to 1).

Concretely, we are showing the full sample distribution of changes in entry, in hat notation $\hat{N}_{i,s} \equiv N'_{i,s}/N_{i,s}$ for all i, s. The histogram shows that the entry margin is very active and heavily impacted by the changes in trade policy for each of our three experiments. As we can see, there is mass in both tails reflecting that in some country-sector cases entry goes up, while in others it falls. For each country, entry in some sectors must be balanced by exit in other sectors according to equation(28).

As we compare experiments it is evident that both Uruguay Round and Uruguay Round + Preference generate very similar entry effects, while moving to Free trade affects entry more, especially in the Emerging and Developing countries where again free trade produces a larger counterfactual change. In particular, in Emerging and Developing countries all 3 policies tend to cause notable negative entry (values less than 1), i.e., exit, in part, as a consequence of increased import competition in sectors where inefficient firms exit. This exit pattern is very notable in the Emerging and Developing countries where a fatter left tail is evident, with a less spread exit-entry distribution seen in the Advanced economies.

These results show clearly that entry is impacted by tariffs not only theoretically, as we discussed several times in the paper, but in a quantitatively significant way when we model a major historical change in trade policy.

Figure 6: Entry effects from three tariff experiments, histograms



Note: Historgram of entry by country (versus 1990=1) under each scenario.

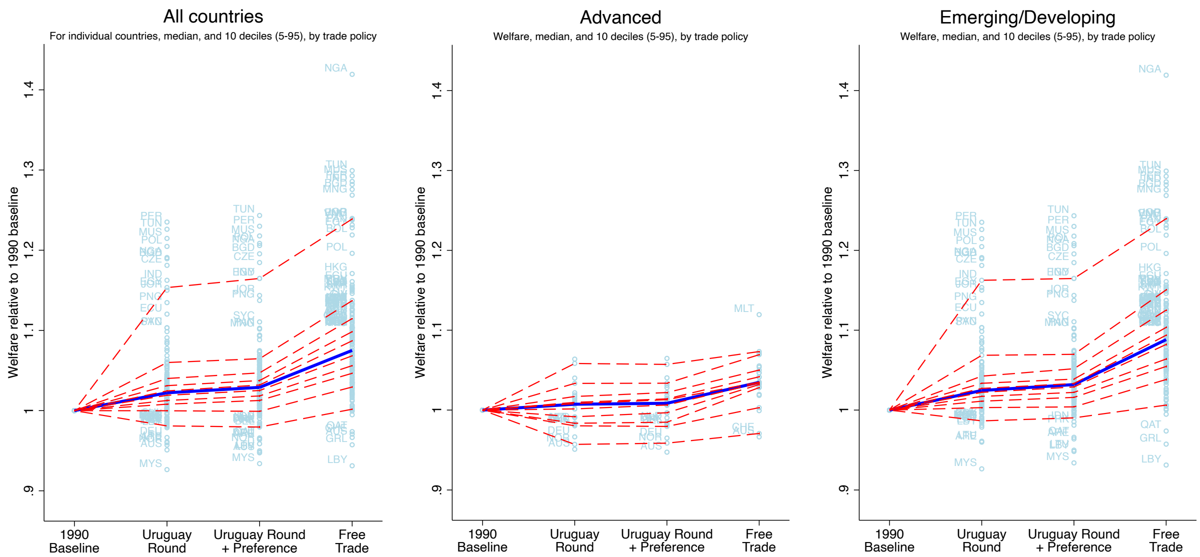
Welfare effects Figure 7 presents the welfare effects for the world, namely the change in welfare relative to the base year 1990 (normalized to 1) for each of our three experiments.

As with trade volumes, the Uruguay Round sees large welfare gains from tariff changes. In fact, the average gains relative to 1990 across countries in our sample are +3.23% for the Uruguay Round experiment, +3.63% for Uruguay Round + Preference, and +8.72% for the move to Free Trade. The Uruguay Round alone accounts for 37% (3.23/8.72) or slightly more than one-third of the total potential welfare gains across countries from a move to free free trade, but the PTAs account for only another 5% of the possible gains. In contrast, the further movement to Free trade would deliver the remaining 58% of potential gains, showing that significant untapped gains (about 1.5 times those achieved by Uruguay) are still available.

In addition, there is substantial heterogeneity in terms of winners and losers, as is more clearly seen when we split the sample into Advanced and Emerging economies in the right two panels. The Uruguay Round brought significant gains for some Emerging and Developing countries, and smaller gains for Advanced economies. PTAs achieved very little by this yardstick, as expected given our earlier results.

And lastly, considering the hypothetical movement to Free trade, the Emerging and Developing countries also stand to gain the most, and the median welfare gain for this group is almost 10%, a very large estimate by the standards of the literature for the potential gains from full tariff liberalization. It is notable that the group of countries with the highest tariffs are the ones that benefit the most from global tariff elimination.

Figure 7: Welfare effects from three tariff experiments, averages



Note: Change in welfare by country (versus 1990=1) under each scenario, with medians and deciles (5/15/.../95).

Welfare decomposition Since we fine large welfare gains relative to prior literature, it is important to understand the source of those gains. We can decompose the gains based on the six main terms in equation (30). We shall refer to these components as Term 1 on line one, then Terms 2 and 3 on line 2, and then Terms 4 to 6 on the remaining lines, as described in the note to Table 2.

What is the intuition? Directionally, we expect Terms 1 and 6 to make a negative contribution since our policy experiments are mostly tariff reductions, so tariff revenue changes would be expected to be negative: indeed we do find this to be the case. Term 2 depends on two forces, the domestic share and entry, which might go either way: we will find that exit tends to dominate the fall in domestic share, meaning that our policy experiments result in fewer but larger domestic firms, so this term ends up being net negative. This leaves Term 3, Term 4 and Term 5 as the remaining likely positive terms, consisting of the remaining "generic" gains from trade plus the contribution of selection effects, as described above, and this what we find in our model.

To give an accounting of the importance of each of these terms we adopt a fairly standard method to perform a regression-based decomposition of the quantitative impacts of each term in Table 2, using the method developed by Fields (2003), and which has been employed in the empirical trade literature previously by Eaton, Kortum and Kramarz (2004). For brevity, rewrite the equation (30) as $y = x_1 + x_2 + x_3 + x_4 + x_5 + x_6$, where y is the log utility change and x_i is Term i. Then the share β_i of the variation in y explained by x_i is computed as the OLS regression coefficient from the regression of x_i on y. By construction, these β_i add up to 1 here, since the equation is an identity given the model (the sum of Terms 1–6 is exactly y).

Table 2: Welfare decomposition via contributions of Terms 1–6 at equation (30)

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Share of gains "Generic" Terms 1+2+3	Share of gains "Selection" Terms 4+5+6
1. Uruguay Round								
ln_U_hat	-0.337	-0.160	1.057	0.528	0.009	-0.097	0.560	0.440
	(0.033)	(0.020)	(0.040)	(0.020)	(0.005)	(0.009)	(0.011)	(0.011)
Observations	179	179	179	179	179	179	179	179
R^2	0.366	0.263	0.800	0.800	0.015	0.408	0.938	0.904
2. Uruguay Round + Preference								
ln_U_hat	-0.341	-0.160	1.060	0.530	0.009	-0.098	0.559	0.441
	(0.034)	(0.020)	(0.040)	(0.020)	(0.005)	(0.009)	(0.011)	(0.011)
Observations	179	179	179	179	179	179	179	179
R^2	0.359	0.266	0.799	0.799	0.016	0.406	0.935	0.900
3. Free Trade								
ln_U_hat	-0.371	-0.138	1.061	0.531	0.018	-0.101	0.552	0.448
	(0.023)	(0.013)	(0.025)	(0.013)	(0.004)	(0.006)	(0.007)	(0.007)
Observations	179	179	179	179	179	179	179	179
R^2	0.599	0.382	0.910	0.910	0.088	0.638	0.968	0.953

Note: The 6 coefficients are from a regression of each Term on $\ln \hat{U}$. By construction, the coefficients add up to 100% of the change in welfare $\ln \hat{U}$. The terms are taken from equation 30, where Terms 2 and 3 are the two elements on line 2, as below. The "Armington" terms dominate, with the "generic" Term 3 and the "selection" Term 4 making up a roughly $\frac{2}{3} : \frac{1}{3}$ share of positive gains from trade. Most other terms are small (Term 5) or negative (in the case of tariff revenue terms and the entry-adjusted share).

$$\text{Term 1} = \ln\left(\frac{L_i + (T_i'/w_i')}{L_i + (T_i/w_i)}\right)$$

$$\text{Term 2} = -\ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\left\{\mathbf{D}\left[\frac{1}{\theta_s}\right]\underbrace{\left(\ln\hat{\boldsymbol{\lambda}}_{ii} - \ln\widehat{\mathbf{N}}_i\right)}_{\text{entry-adjusted domestic share}}\right\}$$

$$\text{Term 3} = -\ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\left\{\underbrace{\mathbf{D}\left[\frac{\sigma_s-\omega_s}{\theta_s(\omega_s-1)}\right]}_{\text{Armington}}\ln\hat{\boldsymbol{\lambda}}_{ii}\right\}$$

$$\text{Term 4} = -\ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s-1}-1\right)\right]}_{\text{selection}}\underbrace{\mathbf{D}\left[\frac{\sigma_s-\omega_s}{\theta_s(\omega_s-1)}\right]}_{\text{Armington}}\ln\hat{\boldsymbol{\lambda}}_{ii}$$

$$\text{Term 5} = +\ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s-1}-1\right)\right]}_{\text{selection}}\mathbf{D}\left[\frac{\Delta_{i,s}}{Y_{i,s}\theta_s}\right]\widetilde{\boldsymbol{\Gamma}}_i\mathbf{D}\left[E_{ii,s}+E_{i,s}\right]\underbrace{(\widehat{\mathbf{N}}_i - \mathbf{1}_S)}_{\text{entry via scale}}$$

$$\text{Term 6} = +\ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\underbrace{\mathbf{D}\left[\left(\frac{\theta_s}{\sigma_s-1}-1\right)\right]}_{\text{selection}}\mathbf{D}\left[\frac{\Delta_{i,s}}{\theta_s}\right](\mathbf{1}_S - \mathbf{R}_i)\underbrace{\left(\frac{L_i + (T_i'/w_i')}{L_i + (T_i/w_i)} - 1\right)}_{\text{tariff revenue}}.$$

Table 2 presents the striking results on the sources of the large gains from trade that we find in our model. Overall, where the total net welfare gain is by definition 100%, we see that the components due to lost tariff revenue at Terms 1 and 6 contribute a loss of about −45% of the net welfare gain in all scenarios. The negative Term 2 adds a further loss of −10%. Hence the positive Terms 3-4-5 must mechanically sum up to +155%. Term 5 is small, so all the action in terms of gains comes from just two terms, one of the "generic" pieces in Term 3 (about +100%) and the gains arising from selection effects under the two-tier Armington structure in Term 4 (about +50%).

More simply, we can partition overall gains into just two terms, as shown in the last two columns of the table. The "generic" gains Terms 1 to 3 together contribute about 55% of the total gains under the three trade policy experiments, leaving gains from "selection" effects in Terms 4 to 6 contributing about +45% of the total gains. Therefore, the gains due to selection are nearly one-half of the total gains. Finally, we should also not ignore the magnifying effects of input-output linkages in Terms 2 to 6 captured by the Leontief Inverse matrices. If these matrices were simply identity matrices (no input-output linkages), welfare gains from both "generic" and "selection" channels would likely be considerably lower.

6 Conclusion

We study the trade, firm entry, and welfare effects arising from actual changes in trade policy from 1990 to 2010. We do so with a multi-sector heterogeneous firm model that incorporates tariffs, traded intermediate goods, and a realistic input-output structure for modern economies.

We combine this model with a new comprehensive annual tariff dataset starting in 1990 that allows us to measure how MFN and preferential tariffs have changed over time at a very disaggregated level. Finally, with our model and data, we use an 179-country/15-sector version of our model to quantify the effects of trade liberalization over the period 1990–2010, including the greatest round of global tariff reduction, the Uruguay Round. We find that the actual reductions in MFN tariffs in this period generated large trade, entry, and welfare effects. We attribute much of this gain to selection effects in our model.

These welfare effects could be enhanced by the further removal of tariffs, in many cases by a large extent. One component of ongoing trade negotiations is to enable trade facilitation through other, non-monetary means, such as decreasing the time spent at the border. We expect that such policies would be strongly welfare-improving in our model, through the usual channel of expanding trade and lowering prices on the intensive margin, and also through encouraging the entry of exporters on the extensive margin. Multilateral liberalization of this nature is likely a much more powerful welfare-enhancing tool than continued preferential trade liberalization, which contributed so little over 1990 to 2010. In sum, our focus on entry and selection in a multi-sector, heterogeneous-firm model with input-output linkages gives new insights into the potential welfare gains from trade liberalization.

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ONLINE APPENDIX

A Tariffs, icebergs, and entry in a one-sector model

We derive the impact of a change in *ad valorem* tariffs on entry in a one-sector Melitz-Chaney model. For simplicity, we suppose that the intermediate inputs are produced only with labor, so then the model is equivalent to the case where the differentiated goods are final goods. Consider first the case of tariffs applied to the variable cost of imports — or "cost-based" tariffs — with no rebate of the tariff revenue to consumers. The government instead wastes the revenue on a good with zero utility, so this case will be identical to iceberg trade costs. Assume labor in country i is the numeraire, with $w_i = 1$. The firm in country i selling to country j solves the profit-maximization problem

$$\pi_{ij}(\varphi) = \max_{p_{ij}(\varphi)\geq 0} \left\{ p_{ij}(\varphi)\, q_{ij}(\varphi) - \frac{\tau_{ij}\,(1+t_{ij})\, q_{ij}(\varphi)}{\varphi} - f_{ij} \right\}, \tag{31}$$

where $q_{ij}(\varphi)$ is the quantity chosen by consumers at the price $p_{ij}(\varphi)$, the firm's marginal costs inclusive of iceberg costs τ_{ij} and the ad valorem cost-based tariff t_{ij} are $\tau_{ij}(1+t_{ij})/\varphi$, and f_{ij} are the fixed operating costs. We assume CES demand with elasticity σ and a Pareto distribution, $G(\varphi) = 1 - \varphi^{-\theta}$, for the firm productivities, with $\varphi \geq 1$. Then it can be shown by evaluating the integrals below that assumption R2 of Arkolakis, Costinot, and Rodríguez-Clare (ACR, 2012) holds, namely:

$$\underbrace{\int_{\varphi^*_{ij}}^{\infty} \pi_{ij}(\varphi)\, dG(\varphi)}_{\Pi_{ij}\equiv \text{ profits from } j} = \frac{\sigma-1}{\sigma\theta} \underbrace{\int_{\varphi^*_{ij}}^{\infty} p_{ij}(\varphi)\, q_{ij}(\varphi)\, dG(\varphi)}_{R_{ij}\equiv \text{ revenue paid by consumers in } j}, \tag{32}$$

where φ^*_{ij} is the zero cutoff profit level of productivity at which $\pi_{ij}(\varphi^*_{ij}) = 0$. Note that both the profits from j and the revenue paid by consumers in j go to the firms in country i. So summing over all destination markets j, denoting the mass of entrants by N_i and the sunk costs of entry by f^E_i, and using the free-entry condition and equation (32), we can compute the integrals to obtain $N_i f^E_i = \Pi_i = \frac{\sigma-1}{\sigma\theta} I_i = \left(\frac{\sigma-1}{\sigma\theta}\right) L_i$, where L_i is the labor earnings in this one-sector economy coming from the aggregate revenue of firms. It immediately follows that entry is:

$$N_i = \frac{\sigma-1}{\sigma\theta}\, \frac{1}{f^E_i}\, L_i, \tag{33}$$

which is fixed and does not vary with iceberg trade costs or with un-rebated cost tariffs.

Furthermore, this result of fixed entry will continue to hold if we add a nontraded competitive sector to each country. In that case, the fraction $(1-\alpha)$ of labor will be devoted to the competitive sector, with αL remaining for the differentiated sector. Then entry into that sector is determined by:

$$N_i = \frac{\sigma-1}{\sigma\theta}\, \frac{\alpha}{f^E_i}\, L_i, \tag{34}$$

which is again fixed.

Returning to the one-sector model, now consider the realistic case of *ad valorem* tariffs applied to the import revenue gross of price markups — or "revenue-based" tariffs — with full rebate of the tariff revenue to consumers. In this case, the tariff-inclusive price $p_{ij}(\varphi)$ must be divided by

$(1+t_{ij})$ to obtain the net price $p_{ij}(\varphi)/(1+t_{ij})$ earned by the firm, which is used to compute net revenue of the firm. Profits of the the firm are then

$$\pi_{ij}(\varphi) = \max_{p_{ij}(\varphi)\geq 0} \left\{ \frac{p_{ij}(\varphi)}{(1+t_{ij})}\, q_{ij}(\varphi) - \frac{x_i}{\varphi}\, \tau_{ij}\, q_{ij}(\varphi) - f_{ij} \right\}. \tag{35}$$

Direct calculation of the integrals below shows that the analogous expression for R2, but now in the presence of revenue-based tariffs, becomes

$$\underbrace{\int_{\varphi^*_{ij}}^{\infty} \pi_{ij}(\varphi)\, dG(\varphi)}_{\Pi_{ij} \equiv \text{ profits from } j} = \frac{\sigma-1}{\sigma\,\theta} \underbrace{\int_{\varphi^*_{ij}}^{\infty} \frac{p_{ij}(\varphi)}{(1+t_{ij})} q_{ij}(\varphi)\, dG(\varphi)}_{R_{ij} \equiv \text{ revenue earned by firms from } j}. \tag{36}$$

A clear difference between (32) and (36) is that the former uses revenue R_{ij} paid by consumers, whereas the latter uses revenue R_{ij} earned by firms, and these differ when ad valorem revenue-based tariffs are used.[40] This difference is immaterial, however, when the tariff revenue is fully rebated. In that case the labor earnings paid by the firm are still L_i, equal to the labor endowment. Then summing over destination markets j, firm revenue net of tariffs is $I_i = L_i$. It follows that entry is determined by $N_i f_i^E = \Pi_i = \frac{\sigma-1}{\sigma\theta} I_i = \left(\frac{\sigma-1}{\sigma\theta}\right) L_i$, which is again fixed as in (33).

Yet, a careful re-examination of these two cases shows that entry is not fixed under alternative assumptions on the tariff rebate. For example, with full rebate of the revenue under cost-based tariffs, we would obtain $N_i = \frac{\sigma-1}{\sigma\theta} \frac{1}{w_i f_i^E} I_i$. The consumer income I_i in country i equals expenditure at tariff-inclusive prices and is given by $I_i = w_i L_i + T_i$, which depends on the collected tariff revenue T_i. Therefore entry depends on the tariff, and is given by

$$N_i = \frac{\sigma-1}{\sigma\theta} \frac{1}{w_i\, f_i^E} \left(w_i L_i + T_i\right).$$

Alternatively, with no rebate under revenue-based tariffs, then country i tariff revenue T_i is wasted. It follows that in this case we have that $N_i = \frac{\sigma-1}{\sigma\theta} \frac{1}{w_i f_i^E} I_i$, where $I_i = w_i L_i - T_i$. Therefore entry again depends on the tariff, and is given by

$$N_i = \frac{\sigma-1}{\sigma\theta} \frac{1}{w_i\, f_i^E} \left(w_i L_i - T_i\right).$$

Table A.1 fully summarizes all of the above results for the one-sector model. The impact of tariffs on entry and welfare could in principle consider any of the three hypothetical tariff/rebate configurations. But in this paper we focus exclusively on *ad valorem* tariffs applied to the revenue of imports. This choice is made for two reasons. First, we believe that these tariffs are the realistic choice.[41] The second reason comes from our finding that entry is fixed in the one-sector

[40] In contrast, with iceberg trade costs, c.i.f. revenue paid by consumers (at c.i.f. prices but with quantity net of iceberg costs) equals f.o.b. revenue earned by firms (at lower f.o.b. prices but with quantity gross of iceberg costs).

[41] Under the rules of the World Trade Organization, *ad valorem* tariffs are applied to the "customs value" of an import product: see: `http://www.wto.org/english/tratop_e/cusval_e/cusval_info_e.htm`. There are six methods given for determining the customs value, and the first four are intended to reflect the price paid between unrelated parties. The fifth (and "rarely used") method involves costs, which are defined "on the basis of the cost of production of the goods being valued, plus an amount for profit and general expenses"; and the sixth method is a fall-back. So under the fifth method, profits are include in costs, and the customs value therefore incorporates the markup.

Table A.1: Operation of the entry margin (Yes or No) under different forms of trade costs

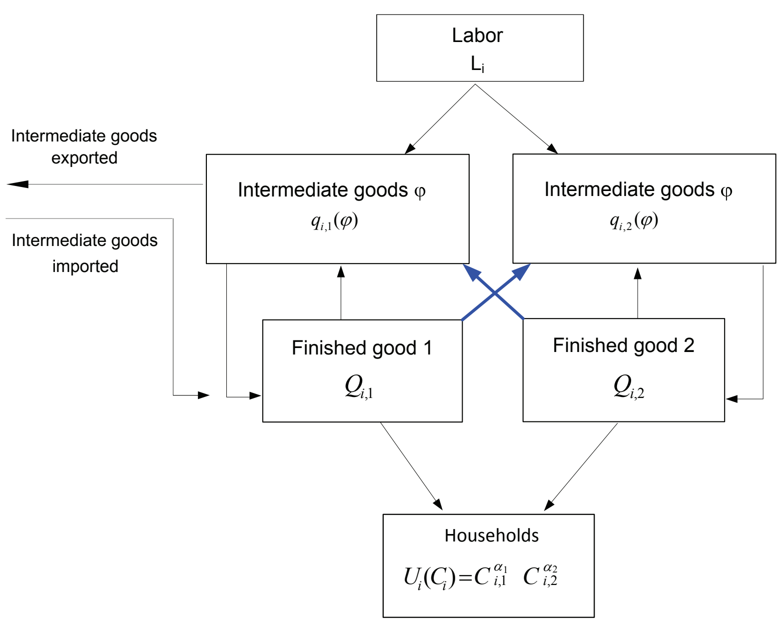
	No rebate	Rebate
Icebergs	**No:** $N_i = \frac{\sigma-1}{\sigma\theta}\frac{1}{f_i^E}L_i$	Not applicable
Cost tariffs	**No:** $N_i = \frac{\sigma-1}{\sigma\theta}\frac{1}{f_i^E}L_i$	**Yes:** $N_i = \frac{\sigma-1}{\sigma\theta}\frac{1}{w_i f_i^E}\left(w_i L_i + T_i\right)$
Revenue tariffs	**Yes:** $N_i = \frac{\sigma-1}{\sigma\theta}\frac{1}{w_i f_i^E}\left(w_i L_i - T_i\right)$	**No:** $N_i = \frac{\sigma-1}{\sigma\theta}\frac{1}{f_i^E}L_i$

model when using revenue-based tariffs with rebate. This is a very convenient, and parsimonious, starting point for our broader analysis of tariffs with multiple sectors.

B General theoretical model

In this Appendix we present further results on the general theoretical model. The schematic production structure of the model is shown in Figure A.1, where the significant inclusion of intersectoral production linkages is shown by the crossed highlighted arrows.

Figure A.1: Schematic production structure of the model



B.1 Households

We assume that agents consume only domestically produced nontraded finished goods with preferences given by

$$U_i\left(C_i\right) = \prod_{s=1}^{S}\left(C_{i,s}\right)^{\alpha_{i,s}}, \tag{37}$$

where $C_{i,s}$ is the consumption of a finished good with sector index s and produced in country i, and the $\alpha_{i,s}$ are standard expenditure shares.

Demand is then given by

$$C_{i,s} = \frac{\alpha_{i,s}\, I_i}{P_{i,s}}, \tag{38}$$

where I_i represents the income of the agents in country i, and $P_{i,s}$ is the price of finished good s in country i. As explained in the main text, agents derive income from two sources, labor income $w_i L_i$ and rebated tariff revenue T_i, and firm profits will be equal to zero by an assumption of free entry. It follows that indirect utility is

$$U_i = \frac{w_i L_i + T_i}{\prod\limits_{s=1}^{S} \left(P_{i,s}/\alpha_{i,s}\right)^{\alpha_{i,s}}}. \tag{39}$$

B.2 Finished goods producers

Cost minimization The cost minimization problem of finished good firms in sector s and country i is[42]

$$\min_{\{q_{ji,s}(\varphi)\}\geq 0} \sum_{j=1}^{M} N_{j,s} \int_{\varphi^*_{ji,s}}^{\infty} p_{ji,s}(\varphi)\, q_{ji,s}(\varphi)\, g_s(\varphi)\, d\varphi,$$

subject to

$$Q_{i,s} = \left[\left(Q_{ii,s}\right)^{\frac{\omega_s - 1}{\omega_s}} + \left(Q^F_{i,s}\right)^{\frac{\omega_s - 1}{\omega_s}} \right]^{\frac{\omega_s}{\omega_s - 1}},$$

where

$$Q_{ii,s} = \left(N_{i,s} \int_{\varphi^*_{ii,s}}^{\infty} q_{ii,s}(\varphi)^{\frac{\sigma_s - 1}{\sigma_s}}\, dG_s(\varphi) \right)^{\frac{\sigma_s}{\sigma_s - 1}}, \quad Q^F_{i,s} = \left(\sum_{j\neq i}^{M} N_{j,s} \int_{\varphi^*_{ji,s}}^{\infty} q_{ji,s}(\varphi)^{\frac{\sigma_s - 1}{\sigma_s}}\, dG_s(\varphi) \right)^{\frac{\sigma_s}{\sigma_s - 1}},$$

and $q_{ji,s}(\varphi)$ is the demand by country i and sector s of an intermediate variety φ from country j with the tariff-inclusive price $p_{ji,s}(\varphi)$, $Q_{i,s}$ is the total quantity of finished goods produced, and $N_{j,s}$ is the number of entering firms in country j and sector s. Under the Pareto distribution of productivity, the number of firms/products actually sold to market i is $N_{j,s}\left[1 - G_s\left(\varphi^*_{ji,s}\right)\right] = N_{j,s}\varphi^{*-\theta_s}_{ji,s}$. Note that $q_{ji,s}(\varphi) > 0$, and the good is produced by j for i, if and only if $\varphi \geq \varphi^*_{ji,s}$. Otherwise $q_{ji,s}(\varphi) = 0$, which accounts for the lower limit of the integrals above.

[42]Intermediate good producers are heterogeneous in their productivity levels and since a particular variety is related to a particular productivity throughout the paper we will abuse notation and denote by φ both the productivity level and variety of the firm.

B.3 Intermediate goods producers

The intermediate good firm in sector s in country i with variety φ employs labor and uses materials from all sectors (production linkages) and combines them using the following production function

$$q_{i,s}(\varphi) = \varphi \; l_{i,s}(\varphi)^{1-\gamma_{i,s}} \prod_{s'=1}^{S} m_{i,s's}(\varphi)^{\gamma_{i,s's}}, \tag{40}$$

where: φ is the productivity draw of the firm; $l_{i,s}(\varphi)$ is labor demand; $m_{i,s's}(\varphi)$ is the quantity of materials used from sector s'; $\gamma_{i,s's} \geq 0$ is the cost share of inputs from sector s' used by sector s (input-output coefficients); $\gamma_{i,s} \equiv \sum_{s'=1}^{S} \gamma_{i,s's} < 1$ is the cost share of all intermediate inputs; and $(1-\gamma_{i,s}) > 0$ is the share of value added (here, labor costs) in the total cost of production.

Cost minimization We solve the problem of the tradable intermediate variety producer in two stages. First, we determine the minimum cost of producing a given quantity. The solution to this problem is the variable cost function of the firm. Second, we solve the profit maximization problem of the firm using the cost function derived in the first stage and allowing for the fixed costs.

The cost minimization problem of tradable intermediate firms of variety φ in country i is

$$C\left(q_{i,s}(\varphi);\, w_i,\, \{P_{i,s'}\}_{s'=1}^{S}\right) = \min_{(l_i(\varphi),\, \{m_{i,s's}(\varphi)\}_{s'=1}^{S}) \geq 0} w_i \, l_{i,s}(\varphi) + \sum_{s'=1}^{S} P_{i,s'} \, m_{i,s's}(\varphi),$$

subject to (40), where w_i denotes the wage in country i.

The solution to the cost minimization problem yields the following variable cost function for each producer of variety φ in country i and sector s:

$$C\left(q_{i,s}(\varphi); x_{i,s}\right) = \frac{x_{i,s}}{\varphi} \, q_{i,s}(\varphi). \tag{41}$$

The marginal cost of each producer is then given by

$$MC_{i,s}\left(q_{i,s}(\varphi); x_{i,s}\right) = \frac{x_{i,s}}{\varphi}. \tag{42}$$

B.4 Labor allocation and entry

For simplicity, we consider the case of roundabout production so that $\gamma_{i,ss'} = 0$ for $s \neq s'$, and the input-output matrix is diagonal with $\gamma_{i,s} \equiv \gamma_{i,ss}$. Then labor market demand in each sector s is

$$\begin{aligned} L_{i,s} &= N_{i,s} f_{i,s}^{e} + N_{i,s} f_{ii,s} \int_{\varphi_{ii,s}^{*}}^{\infty} g(\varphi)\, d\varphi + N_{i,s} f_{ij,s} \int_{\varphi_{ij,s}^{*}}^{\infty} g(\varphi)\, d\varphi \\ &\quad + \gamma_{i,s}(\sigma_s - 1) N_{i,s} \sum_{k=i,j} \left[\int_{\varphi_{ik,s}^{*}}^{\infty} \frac{\pi_{ik,s}}{w_i}(\varphi)\, g(\varphi)\, d\varphi + f_{ik,s} \int_{\varphi_{ik,s}^{*}}^{\infty} g(\varphi)\, d\varphi \right]. \end{aligned}$$

Using free entry and the Pareto distribution, we obtain

$$\frac{L_{i,s}}{N_{i,s}} = [1 + \gamma_{i,s} (\sigma_s - 1)] \left(f_{i,s}^e + f_{ii,s} {\varphi_{ii,s}^*}^{-\theta_s} + f_{ij,s} {\varphi_{ij,s}^*}^{-\theta_s} \right). \tag{43}$$

Also using (10), entry into each sector becomes

$$N_{i,s} = \frac{(\sigma_s - 1)}{[1 + \gamma_{i,s} (\sigma_s - 1)] \theta_s} \frac{L_{i,s}}{f_{i,s}^e}. \tag{44}$$

We see that entry is proportional to the labor allocation in each sector. The totally differentiating $\sum_s L_{i,s} = L_i$, we immediately obtain (28).

C Equilibrium conditions of the model in relative changes

To calculate the effects of tariffs changes in the quantitative model, we express the equilibrium conditions in relative terms using the "exact-hat" notation for the ratio of after-versus-before levels for a given perturbation, that is, $\widehat{z} = z'/z$ for any variable z. As shown below, the equilibrium conditions of our model can be expressed as follows, where the change in the price of the input bundle is given by

$$\hat{x}_{i,s} \equiv (\hat{w}_i)^{1-\gamma_{i,s}} \prod_{s'=1}^{S} \left(\hat{P}_{i,s'}\right)^{\gamma_{i,s's}}, \tag{45}$$

the change in the price index

$$\hat{P}_{i,s} = \left(\lambda_{ii,s}^{1-\xi_s} \hat{\Lambda}_{ii,s}^{\xi_s} + (1 - \lambda_{ii,s})^{1-\xi_s} \hat{\Lambda}_{Fi,s}^{\xi_s} \right)^{\frac{-1}{\theta_s \xi_s}} \tag{46}$$

where $\hat{\Lambda}_{ii,s} = \left(\lambda_{ii,s} [\hat{x}_{i,s}]^{-\theta_s} \hat{A}_{ii,s} \right)$, and $\hat{\Lambda}_{Fi,s} = \sum_{j \neq i}^{M} \lambda_{ji,s} \left[\hat{x}_{j,s} \widehat{\tau}_{ji,s} \widehat{(1 + t_{ji,s})} \right]^{-\theta_s} \hat{A}_{ji,s}$, while the parameter ξ_s is defined as

$$\xi_s \equiv \frac{(\sigma_s - 1)(\omega_s - 1)}{\theta_s (\sigma_s - \omega_s) + (\sigma_s - 1)(\omega_s - 1)}, \tag{47}$$

and

$$\hat{A}_{ji,s} \equiv \hat{N}_{j,s} \left(\frac{\hat{w}_j \widehat{(1 + t_{ji,s})}}{\hat{Y}_{i,s}} \right)^{\frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \quad \text{for all } j \text{ with } t_{ii,s} \equiv 0. \tag{48}$$

The change in trade shares are given by

$$\hat{\lambda}_{ii,s} = \left(\frac{\hat{x}_{i,s}}{\hat{P}_{ii,s}} \right)^{-\theta_s} \left(\frac{\hat{P}_{ii,s}}{\hat{P}_{i,s}} \right)^{-\theta_s \frac{1-\omega_s}{1-\sigma_s}} \hat{A}_{ii,s}, \tag{49}$$

$$\hat{\lambda}_{ji,s} = \left(\frac{\hat{x}_{j,s} \widehat{\tau}_{ji,s} \widehat{(1 + t_{ji,s})}}{\hat{P}_{i,s}^F} \right)^{-\theta_s} \left(\frac{\hat{P}_{i,s}^F}{\hat{P}_{i,s}} \right)^{-\theta_s \frac{1-\omega_s}{1-\sigma_s}} \hat{A}_{ji,s}, \quad j \neq i, \tag{50}$$

where $\hat{P}_{ii,s} = \hat{P}_{i,s}^{\xi_s \frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \left(\frac{\hat{\Lambda}_{ii,s}}{\lambda_{ii,s}}\right)^{\frac{\xi_s}{1-\omega_s}}$, $\hat{P}_{i,s}^F = \hat{P}_{i,s}^{\xi_s \frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \left(\frac{\hat{\Lambda}_{Fi}}{1-\lambda_{ii,s}}\right)^{\frac{\xi_s}{1-\omega_s}}$.

The remaining equilibrium conditions are,

$$Y'_{i,s} = \sum_{s'=1}^{S} \tilde{\gamma}_{i,ss'} \sum_{j=1}^{M} \frac{\lambda'_{ij,s'}}{1+t'_{ij,s'}} Y'_{j,s'} + \alpha_{i,s} \left(w'_i L_i + T'_i\right), \tag{51}$$

with tariff revenue given by

$$T'_i = \sum_{s=1}^{S} \sum_{j \neq i} \frac{t'_{ji,s}}{1+t'_{ji,s}} \lambda'_{ji,s} Y'_{i,s}, \tag{52}$$

trade balance

$$\sum_{s=1}^{S} \sum_{j=1}^{M} \frac{\lambda'_{ji,s}}{1+t'_{ji,s}} Y'_{i,s} = \sum_{s=1}^{S} \sum_{j=1}^{M} \frac{\lambda'_{ij,s}}{1+t'_{ij,s}} Y'_{j,s}, \tag{53}$$

and the final condition for firm entry,

$$\hat{N}_{i,s} = \frac{\widehat{\sum_{j=1}^{M} \frac{\lambda_{ij,s}}{1+t_{ij,s}} Y_{j,s}}}{\hat{w}_i}. \tag{54}$$

As we can see, by expressing the model in this way we can analyze the effects of tariff changes without needing information of fixed entry and operating costs which are, in general, difficult to estimate in the data, especially at the necessary disaggregation. The only identification restriction we will impose is that these fixed have not changed over time. The above system of equations can then be used to study the impact of a change in tariffs $\left(\widehat{1+t_{ji,s}}\right)$ (as well as the change in iceberg costs, $\hat{\tau}_{ji,s}$).

To justify this set of equations, we return to the equilibrium conditions in the main text. The parameters of the model are $\alpha_{i,s}$, σ_s, ω_s, $f_{ii,s}$, $\tau_{ij,s}$, θ_s, δ, $f_{i,s}^E$, $\gamma_{i,s}$, and $\gamma_{i,ss'}$, subject to the constraints $\sum_{s=1}^{S} \alpha_{i,s} = 1$ and $\gamma_{i,s} \equiv \sum_{s'=1}^{S} \gamma_{i,ss'} < 1$. The equilibrium conditions to solve the model are then as follows: $M \times M \times S$ ZCP conditions (9),

$$\varphi_{ii,s}^* = \left(\frac{\sigma_s}{\sigma_s - 1}\right) \left(\frac{\sigma_s w_i f_{ii,s}}{Y_{i,s}}\right)^{\frac{1}{\sigma_s - 1}} \frac{x_{i,s}}{P_{ii,s}} \left(\frac{P_{ii,s}}{P_{i,s}}\right)^{\frac{\omega_s - 1}{\sigma_s - 1}},$$

$$\varphi_{ij,s}^* = \left(\frac{\sigma_s}{\sigma_s - 1}\right) \left(\frac{\sigma_s w_i f_{ij,s}}{Y_{j,s}}\right)^{\frac{1}{\sigma_s - 1}} \frac{x_{i,s} \tau_{ij,s} \left(1+t_{ij,s}\right)^{\frac{\sigma_s}{\sigma_s - 1}}}{P_{j,s}^F} \left(\frac{P_{j,s}^F}{P_{j,s}}\right)^{\frac{\omega_s - 1}{\sigma_s - 1}};$$

$M \times S$ goods market equilibria (17),

$$Y_{i,s} = \frac{\sigma_s - 1}{\sigma_s} \sum_{s'=1}^{S} \gamma_{i,ss'} \sum_{j=1}^{M} \frac{\lambda_{ij,s'}}{1+\tau_{ij,s'}} Y_{j,s'} + \alpha_{i,s} \left(w_i L_i + T_i\right);$$

$M \times S$ sectoral prices (12),

$$P_{i,s} = \left(\left(P_{ii,s}\right)^{1-\omega_s} + \left(P_{i,s}^F\right)^{1-\omega_s}\right)^{\frac{1}{1-\omega_s}},$$

where

$$
\begin{aligned}
P_{ii,s} &= \left({\varphi^*_{ii,s}}^{-\theta_s} N_{i,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x_{i,s}}{\tilde{\varphi}_{ii,s}} \right)^{1-\sigma_s} \right)^{\frac{1}{1-\sigma_s}} , \\
P^F_{i,s} &= \left(\sum_{j \neq i}^{M} {\varphi^*_{ji,s}}^{-\theta_s} N_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x_{j,s}\, \tau_{ji,s} \left(1 + t_{ji,s}\right)}{\tilde{\varphi}_{ji,s}} \right)^{1-\sigma_s} \right)^{\frac{1}{1-\sigma_s}} ;
\end{aligned}
$$

$M \times M \times S$ expenditure shares (14),

$$
\begin{aligned}
\lambda_{ii,s} &= {\varphi^*_{ii,s}}^{-\theta_s} N_{i,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x_{i,s}}{\tilde{\varphi}_{ii,s}\, P_{ii,s}} \right)^{1-\sigma_s} \left(\frac{P_{ii,s}}{P_{i,s}} \right)^{1-\omega_s} , \\
\lambda_{ji,s} &= {\varphi^*_{ji,s}}^{-\theta_s} N_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{\tau_{ji,s}\, x_{j,s} \left(1 + t_{ji,s}\right)}{\tilde{\varphi}_{ji,s}\, P^F_{i,s}} \right)^{1-\sigma_s} \left(\frac{P^F_{i,s}}{P_{i,s}} \right)^{1-\omega_s} ;
\end{aligned}
$$

$M \times S$ free entry conditions (10),

$$
\sum_{j=1}^{M} f_{ij,s}\, {\varphi^*_{ij,s}}^{-\theta_s} = \frac{\theta_s - \sigma_s + 1}{\sigma_s - 1} f^E_{i,s} ;
$$

$M \times S$ input bundle costs (4),

$$
x_{i,s} \equiv \left(\frac{w_i}{1 - \gamma_{i,s}} \right)^{1-\gamma_{i,s}} \prod_{s'=1}^{S} \left(\frac{P_{i,s'}}{\gamma_{i,s's}} \right)^{\gamma_{i,s's}} ,
$$

and M trade balances (16),

$$
\sum_{s=1}^{S} \sum_{j=1}^{M} \frac{\lambda_{ji,s}}{1 + \tau_{ji,s}} Y_{i,s} = \sum_{s=1}^{S} \sum_{j=1}^{M} \frac{\lambda_{ij,s}}{1 + \tau_{ij,s}} Y_{j,s} .
$$

We now show how we can express the model in relative changes. Consider the impact of a change in iceberg costs $\tau_{ji,s}$ and/or tariffs $t_{ji,s}$. Denote equilibrium prices and allocations under policy vector $(\boldsymbol{\tau}, \mathbf{t})$, by the vector y and equilibrium prices and allocations under policy vector $(\boldsymbol{\tau}', \mathbf{t}')$, by the vector y'. In the hat notation, we let $\hat{y} = y'/y$ denote the relative change in equilibrium prices and allocations after a change in policy, for any element y of the vector y. Similarly, $\widehat{\tau}_{ji,s} = \tau'_{ji,s}/\tau_{ji,s}$ and $\widehat{(1 + t_{ji,s})} = \left(1 + t'_{ji,s}\right) / \left(1 + t_{ji,s}\right)$.

Using input bundle costs (4) before and after a change in policy, we can easily obtain (45). We then proceed to solve for the change in sectoral prices. First we solve for prices after a change in policy using equation (12),

$$
\left(P'_{i,s}\right)^{1-\omega_s} = \left[\left(P'_{ii,s}\right)^{1-\omega_s} + \left(P'^F_{i,s}\right)^{1-\omega_s} \right] ,
$$

$$
\begin{aligned}
P'_{ii,s} &= \left({\varphi^{*\prime}_{ii,s}}^{-\theta_s} N'_{i,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x'_{i,s}}{\tilde{\varphi}'_{ii,s}} \right)^{1-\sigma_s} \right)^{\frac{1}{1-\sigma_s}}, \\
P^{F\prime}_{i,s} &= \left(\sum_{j \neq i}^{M} {\varphi^{*}_{ji,s}}^{\prime -\theta_s} N'_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{\tau'_{ji,s}\, x'_{j,s} \left(1 + t'_{ji,s}\right)}{\tilde{\varphi}'_{ji,s}} \right)^{1-\sigma_s} \right)^{\frac{1}{1-\sigma_s}}.
\end{aligned}
$$

Next we use the definition of expenditure shares before the change in policy (14), and multiply and divide each expression in the summation by (14),

$$
\left(\hat{P}_{ii,s}\right)^{1-\sigma_s} \left(\frac{P_{ii,s}}{P_{i,s}}\right)^{1-\omega_s} = \lambda_{ii,s} \left(\widehat{\varphi^*_{ii,s}}\right)^{\sigma_s - 1 - \theta_s} \hat{N}_{i,s} \left(\hat{x}_{i,s}\right)^{1-\sigma_s}, \tag{55}
$$

$$
\left(\hat{P}^F_{i,s}\right)^{1-\sigma_s} \left(\frac{P^F_{i,s}}{P_{i,s}}\right)^{1-\omega_s} = \sum_{j \neq i}^{M} \lambda_{ji,s} \left(\widehat{\varphi^*_{ji,s}}\right)^{\sigma_s - 1 - \theta_s} \hat{N}_{j,s} \left(\widehat{\tau}_{ji,s}\, \hat{x}_{j,s} \widehat{(1 + t_{ji,s})}\right)^{1-\sigma_s}, \tag{56}
$$

where we use the fact that $\widehat{\varphi^*}_{ji,s} = \widehat{\tilde{\varphi}}_{ji,s}$. Now solve for the ZCP conditions (9) in relative changes,

$$
\widehat{\varphi^*_{ii,s}} = \left(\frac{\hat{w}_i}{\hat{Y}_{i,s}}\right)^{\frac{1}{\sigma_s - 1}} \frac{\hat{x}_{i,s}}{\hat{P}_{ii,s}} \left(\frac{\hat{P}_{ii,s}}{\hat{P}_{i,s}}\right)^{\frac{\omega_s - 1}{\sigma_s - 1}}, \tag{57}
$$

$$
\widehat{\varphi^*_{ji,s}} = \left(\frac{\hat{w}_j}{\hat{Y}_{i,s}}\right)^{\frac{1}{\sigma_s - 1}} \frac{\hat{x}_{j,s}\, \widehat{\tau}_{ji,s} \widehat{(1 + t_{ji,s})}^{\frac{\sigma_s}{\sigma_s - 1}}}{\hat{P}^F_{i,s}} \left(\frac{\hat{P}^F_{i,s}}{\hat{P}_{i,s}}\right)^{\frac{\omega_s - 1}{\sigma_s - 1}}, \tag{58}
$$

and substitute it into (55) and (56) to obtain

$$
\hat{P}_{ii,s} = \hat{P}_{i,s}^{\xi_s \frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \left(\frac{\lambda_{ii,s} \left[\hat{x}_{i,s}\right]^{-\theta_s} \hat{A}_{ii,s}}{\lambda_{ii,s}} \right)^{\frac{\xi_s}{1-\omega_s}},
$$

$$
\hat{P}^F_{i,s} = \hat{P}_{i,s}^{\xi_s \frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \left(\frac{\sum_{j \neq i}^{M} \lambda_{ji,s} \left[\hat{x}_{j,s}\, \widehat{\tau}_{ji,s} \widehat{(1 + t_{ji,s})}\right]^{-\theta_s} \hat{A}_{ji,s}}{\left(1 - \lambda_{ii,s}\right)} \right)^{\frac{\xi_s}{1-\omega_s}},
$$

where we use the definitions in (47)–(49). After combining terms using

$$
\left(\hat{P}_{i,s}\right)^{1-\omega_s} = \left(\frac{P_{ii,s}}{P_{i,s}}\right)^{1-\omega_s} \left(\hat{P}_{ii,s}\right)^{1-\omega_s} + \left(\frac{P^F_{i,s}}{P_{i,s}}\right)^{1-\omega_s} \left(\hat{P}^F_{i,s}\right)^{1-\omega_s},
$$

we obtain (46).

Expenditure shares in relative changes are solved in a similar way. Start from solving for the expenditure share after a change in policy using (14)

$$\lambda'_{ji,s} = \varphi^{*}_{ji,s}{}'^{-\theta_s} N'_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{\tau'_{ji,s}\, x'_{j,s} \left(1 + t'_{ji,s}\right)}{P'_{i,s} \tilde{\varphi}'_{ji,s}} \right)^{1-\sigma_s},$$

$$\begin{aligned}
\lambda'_{ii,s} &= \varphi^{*\prime}_{ii,s}{}^{-\theta_s} N'_{i,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{x'_{i,s}}{\tilde{\varphi}'_{ii,s}\, P'_{ii,s}} \right)^{1-\sigma_s} \left(\frac{P'_{ii,s}}{P'_{i,s}} \right)^{1-\omega_s}, \\
\lambda'_{ji,s} &= \varphi^{*\prime}_{ji,s}{}^{-\theta_s} N'_{j,s} \left(\frac{\sigma_s}{\sigma_s - 1} \frac{\tau'_{ji,s}\, x'_{j,s} \left(1 + t'_{ji,s}\right)}{\tilde{\varphi}'_{ji,s}\, P'^{F}_{i,s}} \right)^{1-\sigma_s} \left(\frac{P'^{F}_{i,s}}{P'_{i,s}} \right)^{1-\omega_s};
\end{aligned}$$

take the ratio of this expression relative to the expenditure share before the change in policy,

$$\begin{aligned}
\frac{\lambda'_{ii,s}}{\lambda_{ii,s}} &= \left(\widehat{\varphi^{*}_{ii,s}} \right)^{\sigma_s - 1 - \theta_s} \hat{N}_{i,s} \left(\frac{\hat{x}_{i,s}}{\hat{P}_{ii,s}} \right)^{1-\sigma_s} \left(\frac{\hat{P}_{ii,s}}{\hat{P}_{i,s}} \right)^{1-\omega_s}, \\
\frac{\lambda'_{ji,s}}{\lambda_{ji,s}} &= \left(\widehat{\varphi^{*}_{ji,s}} \right)^{\sigma_s - 1 - \theta_s} \hat{N}_{j,s} \left(\frac{\hat{\tau}_{ji,s}\, \hat{x}_{j,s} \widehat{(1 + t_{ji,s})}}{\hat{P}^{F}_{i,s}} \right)^{1-\sigma_s} \left(\frac{\hat{P}^{F}_{i,s}}{\hat{P}_{i,s}} \right)^{1-\omega_s}.
\end{aligned}$$

Now use the ZCP condition in relative changes (57) and combine terms to obtain the expenditure shares in relative changes (49),

$$\begin{aligned}
\hat{\lambda}_{ii,s} &= \left(\frac{\hat{x}_{i,s}}{\hat{P}_{ii,s}} \right)^{-\theta_s} \left(\frac{\hat{P}_{ii,s}}{\hat{P}_{i,s}} \right)^{-\theta_s \frac{1-\omega_s}{1-\sigma_s}} \hat{A}_{ii,s}\,. \\
\hat{\lambda}_{ji,s} &= \left(\frac{\hat{x}_{j,s}\, \hat{\tau}_{ji,s} \widehat{(1 + t_{ji,s})}}{\hat{P}^{F}_{i,s}} \right)^{-\theta_s} \left(\frac{\hat{P}^{F}_{i,s}}{\hat{P}_{i,s}} \right)^{-\theta_s \frac{1-\omega_s}{1-\sigma_s}} \hat{A}_{ji,s}\,.
\end{aligned}$$

The goods market equilibrium conditions (51) and the trade balance equilibrium conditions (53) are given by (16) and (17) at policy $(\boldsymbol{\tau}', \mathbf{t}')$.

Finally, to solve for the change in entry, note that, from the free entry condition (10) and imposing trade balance (16), we obtain

$$N_{i,s} = \frac{E_{ii,s} + E_{i,s}}{w_i\, f^{E}_{i,s} \left(\frac{\theta_s\, \sigma_s}{\sigma_s - 1} \right)},$$

and expressing this in relative terms we end up with (54).

D Decomposition of the change in utility

Using (37) and (38), the total change in utility with $w_i \equiv 1$ is

$$\frac{dU_i}{U_i} = \frac{dT_i}{L_i + T_i} - \sum_{s=1}^{S} \alpha_{i,s} \frac{dP_{i,s}}{P_{i,s}}. \tag{59}$$

In the case of a diagonal input-output matrix and also assuming that there is no two-tier Armington, so that $\omega_s = \sigma_s$, then we can substitute from (21), we obtain (27). The goal of this Appendix is to generalize the expression for large rather than infinitesimal changes in utility, with a general input-output matrix and $\omega_s \neq \sigma_s$.

We combine (49) with $\hat{P}_{ii,s} = \hat{P}_{i,s}^{\xi_s \frac{\sigma_s - 1 - \theta_s}{\sigma_s - 1}} \left(\frac{\hat{\Lambda}_{ii,s}}{\lambda_{ii,s}}\right)^{\frac{\xi_s}{1-\omega_s}}$ to obtain after some simplification

$$\hat{\lambda}_{ii,s} = \hat{x}_{i,s}^{-\theta_s} \hat{P}_{i,s}^{\theta_s \xi_s} \left(\frac{\hat{\Lambda}_{ii,s}}{\lambda_{ii,s}}\right)^{\frac{\theta_s \xi_s (\omega_s - \sigma_s)}{(1-\omega_s)(1-\sigma_s)}} \hat{A}_{ii,s}.$$

Inverting this equation we obtain

$$\hat{P}_{i,s} = \hat{\lambda}_{ii,s}^{\frac{1}{\theta_s \xi_s}} \left(\frac{\hat{\Lambda}_{ii,s}}{\lambda_{ii,s}}\right)^{\frac{-(\sigma_s - \omega_s)}{(\omega_s - 1)(1-\sigma_s)}} \left(\hat{x}_{i,s}^{-\theta_s} \hat{A}_{ii,s}\right)^{\frac{-1}{\theta_s \xi_s}}.$$

Substitute from $\hat{\Lambda}_{ii,s} \equiv \lambda_{ii,s} \left(\hat{x}_{i,s}\right)^{-\theta_s} \hat{A}_{ii,s}$, and using $\frac{(\sigma_s - \omega_s)}{(\omega_s - 1)(1-\sigma_s)} + \frac{1}{\theta_s \xi_s} = \frac{1}{\theta_s}$, we arrive at

$$\ln \hat{P}_{i,s} = \left(\frac{1}{\theta_s \xi_s}\right) \ln \hat{\lambda}_{ii,s} + \ln \hat{x}_{i,s} - \left(\frac{1}{\theta_s}\right) \ln \hat{A}_{ii,s}.$$

Using (45) we have

$$\ln \hat{x}_{i,s} = (1 - \gamma_{i,s}) \ln \hat{w}_i + \sum_{s'=1}^{S} \gamma_{i,s's} \ln \hat{P}_{i,s'},$$

and combining the above two equations in matrix form we obtain

$$\ln \hat{\mathbf{P}}_i - \mathbf{D}\left[\frac{1}{\theta_s \xi_s}\right] \ln \hat{\boldsymbol{\lambda}}_{ii,s} + \mathbf{D}\left[\frac{1}{\theta_s}\right] \ln \hat{\mathbf{A}}_{ii} = \mathbf{D}[1 - \gamma_{i,s}] \ln \hat{w}_i + \boldsymbol{\Gamma}_i \ln \hat{\mathbf{P}}_i,$$

where $\ln \hat{\mathbf{P}}_i$ is an $S \times 1$ vector with elements $\ln \hat{P}_{i,s}$, $\hat{\mathbf{A}}_{ii}$ is an $S \times 1$ vector with elements $\ln \hat{A}_{ii,s}$, $\boldsymbol{\Gamma}_i$ is the $S \times S$ matrix with elements $\gamma_{i,ss'}$, and $\mathbf{D}[1 - \gamma_{i,s}]$ is the $S \times S$ matrix with diagonal elements $(1 - \gamma_{i,s})$ and zero's elsewhere. More generally, let $\mathbf{D}$ denote an operator that for any vector of values $z_{i,s}, s = 1, ..., S$, returns the $S \times S$ diagonal matrix $\mathbf{D}[z_{i,s}]$ with elements $z_{i,s}$ along the diagonal and zero's elsewhere.

Solving for $\ln \hat{\mathbf{P}}_i$ we obtain

$$\ln \hat{\mathbf{P}}_i = (\mathbf{I} - \boldsymbol{\Gamma}_i)^{-1} \left\{ \mathbf{D}[1 - \gamma_{i,s}] \ln \hat{w}_i + \mathbf{D}\left[\frac{1}{\theta_s \xi_s}\right] \ln \hat{\boldsymbol{\lambda}}_{ii} - \mathbf{D}\left[\frac{1}{\theta_s}\right] \ln \hat{\mathbf{A}}_{ii} \right\}.$$

Because $\gamma_{i,s} \equiv \sum_{s'=1}^{S} \gamma_{i,s's}$, then it is readily confirmed that $(\mathbf{I} - \mathbf{\Gamma}_i)^{-1}\mathbf{D}[1 - \gamma_{i,s}] = \mathbf{1}_S$, where $\mathbf{1}_S$ is an $S \times 1$ vector of one's. So the above equation is simplified as

$$\ln \hat{\mathbf{P}}_i = \mathbf{1}_S\, w_i + (\mathbf{I} - \mathbf{\Gamma}_i)^{-1} \left\{ \mathbf{D}\left[\frac{1}{\theta_s \xi_s}\right] \ln \hat{\boldsymbol{\lambda}}_{ii} - \mathbf{D}\left[\frac{1}{\theta_s}\right] \ln \hat{\mathbf{A}}_{ii} \right\}. \tag{60}$$

For the value of finished good output, we start by repeating market clearing from (22) as

$$Y_{i,s} = \alpha_{i,s}\,(w_i\, L_i + T_i) + \sum\nolimits_{r=1}^{S} \widetilde{\gamma}_{i,sr}\,(E_{ii,r} + E_{i,r})\,.$$

Defining $\tilde{Y}_{i,s} \equiv (Y_{i,s}/w_i)$ as real output, we rewrite the above expression as

$$\tilde{Y}_{i,s} = \alpha_{i,s}\,(L_i + (T_i/w_i)) + \sum\nolimits_{r=1}^{S} \widetilde{\gamma}_{i,sr}\,(E_{ii,r} + E_{i,r})\,/w_i,$$

and in period ′ this becomes

$$\tilde{Y}'_{i,s} = \alpha_{i,s}\,\left(L_i + (T'_i/w'_i)\right) + \sum\nolimits_{r=1}^{S} \widetilde{\gamma}_{i,sr}\,\left(E'_{ii,r} + E'_{i,r}\right)/w_i.$$

Then dividing period ′ by the initial period we obtain:

$$\begin{aligned}
\frac{\tilde{Y}'_{i,s}}{\tilde{Y}_{i,s}} &= (1 - R_{i,s})\frac{(L_i + (T'_i/w'_i))}{(L_i + (T_i/w_i))} + R_{i,s}\,\frac{\sum_{r=1}^{S} \widetilde{\gamma}_{i,sr}\left(E'_{ii,r} + E'_{i,r}\right)/w'_i}{\sum_{t=1}^{S} \widetilde{\gamma}_{i,st}\,(E_{ii,t} + E_{i,t})\,/w_i} \\
&= (1 - R_{i,s})\frac{(L_i + (T'_i/w'_i))}{(L_i + (T_i/w_i))} + R_{i,s}\sum\nolimits_{r=1}^{S} \frac{\widetilde{\gamma}_{i,sr}\left(E'_{ii,r} + E'_{i,r}\right)/w'_i}{\widetilde{\gamma}_{i,sr}\,(E_{ii,r} + E_{i,r})\,/w_i}\,\frac{\widetilde{\gamma}_{i,sr}\,(E_{ii,r} + E_{i,r})\,/w_i}{\sum_{t=1}^{S} \widetilde{\gamma}_{i,st}\,(E_{ii,t} + E_{i,t})\,/w_i} \\
&= (1 - R_{i,s})\frac{(L_i + (T'_i/w'_i))}{(L_i + (T_i/w_i))} + \sum\nolimits_{r=1}^{S} \widetilde{\gamma}_{i,sr}\left(\frac{N'_{i,r}}{N_{i,r}}\right)\frac{(E_{ii,r} + E_{i,r})}{Y_{i,s}}\,,
\end{aligned}$$

where the first line follows from (23), the second from algebra, and the third using free entry in (19) and (23) once again. We rewrite this expression in vector notation as

$$\hat{\tilde{\mathbf{Y}}}_i = (\mathbf{1}_S - \mathbf{R}_i)\left(\frac{L_i + (T'_i/w'_i)}{L_i + (T_i/w_i)}\right) + D\left[\frac{1}{Y_{i,s}}\right]\widetilde{\mathbf{\Gamma}}_i \mathbf{D}\,[E_{ii,s} + E_{i,s}]\,\widehat{\mathbf{N}}_i\,, \tag{61}$$

where $\hat{\tilde{\mathbf{Y}}}_i$ is the $S \times 1$ vector with elements $\hat{\tilde{Y}}_{i,s}$, or the change in real output ; $\mathbf{1}_S$ is the $S \times 1$ vector of one's; $\mathbf{R}_i$ is the $S \times 1$ vector with elements $R_{i,s}$ from (23); $\widetilde{\mathbf{\Gamma}}_i$ is the $S \times S$ matrix with elements $\widetilde{\gamma}_{i,ss'}$; and $\hat{\mathbf{N}}_i$ is the $S \times 1$ vector with elements $\hat{N}_{i,s}$.

We will need to express this equation in log form, however. To achieve this, note that the definition of $R_{i,s}$ in (23) is readily written in matrix form as

$$\mathbf{R}_i = \widetilde{\mathbf{\Gamma}}_i \mathbf{D}\left[\frac{E_{ii,s} + E_{i,s}}{Y_{i,s}}\right]\mathbf{1}_S \implies \mathbf{1}_S = (\mathbf{1}_S - \mathbf{R}_i) + \widetilde{\mathbf{\Gamma}}_i \mathbf{D}\left[\frac{E_{ii,s} + E_{i,s}}{Y_{i,s}}\right]\mathbf{1}_S.$$

It follows that (61) can be rewritten as,

$$(\hat{\tilde{\mathbf{Y}}}_i - \mathbf{1}_S) = (\mathbf{1}_S - \mathbf{R}_i)\left(\frac{L_i + (T'_i/w'_i)}{L_i + (T_i/w_i)} - 1\right) + \widetilde{\mathbf{\Gamma}}_i \mathbf{D}\left[\frac{E_{ii,s} + E_{i,s}}{Y_{i,s}}\right](\widehat{\mathbf{N}}_i - \mathbf{1}_S). \tag{62}$$

An element of the column vector on the left-hand side is $(\hat{\hat{Y}}_{i,s}-1)$, which is a percentage change in $Y_{i,s}$. It is not the same as a log-change $\ln\hat{\hat{Y}}_{i,s}$, and so we define the "adjustment factor":

$$\Delta_{i,s} \equiv \frac{\ln\hat{\hat{Y}}_{i,s}}{(\hat{\hat{Y}}_{i,s}-1)} = \frac{\ln(\widehat{Y_{i,s}/w_i})}{(\widehat{Y_{i,s}/w_i})-1},$$

as shown by (29) in the main text. The usefulness of this adjustment factor is that it allows us to convert (62) to the vector of log changes $\ln\hat{\hat{\mathbf{Y}}}_i$ by multiplying by the diagonal matrix of adjustment factors $\mathbf{D}[\Delta_{i,s}]$, so that:

$$\ln\hat{\hat{\mathbf{Y}}}_i = \mathbf{D}[\Delta_{i,s}]\left(\mathbf{1}_S-\mathbf{R}_i\right)\left(\frac{L_i+(T_i'/w_i')}{L_i+(T_i/w_i)}-1\right)+\mathbf{D}\left[\frac{\Delta_{i,s}}{Y_{i,s}}\right]\widetilde{\boldsymbol{\Gamma}}_i\mathbf{D}\left[E_{ii,s}+E_{i,s}\right](\widehat{\mathbf{N}}_i-\mathbf{1}_S).$$

We can now complete the decomposition of utility changes. Rewriting (48) in matrix notation we obtain

$$\ln\widehat{\mathbf{A}}_{ii} = \ln\widehat{\mathbf{N}}_{i,s}+\mathbf{D}\left[\frac{\theta_s-\sigma_s+1}{\sigma_s-1}\right]\ln\hat{\hat{\mathbf{Y}}}_i.$$

Combining the above two equations with (60) we obtain

$$\begin{aligned}\ln\hat{\mathbf{P}}_i &= \mathbf{1}_S\ln\hat{w}_i+(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\left\{\mathbf{D}\left[\frac{1}{\theta_s\xi_s}\right]\ln\hat{\boldsymbol{\lambda}}_{ii}-\mathbf{D}\left[\frac{1}{\theta_s}\right]\ln\widehat{\mathbf{N}}_{i,s}\right\}\\ &- (\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\mathbf{D}\left[\frac{\Delta_{i,s}(\theta_s-\sigma_s+1)}{Y_{i,s}\theta_s(\sigma_s-1)}\right]\widetilde{\boldsymbol{\Gamma}}_i\mathbf{D}\left[E_{ii,s}+E_{i,s}\right](\widehat{\mathbf{N}}_i-\mathbf{1}_S)\\ &- (\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\mathbf{D}\left[\frac{\Delta_{i,s}(\theta_s-\sigma_s+1)}{\theta_s(\sigma_s-1)}\right](\mathbf{1}_S-\mathbf{R}_i)\left(\frac{L_i+(T_i'/w_i')}{L_i+(T_i/w_i)}-1\right).\end{aligned}$$

Then we make use of indirect utility in (39) to obtain

$$\begin{aligned}\ln\widehat{U}_i &= \ln\left(\frac{L_i+(T_i'/w_i')}{L_i+(T_i/w_i)}\right)-\boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\left\{\mathbf{D}\left[\frac{1}{\theta_s\xi_s}\right]\ln\hat{\boldsymbol{\lambda}}_{ii}-\mathbf{D}\left[\frac{1}{\theta_s}\right]\ln\widehat{\mathbf{N}}_i\right\}\\ &+ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\mathbf{D}\left[\frac{\Delta_{i,s}(\theta_s-\sigma_s+1)}{Y_{i,s}\theta_s(\sigma_s-1)}\right]\widetilde{\boldsymbol{\Gamma}}_i\mathbf{D}\left[E_{ii,s}+E_{i,s}\right](\widehat{\mathbf{N}}_i-\mathbf{1}_S)\\ &+ \boldsymbol{\alpha}_i^T(\mathbf{I}-\boldsymbol{\Gamma}_i)^{-1}\mathbf{D}\left[\frac{\Delta_{i,s}(\theta_s-\sigma_s+1)}{\theta_s(\sigma_s-1)}\right](\mathbf{1}_S-\mathbf{R}_i)\left(\frac{L_i+(T_i'/w_i')}{L_i+(T_i/w_i)}-1\right).\end{aligned} \tag{63}$$

To obtain (30), we note the the inverse of ξ_s from (47) equals

$$\frac{1}{\xi_s} = 1+\left(\frac{\sigma_s-\omega_s}{\omega_s-1}\right)+\left(\frac{\theta_s}{\sigma_s-1}-1\right)\left(\frac{\sigma_s-\omega_s}{\omega_s-1}\right).$$

Substituting this expression into (63), we immediately obtain (30). We can slightly extend (30) by introducing a nonzero nominal trade surplus S_i to tariff revenue T_i in each country, and by adding S_i' to tariff revenue T_i' in the new equilibrium, as we do in the quantitative model.

E Domestic sales, expenditure shares and final good shares

In this Appendix we show how using information on tariffs, trade flows, production and with the estimated trade elasticities we can solve for the model value added and intermediate goods shares, domestic sales, expenditure shares and finished good shares. We then show how to aggregate tariffs in a model consistent way.

Value Added Shares To calculate a measure of the share of value added in production, we cannot diectly use the shares of industry revenue that go to value added directly reported in the data. The reason is that the share of value added also includes profits or "operating surplus". We compute the share of intermediate goods in the cost of production for each sectors as the sum of the intermediate goods purchased from all sectors divided by the sum of the compensation of employees, the consumption of fixed capital and the total intermediate goods purchased. These three terms are used to measure the costs of production and exclude "operating surplus", or profits.

Value of Final Goods and Domestic Sales We measure the value of final goods produced in each sector as the sum of the total domestic purchases plus total imports. Domestic sales, or purchases, are reported directly in EORA.

Expenditure Shares Denote by $Y_{ij,s}$ the total expenditure of country j on sector s goods from country i. Total expenditure includes tariffs, therefore in order to calculate $Y_{ij,s}$ we take imports and multiply by tariffs. We do this at the sectoral level, namely $Y_{ij,s} = E_{ij,s}\left(1 + t_{ij,s}\right)$. Note that $Y_{ii,s} = E_{ii,s}$. We then calculate expenditure shares as

$$\lambda_{ij,s} = Y_{ij,s} \Big/ \sum_i Y_{ij,s}\,, \tag{64}$$

where $\sum_i Y_{ij,s} = Y_{j,s}$ is total expenditure.

Finished goods consumption shares To calculate final consumption share, $\alpha_{i,s}$ we take the total expenditure of sector s goods, subtract the intermediate goods expenditure and divide by total final absorption. Namely

$$\alpha_{i,s} = \frac{Y_{i,s} - \sum_{s'=1}^{S} \gamma_{i,ss'} \frac{\sigma_s - 1}{\sigma_s} GO_{i,s'}}{w_i L_i + T_i}\,,$$

where $w_i L_i$ is total value added and T_i tariff revenue which we calculate as $T_i = \sum_{s=1}^{S} \sum_{j \neq i} t_{ji,s}\, E_{ji,s}$.

Tariff aggregation from the good level An important task is to find a model consistent procedure to aggregate goods-level tariffs at a fine level to the correct sectoral-level equivalent at a coarser level.

We make the assumption that in country j and sector s there are $G_{j,s}$ goods indexed by g. Our goal is to solve for a sectoral tariff $t_{ji,s}$ such that the change in this sectoral tariff $(1 + t_{ji,s})$ is equivalent to the effect of the observed changes in tariffs at a goods level $1 + t_{ji,s}(g)$, for $g = 1, ..., G_{j,s}$.

We calculate $\lambda_{ij,s}(g)$, namely the expenditure share on g goods as

$$\lambda_{ij,s}(g) = E_{ij,s}(g)\left(1 + t_{ij,s}(g)\right) \Big/ \sum_i Y_{ij,s}\,. \tag{65}$$

Note that the expenditure share from country i on all $G_{i,s}$ goods from country j has to equal to the total expenditure on sector s goods from country j, therefore

$$\sum_{g=1}^{G_{j,s}} \lambda_{ji,s}(g) = \lambda_{ji,s}\,.$$

Then the trade balance condition (16) can be re-written by adding the summation over goods g as

$$\sum_{s=1}^{S}\sum_{j\neq i}\sum_{g=1}^{G_{j,s}} \frac{\lambda_{ji,s}(g)}{1+t_{ji,s}(g)} Y_{i,s} = \sum_{s=1}^{S}\sum_{j\neq i}\sum_{g=1}^{G_{i,s}} \frac{\lambda_{ij,s}(g)}{1+t_{ij,s}(g)} Y_{j,s}\,. \tag{66}$$

In order for (66) to be equivalent to (16), it is apparent that the tariffs must satisfy

$$\frac{\lambda_{ji,s}}{1+t_{ji,s}} \equiv \sum_{g=1}^{G_{j,s}} \frac{\lambda_{ji,s}(g)}{1+t_{ji,s}(g)}\,. \tag{67}$$

Using (64) , (65) and some manipulation we obtain a tariff aggregation formula:

$$\left(1+t_{ji,s}\right) = \frac{\sum_{g=1}^{G_{j,s}} E_{ji,s}(g)\left(1+t_{ji,s}(g)\right)}{\sum_{g=1}^{G_{j,s}} E_{ji,s}(g)} \quad\Longleftrightarrow\quad t_{ji,s} = \frac{\sum_{g=1}^{G_{j,s}} E_{ji,s}(g)\, t_{ji,s}(g)}{\sum_{g=1}^{G_{j,s}} E_{ji,s}(g)}\,. \tag{68}$$

In other words, when aggregating over a finer set of goods g to a coarse sector level, the sectoral aggregate tariff factor $1 + t_{ji,s}$ should be computed as a trade-weighted mean of the tariff factors across the various goods g. The analogous condition must hold for computing $1 + t'_{ji,s}$ in the new equilibrium, evaluating the shares $\lambda'_{ji,s}(g)/\lambda'_{ji,s}$ in this new equilibrium. Clearly, if there is a uniform change in the goods-level tariffs $1 + t_{ji,s}(g)$ then the new shares would equal their initial values $\lambda_{ji,s}(g)/\lambda_{ji,s}$, and in that case it is obvious from the above that the change in $1 + t_{ji,s}(g)$ would equal the change in $1 + t_{ji,s}$, i.e., the change in the sectoral tariff just equals the uniform change in the goods-level tariffs.

ONLINE DATA APPENDIX: Worldwide Tariff Database (WTD)

A Worldwide Tariff Database (WTD) over 1990-2010 has been prepared for the analysis in this paper. An earlier version of the database, WTD version 0 (WTD0) was used for our working paper Caliendo, Feenstra, Romalis and (2020), but it is not available in its original form. WTD version 1 (WTD1) makes extensive checks and improvements to WTD0, and in this Appendix we provide the documentation for WTD1 and the quantitative analysis in this paper.

WTD1 is available in two datasets:

(a) annual files containing the Most Favored Nation (MFN) and preferential tariff data at the Standard International Trade Classification (SITC) 4-digit level, by importing country and for each exporting country when there is a preferential arrangement;

(b) annual files containing MFN and preferential tariff data by importing country and for all exporting countries and SITC goods when there is positive trade in that year. This dataset, when restricted to 178 countries, is used to obtain Figures 1-3 in the main text. Figure 4 and all the quantitative analysis in the main text uses various sectoral tariff aggregates (for 178 countries plus the rest of the world) calculated from the disaggregate tariff data in part (b), as we explain in this Appendix.

During the time period covered by the data, 1990-2010, a number of countries in eastern Europe changed their composition, so that by 1993: Czechoslovakia split into two countries (the Czech Republic and Slovakia); the USSR split into 15 countries (see the list below); and Socialist Federal Republic of Yugoslavia split into 5 and later 6 countries (see the list below).[43] The quantitative model in the main text is based on the Eora multi-region input-output table,[44], and Eora includes the Czech Republic, Slovakia, the 15 countries of former USSR, and the 6 countries of former Yugoslavia from 1990 onwards. For consistency with Eora, we have omitted Czechoslovakia, the USSR and Yugoslavia from the database, and in their place we have imputed the tariffs of the future countries formed from them: specific details on how that is achieved are provided below.

While the Eora database has 190 countries, in the application of the WTD1 database to Eora, we focus on 178 of these countries plus the rest of the world: the omitted countries were judged to have unreliable input-output tables in Eora, or overlapped with other included regions in Eora, or we were lacking trade data. Nevertheless, the tariffs for these omitted countries are included within the WTD1 database parts (a) and (b), but these countries are omitted from the quantitative analysis.[45]

Countries of the former USSR (15 countries, with ISO codes): Armenia (ARM), Azerbaijan (AZE), Belarus (BLR), Estonia (EST), Georgia (GEO), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Latvia (LVA), Lithuania (LTU), Moldova (MDA), Russia (RUS), Tajikistan (TJK), Turkmenistan (TKM), Ukraine (UKR), Uzbekistan (UZB)

Countries of the former Yugoslavia (6 countries with ISO codes, and one combined ISO code): Bosnia and Herzegovina (BIH), Croatia (HRV), Montenegro (MNE), North Macedonia (MKD), Serbia (SRB), Slovenia (SVN), and a combined ISO code for Serbia and Montenegro (SCG)

[43]Serbia and Montenegro (SCG) did not separate into independent nations until 2006, and both these nations are included in Eora. Kosovo declared its independence from Serbia in 2008, but it is not included in our tariff database for 1990-2010.

[44]https://worldmrio.com

[45]For example, tariffs for Yugoslavia in 1990 and 1991 are included in the WTD1 datasets in parts (a) and (b), even though that country is omitted from our quantitative analysis in the main text.

Datasets

a) Disaggregate tariff data by importing country, for each exporting country with a preferential arrangement

The MFN and preferential tariff data in its most "compact" form is contained in the annual STATA files $tariffYEAR\_compact\_v1.dta$, for YEAR=1990, 1991, ..., 2010.

Variables:

year – 4-digit number indicating the year
iiso – 3-digit string giving the importing country ISO code
eiso – 3-digit string giving the exporting country ISO code
icode – United Nations (UN) numeric code for the importing country
ewits – WITS numeric code for the exporting country
sitc4 – Standard International Trade 4-digit (SITC) classification, rev. 2
t1 – Most favored nation (MFN) *ad valorem* tariff, in percent
$t1\_pref$ – Preferential *ad valorem* tariff, in percent
$t1\_nonmfn$ – a non-MFN *ad valorem* tariff, in percent

Description:

Listed in these files is the importer country code (*iiso*), exporter country code (*eiso*), alternative country codes from the UN or WITS[46] (*icode* and *ewits*), SITC rev. 2, 4-digit code (*sitc4*), along with the most-favored nation (MFN) tariff $t1$, the preferential tariff between the countries, $t1\_pref$, and – for a very small number of observations – a non-MFN tariff, $t1\_nonmfn$. The main importers for which a non-MFN tariff is recorded are the United States and Japan, and in these cases, it is only for a small number of exporting countries: in the United States, for example, these are mostly Communist countries for which "column 2" tariffs are used rather than the MFN tariff. Thus, in most cases the non-MFN tariff $t1\_nonmfn$ is missing.

Importantly, for each importing country the exporters include all countries for which the importer has a preferential trade arrangement. For these exporters, the preferential tariff $t1\_pref$ and the MFN tariff $t1$ are listed; but exporting countries that have no preferential arrangement with the importer may or may not be listed.[47] The MFN tariff for those exporting countries not listed can be inferred, however, from the MFN tariff listed for that importer and SITC good. Specifically, if an importing country has no preferential agreements, then the MFN tariff schedule might be listed between that importing country and itself as an exporter,[48] or between that importing country and the world (WLD) as an exporter, or between that importing country and specific exporting countries: so in any case, the MFN tariffs are provided. To merge in a complete set of tariffs into a bilateral trade dataset, the tariff data needs to be merged TWICE. The first merge by importing country (*iiso*) and product (*sitc4*) will give a complete set of MFN tariffs. The researcher should then DROP the $t1\_pref$ and $t1\_nonmfn$ variables, and then again merge in the tariff data, this time

[46] WITS is the World Integrated Trade Solution database of the World Bank and includes a numeric iso country code: https://wits.worldbank.org. The UN country codes are described in Feenstra, et. al. (2005).

[47] Exporting countrties are often listed PRIOR to a preferential agreement coming into effect, but in these cases $t1 = t1\_pref$.

[48] In this case the preferential tariff $t1\_pref$ will be zero.

by importing country (*iiso*), exporting country (*eiso*) and product (*sitc4*). For observations where $t1\_pref$ is missing, $t1$ is the operative tariff.

The SITC rev. 2, 4-digit classification used in this part (a) dataset includes updated data that has 784 goods. That is smaller than the 818 goods in the SITC rev. 2, 4-digit classification used in WTD0, an earlier version of the data, but a number of those 818 SITC codes are not true 4-digit SITC subgroups.

In the Data Appendix Tables, we list the year for which each country has a tariff schedule available and all the preferential trade agreements that are incorporated into the database. For example, Russia appears with a tariff schedule in 1990-1992, though that schedule is actually the published 1993 schedule for Russia. Other new countries in eastern Europe are treated in a similar way. The tariffs of many former Soviet republics are often inferred in the early 1990s from the 1993 schedule for Russia, before being inferred from one of their own schedules. Data Appendix Table 1 gives details of which tariff schedule was used to infer tariffs for each country and year.

b) MFN and preferential tariff data by importing country, for each exporting country and SITC good with positive trade

The tariff data described in (a) was reorganized so that, for each year, it contains the MFN and preferential tariff for each importing country, exporting country and SITC good with a positive trade value based on the COMTRADE database of the United Nations.[49] The resulting dataset in part (b) has observations for which there is positive trade value between the countries in that SITC good and year.[50] We refer to this dataset as the "base" version.

The MFN and preferential tariff data for all exporters and SITC codes with positive trade is contained the annual STATA files: $tariffYEAR\_base\_v1.dta$ for YEAR=1990, 1991, ..., 2010.

Variables:

year – 4-digit number indicating the year
iiso – 3-digit string giving the importing country ISO code
eiso – 3-digit string giving the exporting country ISO code
iwits – WITS numeric code for the importing country
ewits – WITS numeric code for the exporting country
importer – string variable giving the importer country name
exporter – string variable giving the exporter country name
sitc4 – Standard International Trade 4-digit (SITC) classification, rev. 2
t1 – Most favored nation (MFN) *ad valorem* tariff, in percent
$t1\_pref$ – Preferential *ad valorem* tariff, in percent
$t1\_nonmfn$ – a non-MFN *ad valorem* tariff, in percent
version – an indicator variable which takes the value of 0 if the MFN and preferential tariffs are taken from version 0 of the database (WTD0), and 1 otherwise

[49]The World Trade Flows (WTF) from Feenstra, et. al. (2005), available at cid.econ.ucdavis.edu reports trade values for years up to 2000. For later years, users are referred to the COMTRADE database from the UN from which the SITC trade data can be obtained and used to construct WTF as described in Feenstra, et. al. (2005). The trade values for Taiwan are taken from "Other Asia, nes" in the COMTRADE data.

[50]There are several exceptions to this rule as noted below, where tariffs are included for all SITC codes even though trade might not have occurred: see note 51.

Description:

These files use the identical importer country code (*iiso*), exporter country code (*eiso*) and WITS codes (*ewits* and now *iwits*) that are contained in the tariff files described in part (a), and now country names (*importer* and *exporter*) are also introduced. There are slight differences, however, in the SITC 4-digit code (*sitc4*) and the tariffs as compared to part (a), and also the WTD version from which the tariff is drawn. Each of these items is described below.

i) SITC codes and Countries:

The WTD0 database includes 818 4-digit SITC codes, some of which were not true SITC subgroups, but as noted in part (a), tariff data in WTD1 included updated data that only used 784 codes because it did not include any 4-digit codes that were not SITC subgroups. The tariff dataset in part (b) of the WTD1 database, includes some SITC codes ending in 0 that are not true SITC subgroups, in which case the tariffs are obtained from version 0 of the data, WTD0. In addition, there are a few importing countries whose tariffs are drawn from version 0 of the data. In both cases, that is indicated by the indicator variable version=0; otherwise, version=1.

ii) MFN tariffs:

The most-favored nation (MFN) tariff $t1$ reported in this dataset is drawn from the dataset described in part (a). As mentioned at the outset of the Appendix, for certain eastern European countries especially during 1990-1993, we created tariffs before these countries existed as separate entities.

Specifically, for Russia during 1990-1992 we use the tariffs from the published 1993 tariff schedule, and these tariffs are reported for all exporters and SITC goods that the USSR imported in each year 1990-1993. The other 14 countries of the former USSR first appear with tariff schedules that are usually later than 1993. For the tariff database in part (b), we use the 1993 tariffs of Russia for these other 14 countries during 1990-1993, until these countries published their own schedules; and throughout 1990-1993, these tariffs are reported for all exporters and SITC goods that these countries imported in 1994.[51]

Several other new countries of eastern Europe are also treated in a similar way until they publish their own tariff schedules. Specifically, for the Czech Republic and Slovakia (which were formed from Czechoslovakia on January 1, 1993), their tariffs in 1990-1995 are taken from the 1992 Czechoslovakia tariff schedule, and these tariffs are reported for those exporters and SITC goods that Czechoslovakia imported in 1993. For Serbia during 1990-2000 we use the tariffs from its published 2001 tariff schedule.[52] For the other countries from the former Yugoslavia, see Data Appendix Table 1 for details of which tariff schedule was used to infer tariffs for each country and year.

iii) Preferential and non-MFN tariffs:

[51] For Russian imports from the 14 other Soviet-bloc countries prior to 1994, we set $t1\_pref = 0$ for all SITC codes. The same procedure was used for the five countries of the South African Customs Union (Botswana, Lesotho, Namibia, South Africa, and Swaziland), for which we did not have trade values prior to 1994: we set $t1\_pref = 0$ for all SITC codes.

[52] This tariff schedule includes a PTA with the European Union, which we presume is a legacy of an older Yugoslavian schedule since the EU placed trade sanctions on Yugoslavia (essentially Serbia) in 1992 after the Yugoslav wars commenced.

For the 15 former USSR countries that are created as distinct entities during 1990-1993, the preferential tariffs between them are set at zero until each country gains independence and publishes a tariff schedule, when tariffs were sometimes applied against the other countries. Similarly, the Czech Republic and Slovakia, which are treated as having zero tariffs against each other when they are part of Czechoslovakia during 1990-1992, and the countries of the former Yugoslavia are treated similarly prior to their independence.

The non-MFN tariff, $t1\_nonmfn$, in this dataset is very similar to the dataset described in part (a). Two adjustments have been made to the preferential tariff between the countries as compared to part (a). First, we set $t1\_pref$ equal to $t1$ in cases where there is no preferential agreements between the countries. Second, for the very small number of observations where $t1\_nonmfn$ is reported (which is at least as large as $t1$) , then we set $t1\_pref$ equal to $t1\_nonmfn$. In this way, a value for $t1\_pref$ is reported for every observation in the dataset, and $t1\_pref \leq t1$ for nearly all observations, with the exception of those cases where there is a non-MFN tariff reported, in which case as a matter of convention we choose to set $t1\_pref = t1\_nonmfn \geq t1$. By this convention, $t1\_pref$ always reflects the operative tariff between countries.

Sectoral Tariffs for the Quantitative Analysis

For the quantitative analysis in the main text, we start with the disaggregate tariff data from part (b). The quantitative analysis requires MFN and preferential tariffs at the sectoral level used by Eora, for all sectors and all 178 countries (plus the rest of the world),[53] even if Eora records zero trade between two countries in a particular sector. So starting from the disaggregate data in part (b), we need to "fill in" tariffs even when there is zero trade and also aggregate to the sectoral level. This procedure is achieved in several steps.

First, we merged the tariff data described in part (b) with trade values from COMTRADE. The resulting dataset for each year is then partially filled-in across zero trade values by including tariffs for all SITC commodities and country pairs that have a preferential trade agreement, even when there is no trade in those commodities. So for every preferential agreement between countries, we include the MFN tariff $t1$ and the preferential tariff $t1$_pref, as well as the trade value by SITC good. If there is no trade between those countries in a SITC good then we artificially introduce 1 as the trade value, so that those tariffs can still be incorporated in a sectoral weighted average tariff.[54] In this way, if all the SITC goods in a sector have no trade between two countries, then the weighted average tariff between them is calculated as a simple average tariff (because the weights are all 1).

At the disaggregate SITC level, we then have the MFN tariffs in both 1990 and 2010, $t1\_1990$ and $t1\_2010$, and likewise the preferential tariffs $t1\_pref\_1990$ and $t1\_pref\_2010$. The second step

[53] See note 33 for the countries excluded from the quantitative analysis.

[54] As discussed in note 51, we included in the dataset of part (b) $t1\_pref = 0$ for Russian imports in all SITC goods from the other 14 Soviet-bloc countries during 1990-1993, and $t1\_pref = 0$ for all SITC goods between the countries of the South African Customs Union (SACU), since those trade values were not available from COMTRADE. We now use 1 for those (unobserved) internal trade values. For the direct, external imports of the other 14 Soviet-bloc countries besides Russia from external countries during 1990-1993, we have introduced tariffs in part (b) whenever those countries showed positive import values in 1994. Now we make a further adjustment to reflect imports to the USSR that ultimately went to each of these regions before they become independent countries. Because we do not observe those indirect imports through internal trade, we divided USSR imports from all (non-Soviet-bloc) countries by 15, and imputed a 1/15 share of these imports to each of the 14 Soviet-bloc countries except Russia (Russian imports are equal to the USSR imports in 1990-93). These indirect imports of the 14 countries, by SITC good and exporter, are used to fill-in any missing SITC direct imports during 1990-93. Then we use these imputed import values to create weighted average sectoral tariffs for those 14 countries.

of our procedure is to calculate the impact of the Uruguay Round tariff cuts from 1990 to 2010 by computing what we call the "Uruguay tariff" in 2010:

$$t1\_Uruguay\_2010 \equiv \min \{t1\_pref\_1990, t1\_2010\} . \tag{69}$$

In particular, the impact of the Uruguay Round at the SITC level over 1990 to 2010 is computed by comparing $t1\_pref\_1990$ with $t1\_Uruguay\_2010$. If there is no preferential or non-MFN tariffs between the countries in 1990, then $t1\_pref\_1990$ = $t1\_1990$ by construction, so in that case comparing $t1\_pref\_1990$ with $t1\_Uruguay\_2010$ becomes a comparison of $t1\_1990$ with the minimum of $t1\_1990$ and $t1\_2010$. If the MFN tariff fell in that SITC good for a particular importing country over 1990 to 2010, then $t1\_Uruguay\_2010 = t1\_2010$ and we attribute that fall in the tariff over 1990–2010 to the Uruguay Round. But if the MFN tariff rose in that SITC good for a particular importing country over 1990–2010, then we attribute that rise to protectionist actions taken by the importer and not to the Uruguay Round: in this case, $t1\_Uruguay\_2010 = t1\_1990$ so that there is no change to the MFN tariff from 1990 to 2010 that is due to the Uruguay Round.

Next, consider the case where the two countries have a preferential agreement in 1990, so that $t1\_pref\_1990 < t1\_1990$ in a particular SITC good, and suppose the Uruguay Round has also reduced tariffs so that $t1\_2010 < t1\_1990$. Whether that reduction in tariffs due to the Uruguay Round is effective or not depends on the comparison of $t1\_pref\_1990$ and $t1\_2010$. Suppose that $t1\_pref\_1990 < t1\_2010$, which means that $t1\_Uruguay\_2010 = t1\_pref\_1990$ and the fall in the MFN tariff from 1990 to 2010 is not attributed to the Uruguay Round because the 1990 preferential tariff was even lower: if that preferential arrangement still exists in 2010, then the MFN rate in that year would not apply between the countries; but even if the preferential agreement no longer applied in 2010, so that the tariff goes up from $t1\_pref\_1990$ to $t1\_2010$, then we would attribute that rise in the tariff to the negative impact of cancelling the preferential agreement, and not to the Uruguay Round itself.

The total impact of the change in MFN and preferential tariffs over 1990 to 2010 is computed by comparing $t1\_pref\_1990$ with $t1\_pref\_2010$, since by construction, these two tariffs reflect the applied tariffs of the two countries for each SITC good. As noted above, the impact of the Uruguay Round is computed by comparing $t1\_pref\_1990$ with $t1\_Uruguay\_2010$. It follows that the effect of any changes to preferential agreements over 1990–2010 is obtained by comparing $t1\_Uruguay\_2010$ with $t1\_pref\_2010$. To continue with the example of the previous paragraph, if a preferential agreement no longer exists in 2010 so that $t1\_pref\_2010 = t1\_2010$, then the canceling of the agreement would have a negative impact provided that the Uruguay tariff in 2010, $t1\_Uruguay\_2010$, is lower (as it was in that example).

As a third step, we apply trade weights within each sector to aggregate the following tariffs to the sectoral level by importing and exporting countries: $t1\_pref\_1990$, $t1\_Uruguay\_2010$, $t1\_2010$ and $t1\_pref\_2010$. We consistently use the same weights (i.e. the 1990 trade values) to perform this aggregation. There is still one final step in our procedure, however, because the matrices $t1\_pref\_1990$, $t1\_Uruguay\_2010$, $t1\_2010$ and $t1\_pref\_2010$ do not have values for all possible country pairs and SITC goods. Specifically, if two countries do not have a preferential agreement between them and also have no trade (in 1990) between them for all SITC goods within a sector, then that sector will have a missing value in all matrices. For use in our quantitative model, we require a matrix filled with values, so we make one final imputation to fill-in the missing values.

Specifically, for $t1$_pref_1990, $t1\_2010$ and $t1\_pref\_2010$, we fill-in the missing values for each importer and sector by using the median tariff for that importer and sector across all exporters. Given the sectoral tariffs obtained in this way, we then use (69) to compute $t1\_Uruguay\_2010$ at the sectoral level for each importer and exporter, and use that value to fill-in the missing sectoral tariffs within the matrix $t1\_Uruguay\_2010$. This fourth and final step of our procedure gives us matrices for $t1\_pref\_1990$, $t1\_Uruguay\_2010$ and $t1\_pref\_2010$ that are complete with values and that we use in our quantitative analysis. Specifically, by comparing $t1\_pref\_1990$ with $t1\_Uruguay\_2010$ we obtain the impact of the Uruguay Round at the sectoral level, and by comparing $t1\_Uruguay\_2010$ with $t1\_pref\_2010$ we obtain the impact of any change to preferential agreements at the sectoral level.

Appendix Tables

The Data Appendix Tables consists of:
1. Details of the coverage of the tariff database in Data Appendix Table 1 on pages D.8 to D.11.
2. Details of FTAs and other preferential trade agreements on pages D.12 to D.30.

Data Appendix Table 1: Tariff Schedules

Coverage and Contents of WTD1 Tariff Database																							
iso3	**Country**	**BITD**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
AGO	Angola	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	T	2002	T	T	T	2006	T	T	T
ALB	Albania		1997	1997	1997	1997	1997	1997	1997	T	1997	1997	T	T	T	T	T	T	T	T	T	T	T
AND	Andorra		T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]
ARE	United Arab Emirates		2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	T	2003	T	T	T	T	T	2009
ARG	Argentina	1986	1992	1992	T	T	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
ARM	Armenia		1993[b]	1993[b]	1993[b]	1993[b]	2001	2001	2001	2001	2001	2001	2001	T	2001	T	T	T	T	T	T	T	T
ATG	Antigua and Barbuda	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T
AUS	Australia	1988	1988	T	1991	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
AUT	Austria	1979	T	1990	1990	1990	1990	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
AZE	Azerbaijan		1993[b]	1993[b]	1993[b]	1993[b]	2002	2002	2002	2002	2002	2002	2002	2002	T	2002	2002	T	2005	T	T	T	2009
BDI	Burundi	1981	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	T	T	2003	T	T	T	T	T	T
BEL	Belgium		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
BEN	Benin	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	T	T	T	T	T	T	T	T	T	T
BFA	Burkina Faso		1993	1993	1993	T	1993	1993	1993	1993	1993	1993	2001	T	T	T	T	T	T	T	T	T	T
BGD	Bangladesh		1989	1989	1994	1994	T	1994	1998	1998	T	T	T	T	T	T	T	T	T	T	T	T	T
BGR	Bulgaria	1983	1983	1983	1983	1994	B	1997	1997	T	T	T	T	T	T	T	T	T	T	T	T	T	T
BHR	Bahrain		1999	1999	1999	1999	1999	1999	1999	1999	1999	T	T	T	T	T	T	T	T	T	T	T	T
BHS	Bahamas, The		1999	1999	1999	1999	1999	1999	1999	1999	1999	T	1999	1999	T	2002	2002	2002	T	2006	2006	2006	T
BIH	Bosnia and Herzegovina		2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001	2001	2001	2001	2001	T	2001	2001	2001	2001	T	T	T	T	T
BLR	Belarus		1993[b]	1993[b]	1993[b]	1993[b]	1996	1996	T	T	1997	1997	T	T	T	2002	2002	2002	2002	2002	T	T	T
BLZ	Belize	1986	1986	1986	1986	1986	1986	1986	T	1986	1986	T	1999	T	T	T	2003	2003	T	T	T	T	T
BMU	Bermuda	1970	1970	1970	1970	1970	1970	1970	1970	1970	1970	1970	1970	T	2001	2001	2001	T	2005	T	T	T	T
BOL	Bolivia	1975	1993	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
BRA	Brazil	1987	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
BRB	Barbados	1986	1986	1986	1986	1986	1986	1986	T	1986	1986	T	T	T	T	T	T	2004	T	T	2007	2007	T
BRN	Brunei		1992	1992	T	1992	1992	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
BTN	Bhutan		1996	1996	1996	1996	1996	1996	T	1996	1996	1996	1996	1996	T	2002	T	T	2005	T	2007	2007	2007
BWA	Botswana		T[a]	T[a]	1991[a]	T[a]	1993[a]	1993[a]	T[a]	T[a]	T[a]	T[a]	T[a]	T	T	2002	T	T	T	T	T	T	T
CAF	Central African Republic		1995	1995	1995	1995	1995	T	1995	T	1997	1997	1997	T	T	T	T	T	T	T	T	T	T
CAN	Canada		1989	1989	1989	T	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CHE	Switzerland		T	1990	1990	T	1994	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CHL	Chile	1983	1983	1983	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CHN	China	1986	1989	1989	T	T	T	1994	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CIV	Cote d'Ivoire	1987	1993	1993	1993	T	1993	1993	T	1996	1996	1996	2001	T	T	T	T	T	T	T	T	T	T
CMR	Cameroon		1994	1994	1994	1994	T	T	1995	1995	1995	1995	1995	T	T	T	T	T	T	T	T	T	T
COD	Congo, Dem. Rep.	1983	1983	1983	1983	1983	1983	1983	1983	1983	1983	1983	2003	2003	2003	T	2003	2003	T	T	T	T	T
COG	Congo, Rep.		1994	1994	1994	1994	T	1994	1994	T	1997	1997	1997	T	T	T	T	T	T	T	T	T	T
COL	Colombia	1983	1983	T	T	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CPV	Cape Verde		2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	T	T	T	T	T	T	T
CRI	Costa Rica	1988	1988/95	1988/95	1995	1995	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CUB	Cuba		1993	1993	1993	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
CYP	Cyprus	1984	1984	1984	1984	1984	1984	1995	T	T	T	T	T	T	T	2002	T	T	T	T	T	T	T
CZE	Czech Republic	1986	1986	1986	T	1992	1992	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
DEU	Germany		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
DJI	Djibouti		1998	1998	1998	1998	1998	1998	1998	1998	T	T	1999	1999	T	2002	2002	T	T	2006	2006	T	2009
DMA	Dominica	1986	1986	1986	1986	1986	1986	1986	T	T	T	T	T	T	T	T	2003	T	T	T	2007	2007	T
DNK	Denmark		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
DOM	Dominican Republic	1972	1972	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
DZA	Algeria	1985	1985	1985	1985	T	1993	1993	1993	T	T	1998	1998	T	T	T	2003	T	T	T	T	T	T
ECU	Ecuador	1976	1976	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
EGY	Egypt, Arab Rep.	1987	1987	1987	1987	1987	1987	T	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T

Data Appendix Table 1: Tariff Schedules

Coverage and Contents of WTD1 Tariff Database																							
iso3	**Country**	**BITD**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
ERI	Eritrea		2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	2002	2002	2002	T	2006	2006	2006	2006
ESP	Spain		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
EST	Estonia		1993[b]	1993[b]	1995	1995	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
ETH	Ethiopia		1995	1995	1995	1995	1995	T	1995	1995	1995	1995	1995	T	T	2002	2002	2002	T	2007	T	T	T
FIN	Finland		T	1990	1990	1990	1990	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
FJI	Fiji	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	T	T	2004	T	T	T	T	T
FRA	France		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GAB	Gabon		1995	1995	1995	1995	1995	T	1995	1995	T	1998	T	T	T	T	T	T	2005	T	T	T	T
GBR	United Kingdom		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GEO	Georgia		1993[b]	1993[b]	1993[b]	1993[b]	1999	1999	1999	1999	1999	T	1999	T	T	T	T	T	T	T	T	T	T
GHA	Ghana	1974	1993	1993	1993	T	1993	1993	1993	1993	1993	1993	T	T	T	T	T	2004	2004	T	T	T	T
GIN	Guinea	1971	1998	1998	1998	1998	1998	1998	1998	1998	T	1998	1998	1998	1998	1998	T	T	2005	2005	T	T	T
GMB	Gambia, The	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	1967	T	2003	2003	2003	T	T	T	T
GNB	Guinea-Bissau		2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	T	T	T	T	T	T	T	T	T	T
GNQ	Equatorial Guinea		1998	1998	1998	1998	1998	1998	1998	1998	T	1998	1998	T	T	2002	2002	T	2005	T	2007	2007	2007
GRC	Greece		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GRD	Grenada	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	1996	T	T	T	T	2003	2003	T	T	T	2008	T
GTM	Guatemala	1988	1995	1995	1995	1995	1995	T	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GUY	Guyana	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	T	T	T	2003	2003	T	T	T	T	T
HKG	Hong Kong, China		1988	1988	1988	1988	1988	1988	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
HND	Honduras	1988	1988	1988	1988	1988	1988	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
HRV	Croatia		2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001	2001	2001	2001	2001	T	T	T	T	T	T	T	T	T	T
HTI	Haiti	1977	1977	1977	1977	1977	1977	2001	2001	2001	2001	2001	2001	T	T	2002	2002	2002	2002	T	T	T	T
HUN	Hungary	1984	1984	T	1991	T	1993	1993	T	T	T	T	T	T	T	2002	T	T	T	T	T	T	T
IDN	Indonesia	1987	T	1990	1990	T	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
IND	India	1988	T	1991	T	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
IRL	Ireland		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
IRN	Iran, Islamic Rep.	1974	1974	1974	1974	1974	1974	2000	2000	2000	2000	2000	T	2000	2000	T	T	2004	2004	T	T	2008	2008
ISL	Iceland	1980	1980	1980	1980	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
ISR	Israel	1983	1983	1983	1983	T	1993	1993	1993	1993	1993	T	T	T	T	T	T	T	T	T	T	T	2009
ITA	Italy		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
JAM	Jamaica	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	T	T	T	T	2004	T	T	2007	2007	T
JOR	Jordan	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	T	T	T	T	T	T	T	T	T	T	T
JPN	Japan		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
KAZ	Kazakhstan		1993[b]	1993[b]	1993[b]	1993[b]	1996	1996	T	1996	1996	1996	1996	1996	1996	1996	T	2004	2004	2004	T	2008	T
KEN	Kenya	1971	1994	1994	1994	1994	T	1994	1994	1994	T	T	T	T	T	2002	T	T	T	T	T	T	T
KGZ	Kyrgyz Republic		1993[b]	1993[b]	1993[b]	1993[b]	1995	T	1995	1999	1999	T	T	T	T	T	2003	2003	T	T	T	T	T
KHM	Cambodia		2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	T	T	T	2003	T	T	T	T	2008	T
KNA	St. Kitts and Nevis	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	T	T	T	2003	2003	T	T	T	T	T
KOR	Korea, Rep.		T	1990	T	1992	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
KWT	Kuwait		2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	T	T	T	T	T	T	T	T
LAO	Lao PDR		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	T	T	2001	2001	T	T	T	T	T	2008	2008
LBN	Lebanon		1999	1999	1999	1999	1999	1999	1999	1999	1999	T	T	T	T	2002	T	T	T	T	2007	2007	2007
LBY	Libya	1976	1976	1976	1976	1976	1976	1976	T	1996	1996	1996	1996	1996	T	2002	2002	2002	T	2006	2006	2006	2006
LCA	St. Lucia	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	1996	T	T	T	T	2003	T	T	T	2007	2007	T
LKA	Sri Lanka		T	1990	1990	T	T	1994	1994	T	T	1998	T	T	2001	T	T	T	T	T	T	T	T
LSO	Lesotho		T[a]	T[a]	1991[a]	T[a]	1993[a]	1993[a]	T[a]	T[a]	T[a]	T[a]	T[a]	T	2001	2001	T	T	T	T	T	T	T
LTU	Lithuania		1993[b]	1993[b]	1995	1995	1995	T	1995	T	1997	1997	1997	T	T	T	T	T	T	T	T	T	T
LUX	Luxembourg		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
LVA	Latvia		1993[b]	1993[b]	1996	1996	1996	1996	T	T	T	T	T	T	T	2002	T	T	T	T	T	T	T

Data Appendix Table 1: Tariff Schedules

Coverage and Contents of WTD1 Tariff Database																							
iso3	**Country**	**BITD**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
MAC	Macao		1996	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MAR	Morocco	1987	1987	1987	1987	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MCO	Monaco		T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]
MDA	Moldova		1993[b]	1993[b]	1993[b]	1993[b]	1996	1996	T	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T
MDG	Madagascar		1995	1995	1995	1995	1995	T	T	T	T	1998	T	T	T	T	T	T	T	T	T	T	T
MDV	Maldives		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	T	T	T	T	T	T	T	T	T	T	T
MEX	Mexico	1985	1991	T	1991	1991	1991	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MKD	Macedonia, FYR		2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001[b]	2001	2001	2001	2001	T	T	T	T	T	T	T	T	T	T
MLI	Mali	1970	1995	1995	1995	1995	1995	T	T	T	T	T	1999	T	T	T	T	T	T	T	T	T	T
MLT	Malta	1988N	1988	1988	1988	1988	1988	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MMR	Myanmar		1996	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	2008	T
MNE	Montenegro		2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	T	T	2002	2002	T	2005	T	T	T	T
MNG	Mongolia		1996	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MOZ	Mozambique		1994	1994	1994	1994	T	1994	1994	T	1997	1997	T	T	T	T	2003	T	T	T	T	T	T
MRT	Mauritania	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	1972	T	2001	2001	2001	2001	T	T	T	T	T
MSR	Montserrat	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	1999	1999	1999	1999	1999	1999	1999	1999	1999	1999	1999
MUS	Mauritius	1982	1982	1982	1982	1982	1982	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
MWI	Malawi	1968	1994	1994	1994	1994	T	1994	T	T	T	1998	T	T	2001	T	2003	2003	T	2006	T	T	T
MYS	Malaysia		1988	T	1991	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
NAM	Namibia		T[a]	T[a]	1991[a]	T[a]	1993[a]	1993[a]	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
NER	Niger		1990	1990	1990	1990	1990	1990	1990	1990	1990	1990	1990	T	T	T	T	T	T	T	T	T	T
NGA	Nigeria		T	1990	T	1992	1992	T	T	T	T	T	T	T	T	T	2003	T	T	2006	T	T	T
NIC	Nicaragua		1988	1988	1988	1988	1988	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
NLD	Netherlands		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
NOR	Norway		1988	1988	1988	T	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
NPL	Nepal		1993	1993	1993	T	1993	1993	1993	1993	T	T	T	2000	T	T	T	T	T	T	T	T	T
NZL	New Zealand		1992	1992	T	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
OMN	Oman		1990	1990	T	1990	1990	1990	1990	T	1997	1997	1997	T	T	T	T	T	T	T	T	T	2009
PAK	Pakistan	1980	B	1990	1990	1990	1990	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PAN	Panama		1997	1997	1997	1997	1997	1997	1997	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PER	Peru	1974	1974	1993	1993	T	1993	T	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PHL	Philippines	1984	T	1990	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PNG	Papua New Guinea		1997	1997	1997	1997	1997	1997	1997	T	1997	T	T	T	T	T	T	T	T	T	T	T	T
POL	Poland	1982	1982	T	T	1992	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PRT	Portugal		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PRY	Paraguay	1975	1991	T	1991	1991	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
PYF	French Polynesia		2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	T	T	2009
QAT	Qatar		2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	T	T	T	T	T	T	T	T
ROU	Romania	1974	1990	T	1991	1991	1991	1991	1991	1991	1991	T	1999	T	2001	2001	T	T	2005	T	T	T	T
RUS	Russian Federation		1993[b]	1993[b]	1993[b]	T	T	1994	T	T	1997	1997	1997	T	T	2002	2002	T	2005	T	T	T	T
RWA	Rwanda	1985	1985	1985	1993	T	1993[c]	1993[c]	1993[c]	1993[c]	2000	2000	T	T	T	T	2003	T	T	2006	T	T	T
SAU	Saudi Arabia	1985	1994	1994	1994	1994	T	1994	1994	1994	1994	T	T	T	T	T	T	T	T	T	T	T	T
SDN	Sudan	1976	1976	1976	1976	1976	1996	1996	T	1996	1996	1996	1996	1996	T	2002	2002	2002	T	2006	T	T	T
SEN	Senegal	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978	T	T	T	T	T	T	T	T	T	T
SGP	Singapore	1985	1989	1989	1989	1989	1989	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
SLB	Solomon Islands		1995	1995	1995	1995	1995	T	1995	1995	T	1998	1998	1998	1998	1998	1998	1998	T	T	T	2008	T
SLE	Sierra Leone		2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	T	2004	T	2006	2006	2006	T
SLV	El Salvador	1988	1988[d]	1988[d]	1995	1995	1995	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
SMR	San Marino		T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]	T[f]
SRB	Serbia, FR(Serbia/Montenegro)		2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	2001	T	T	2002	2002	T	2005	T	T	T	T

Data Appendix Table 1: Tariff Schedules

Coverage and Contents of WTD1 Tariff Database																							
iso3	**Country**	**BITD**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
SUR	Suriname	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	2007	2007	2007	2007	2007	2007	T	2007	T	T
SVK	Slovak Republic	1986	1986	1986	T	1992	1992	1996[e]	T[e]	T[e]	T	T	T	T	T	T	T	T	T	T	T	T	T
SVN	Slovenia		2001[b]	2001[b]	2001[b]	1999	1999	1999	1999	1999	1999	T	2001	T	T	T	T	T	T	T	T	T	T
SWE	Sweden		1989	1989	1989	1989	1989	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
SWZ	Swaziland		T[a]	T[a]	1991[a]	T[a]	1993[a]	1993[a]	T[a]	T[a]	T[a]	T[a]	T[a]	T	T	2002	T	T	T	T	T	T	T
SYC	Seychelles		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	T	T	2001	2001	2001	T	T	T	2007	2007	2007
SYR	Syrian Arab Republic	1979	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	2002	2002	2002	2002	2002	2002	T	T
TCD	Chad		1995	1995	1995	1995	1995	T	1995	T	1997	1997	2001	T	T	T	T	T	T	T	T	T	T
TGO	Togo		1996	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
THA	Thailand	1972	1989	T	1991	T	1993	T	1995	1995	1995	T	T	T	T	T	T	T	T	T	T	T	T
TJK	Tajikistan		1993[b]	1993[b]	1993[b]	1993[b]	2002	2002	2002	2002	2002	2002	2002	2002	T	2002	2002	2002	T	2006	2006	2006	T
TKM	Turkmenistan		1993[b]	1993[b]	1998	1998	1998	1998	1998	1998	T	1998	1998	1998	T	2002	2002	2002	2002	2002	2002	2002	2002
TTO	Trinidad and Tobago	1986	1986	T	T	1992	1992	1992	T	1996	1996	T	T	T	T	T	T	T	T	T	T	2008	T
TUN	Tunisia	1982	T	1990	T	1992	1992	T	T	1996	T	T	T	T	T	T	T	T	T	T	T	T	T
TUR	Turkey	1987	1993	1993	1993	T	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
TWN	Taiwan, China		1989	1989	T	1992	1992	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
TZA	Tanzania	1971	1993	1993	1993	T	1993	1993	1993	1993	T	1998	T	2000	2000	T	2003	T	T	T	T	T	T
UGA	Uganda	1971	1971	1971	1971	1971	T	1994	1994	1994	1994	1994	T	T	T	T	T	T	T	T	T	T	T
UKR	Ukraine		1993[b]	1993[b]	1993[b]	1993[b]	1995	T	1995	T	1997	1997	1997	1997	T	2002	2002	2002	T	T	T	T	T
URY	Uruguay		1992	1992	T	1992	1992	T	T	T	T	T	T	T	T	2002	T	T	T	T	T	T	T
USA	United States		T	T	T	T	N	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
UZB	Uzbekistan		1993[b]	1993[b]	1993[b]	1993[b]	2001	2001	2001	2001	2001	2001	2001	T	2001	2001	2001	2001	T	T	T	T	2009
VCT	St. Vincent and the Grenadines	1986	1986	1986	1986	1986	1986	1986	T	1996	1996	T	T	T	T	T	2003	2003	T	T	2007	2007	T
VEN	Venezuela	1979	1992	1992	T	1992	1992	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
VNM	Vietnam		1994	1994	1994	1994	T	1994	1994	1994	1994	T	1999	T	T	T	T	T	T	T	T	T	T
VUT	Vanuatu		2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	T	T	T	T	T	T	T	T	2009
YEM	Yemen		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	T	2000	2000	2000	2000	2000	T	2006	2006	T	2009
ZAF	South Africa		T	T	1991	T	1993	1993	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
ZMB	Zambia		1993	1993	1993	T	1993	1993	1997	T	1997	1997	1997	T	T	T	T	T	T	T	T	T	T
ZWE	Zimbabwe		1996	1996	1996	1996	1996	1996	T	T	T	T	T	T	T	T	2003	2003	2003	T	2008	2008	T

Notes:
- T: MFN tariffs electronically available.
- B: tariff entered from BITD publication.
- N: tariff entered from national sources.
- a: From South African tariff schedule. Country is a member of Southern African Customs Union.
- b: From Russian Tariff Schedule.
- c: Based on 1993 Rwandan schedule, but maximum tariff fell to 60% in 1995 and 40% in 1997 (WTO Trade Policy Review WT/TPR/S/129).
- d: Central American Common Market common external tariff.
- e: From Czech Republic Tariff Schedule
- f: From EU Tariff Schedule

Data Appendix Table 2: Preferential Tariffs in WTD1 Database

EUN European Union

FTA's or CU's: EU – Andorra; EU – Turkey; EU - San Marino; European Economic Area (EEA); EU – Overseas Countries and Territories (OCT); EU - Switzerland – Liechtenstein; EU – Iceland; EU – Norway; EU – Syria; EU - Faroe Islands; EU – Palestine; EU – Tunisia; EU - South Africa; EU – Morocco; EU – Israel; EU – Mexico; EU - North Macedonia; EU – Jordan; EU – Chile; EU – Lebanon; EU – Egypt; EU – Algeria; EU – Albania; EU – Montenegro; EU - Bosnia and Herzegovina; EU - CARIFORUM States; EU - Pacific States; EC - Austria; EC - Bulgaria; EC – Cyprus; EC - Czech and Slovak Federal Republic; EC - Czech Republic Europe Agreement; EC – Estonia; EC - Faeroe Islands; EC – Finland; EC – Hungary; EC – Latvia; EC – Lithuania; EC – Malta; EC – Poland; EC – Romania; EC - Slovak Republic; EC – Slovenia; EC - Sweden Agreement; EC – Yugoslavia.

Other: GSP Scheme EU.

AFG Afghanistan

No data.

ALB Albania

FTA's or CU's: Central European Free Trade Agreement (CEFTA); EU – Albania; Turkey – Albania.

DZA Algeria

FTA's or CU's: EU – Algeria.

Other: Global System of Trade Preferences among Developing Countries (GSTP); Preferential tariff for Arab Maghreb Union; Preferential tariff for Jordan; Preferential tariff for Mauritania; Preferential tariff for the League of Arab States; Preferential tariff for Tunisia.

AND Andorra

FTA's or CU's: EU – Andorra.

AGO Angola

No data.

AIA Anguilla

No data.

ATG Antigua and Barbuda

No data.

ARG Argentina

FTA's or CU's: MERCOSUR.

Other: Argentina – Mexico; Global System of Trade Preferences among Developing Countries (GSTP); Latin American Integration Association (LAIA).

ARM Armenia

FTA's or CU's: Armenia – Kazakhstan; Armenia – Moldova; Armenia – Turkmenistan; Armenia – Ukraine; Georgia – Armenia; Kyrgyz Republic – Armenia; Commonwealth of Independent States (CIS).

ABW Aruba

No data.

AUS Australia

FTA's or CU's: ASEAN - Australia - New Zealand; Australia – Chile; Australia - New Zealand Closer Economic Relations Trade Agreement (ANZCERTA); Australia - Papua New Guinea (PATCRA); Singapore – Australia; South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA); Thailand – Australia; United States – Australia.

Other: Australia GSP.

AUT Austria

FTA's or CU's: European Union; European Free Trade Association (EFTA); EC – Austria; Finland-European Free Trade Association (FINEFTA); EFTA - Spain Agreement; EFTA – Turkey; EFTA - Czech Republic Agreement; EFTA – Czechoslovakia; EFTA - Slovak Republic Agreement; EFTA – Israel; EFTA - Romania Free Trade Agreement; EFTA – Bulgaria; EFTA - Hungary Agreement; EFTA - Poland Agreement.

Other: Austria GSP.

AZE Azerbaijan

FTA's or CU's: Commonwealth of Independent States (CIS); Georgia – Azerbaijan; GUAM (Azerbaijan; Georgia; Moldova, Republic of; Ukraine); Russian Federation – Azerbaijan; Ukraine - Azerbaijan.

BHS Bahamas

No data.

BHR Bahrain

FTA's or CU's: Gulf Cooperation Council (GCC); Pan-Arab Free Trade Area (PAFTA); United States - Bahrain.

BGD Bangladesh

FTA's or CU's: South Asian Free Trade Agreement (SAFTA).

Other: Asia Pacific Trade Agreement (APTA); South Asian Preferential Trade Arrangement (SAPTA).

BRB Barbados

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

BLR Belarus

FTA's or CU's: Russian Federation - Belarus – Kazakhstan; Common Economic Zone (CEZ); Commonwealth of Independent States (CIS); Ukraine – Belarus.

Other: Belarus GSP.

BEL Belgium

FTA's or CU's: European Union.

BLZ Belize

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

BEN Benin

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

BMU Bermuda

No data.

BTN Bhutan

FTA's or CU's: India - Bhutan.

Other: South Asian Preferential Trade Arrangement (SAPTA).

BOL Bolivia

FTA's or CU's: Andean Community (CAN).

Other: Latin American Integration Association (LAIA); Mexico – Bolivia.

BIH Bosnia and Herzegovina

FTA's or CU's: EU - Bosnia and Herzegovina; Turkey - Bosnia and Herzegovina; Albania - Bosnia and Herzegovina; Bulgaria - Bosnia and Herzegovina; Central European Free Trade Agreement (CEFTA); Croatia - Bosnia and Herzegovina; Moldova - Bosnia and Herzegovina; North Macedonia - Bosnia and Herzegovina; Romania - Bosnia and Herzegovina; Slovenia - Bosnia and Herzegovina.

BWA Botswana

FTA's or CU's: Southern African Customs Union (SACU); EFTA – SACU; Southern African Development Community (SADC).

BRA Brazil

FTA's or CU's: MERCOSUR.

Other: Latin American Integration Association (LAIA); Brazil - Mexico.

BRN Brunei Darussalam

FTA's or CU's: ASEAN Free Trade Area (AFTA); ASEAN – China; Trans-Pacific Strategic Economic Partnership.

BGR Bulgaria

FTA's or CU's: European Union; Bulgaria – Albania; Bulgaria - Bosnia and Herzegovina; Bulgaria – Belarus; Bulgaria – EFTA; Bulgaria – EU; Bulgaria – Israel; Bulgaria – Lithuania; Bulgaria – Macedonia; Bulgaria – Moldova; Bulgaria – Russian Federation; Bulgaria - Serbia and Montenegro; Bulgaria – Turkey; Central European Free Trade Agreement (CEFTA).

Other: Bulgaria GSP.

BFA Burkina Faso

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

BDI Burundi

FTA's or CU's: East African Community (EAC); Common Market for Eastern and Southern Africa (COMESA).

CPV Cabo Verde

No data.

KHM Cambodia

FTA's or CU's: ASEAN – China; ASEAN Free Trade Area (AFTA).

CMR Cameroon

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union (UDEAC).

CAN Canada

FTA's or CU's: Canada - Costa Rica; Canada – Israel; Canada – Peru; EFTA – Canada; Canada – Chile; Canada - US Free Trade Agreement (CUSFTA); North American Free Trade Agreement (NAFTA).

Other: Canada GSP.

CYM Cayman Islands

No data.

CAF Central African Republic

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union (UDEAC).

TCD Chad

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union (UDEAC).

CHL Chile

FTA's or CU's: Canada – Chile; Chile – China; Chile - Costa Rica (Chile - Central America); Chile - El Salvador (Chile - Central America); Chile – Japan; Chile – Mexico; EFTA – Chile; EU – Chile; Korea, Republic of – Chile; Peru – Chile; Trans-Pacific Strategic Economic Partnership; United States – Chile.

Other: Chile – India; Latin American Integration Association (LAIA).

CHN China

FTA's or CU's: Chile – China; China - Hong Kong, China; China - Macao, China; China - New Zealand; China – Singapore; Pakistan – China; ASEAN - China.

Other: China GSP; Asia Pacific Trade Agreement (APTA).

COL Colombia

FTA's or CU's: Andean Community (CAN); Chile – Colombia; Colombia - Mexico.

Other: Latin American Integration Association (LAIA).

COM Comoros

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA).

COG Congo

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union (UDEAC).

COD Congo DR

No data.

COK Cook Islands

No data.

CRI Costa Rica

FTA's or CU's: Central American Common Market (CACM); Chile - Costa Rica (Chile - Central America); Dominican Republic - Central America; Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); Panama - Costa Rica (Panama - Central America); Canada - Costa Rica; Costa Rica - Mexico.

CIV Côte d'Ivoire

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

HRV Croatia

FTA's or CU's: Central European Free Trade Agreement (CEFTA); Croatia – Albania; Croatia – Bosnia; and Herzegovina; Croatia – EFTA; Croatia – EU; Croatia – Moldova; Croatia - North Macedonia; Croatia - Serbia and Montenegro; Croatia – Slovenia; Croatia - Turkey.

CUB Cuba

Other: Global System of Trade Preferences among Developing Countries (GSTP); Mexico – Cuba; Latin American Integration Association (LAIA).

CYP Cyprus

FTA's or CU's: European Union; EC - Cyprus.

CZE Czech Republic

FTA's or CU's: European Union; Czech Republic – EU; Central European Free Trade Agreement (CEFTA); Czech Repubic – EFTA; Czech Republic – Bulgaria; Czech Republic – Estonia; Czech Republic – Israel; Czech Republic – Latvia; Czech Republic – Lithuania; Czech Republic – Romania; Czech Republic – Slovak Republic; Czech Republic – Slovenia; Czech Republic – Turkey.

Other: Czech Republic GSP.

DNK Denmark

FTA's or CU's: European Union.

DJI Djibouti

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA).

DMA Dominica

FTA's or CU's: Caribbean Community and Common Market (CARICOM); EU - CARIFORUM States.

DOM Dominican Republic

FTA's or CU's: Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); Dominican Republic - Central America.

Other: Preferential tariff for ACP; Panama - Dominican Republic.

ECU Ecuador

FTA's or CU's: Andean Community (CAN).

Other: Ecuador – Mexico; Latin American Integration Association (LAIA).

EGY Egypt

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); EU – Egypt; Pan-Arab Free Trade Area (PAFTA); Agadir Agreement.

SLV El Salvador

FTA's or CU's: Central American Common Market (CACM); Chile - El Salvador (Chile - Central America); Colombia - Northern Triangle (El Salvador, Guatemala, Honduras); Dominican Republic - Central America; Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); El Salvador- Honduras - Chinese Taipei; Panama - El Salvador (Panama - Central America); Mexico - El Salvador (Mexico - Northern Triangle).

GNQ Equatorial Guinea

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union (UDEAC).

ERI Eritrea

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA).

EST Estonia

FTA's or CU's: European Union.

SWZ Eswatini (Swaziland)

FTA's or CU's: Southern African Customs Union (SACU); Common Market for Eastern and Southern Africa (COMESA); EFTA – SACU; Southern African Development Community (SADC).

Other: Preferential tariff for EU.

ETH Ethiopia

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA).

FJI Fiji

FTA's or CU's: Pacific Island Countries Trade Agreement (PICTA).

Other: Melanesian Spearhead Group (MSG).

FIN Finland

FTA's or CU's: European Union; EC - Finland Agreement; Finland-European Free Trade Association (FINEFTA).

FRA France

FTA's or CU's: European Union.

GUF French Guiana

FTA's or CU's: European Union.

PYF French Polynesia

FTA's or CU's: EU – Overseas Countries and Territories (OCT).

GAB Gabon

FTA's or CU's: Economic and Monetary Community of Central Africa (CEMAC); Central African customs and economic union(UDEAC).

GMB Gambia

No data.

GEO Georgia

FTA's or CU's: Georgia – Armenia; Georgia – Azerbaijan; Georgia – Kazakhstan; Georgia - Russian Federation; Georgia – Turkmenistan; Georgia – Ukraine; GUAM; Turkey – Georgia; Commonwealth of Independent States (CIS).

DEU Germany

FTA's or CU's: European Union.

GHA Ghana

FTA's or CU's: Economic Community of West African States (ECOWAS).

GRC Greece

FTA's or CU's: European Union.

GRL Greenland

No data.

GRD Grenada

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

GLP Guadeloupe

FTA's or CU's: European Union.

GTM Guatemala

FTA's or CU's: Central American Common Market (CACM); Chile - Guatemala (Chile - Central America); Colombia - Northern Triangle (El Salvador, Guatemala, Honduras); Dominican Republic - Central America; Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); Guatemala - Chinese Taipei; Panama - Guatemala (Panama - Central America); Mexico - Guatemala (Mexico - Northern Triangle).

GIN Guinea

No data.

GNB Guinea-Bissau

FTA's or CU's: Economic Community of West African States (ECOWAS).

Other: E.

GUY Guyana

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

Other: Global System of Trade Preferences among Developing Countries (GSTP).

HTI Haiti

No data.

HND Honduras

FTA's or CU's: Central American Common Market (CACM); Colombia - Northern Triangle (El Salvador, Guatemala, Honduras); Dominican Republic - Central America; Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); Panama - Honduras (Panama - Central America); Mexico - Honduras (Mexico - Northern Triangle).

HKG Hong Kong

No data.

HUN Hungary

FTA's or CU's: European Union; Hungary – EFTA; Hungary – Estonia; Hungary – EU; Hungary – Finland; Hungary – Israel; Hungary – Latvia; Hungary – Lithuania; Hungary – Slovenia; Hungary - Turkey.

Other: Hungary GSP.

ISL Iceland

FTA's or CU's: European Free Trade Association (EFTA); EFTA – Canada; EFTA – Chile; EFTA – Egypt; EFTA – Israel; EFTA – Jordan; EFTA - Korea, Republic of; EFTA – Lebanon; EFTA – Mexico; EFTA – Morocco; EFTA - North Macedonia; EFTA – SACU; EFTA – Singapore; EFTA – Tunisia; EFTA – Turkey; EU – Iceland; Iceland - Faroe Islands; EFTA – Bulgaria; EFTA – Croatia; EFTA - Czech Republic Agreement; EFTA - Hungary Agreement; EFTA - Poland Agreement; EFTA - Romania Free Trade Agreement; EFTA - Slovak Republic Agreement; Finland-European Free Trade Association (FINEFTA).

Other: Iceland GSP.

IND India

FTA's or CU's: ASEAN – India; India – Bhutan; India – Singapore; India - Sri Lanka; Korea, Republic of - India.

Other: Asia Pacific Trade Agreement (APTA); Chile – India; Global System of Trade Preferences among Developing Countries (GSTP); India – Afghanistan; India – Nepal; India – Thailand; South Asian Preferential Trade Arrangement (SAPTA); Southern Common Market (MERCOSUR) - India.

IDN Indonesia

FTA's or CU's: ASEAN – China; ASEAN - Korea, Republic of; ASEAN Free Trade Area (AFTA).

IRN Iran

Other: Economic Cooperation Organization (ECO).

IRL Ireland

FTA's or CU's: European Union.

ISR Israel

FTA's or CU's: EFTA – Israel; EU – Israel; Israel – Mexico; Turkey – Israel; Ukraine – Israel; United Kingdom – Israel; United States – Israel; Bulgaria – Israel; Canada – Israel; Czech Republic – Israel; EC - Israel Agreement of 1975; Hungary – Israel; Poland – Israel; Romania – Israel; Slovak Republic – Israel; Slovenia - Israel.

ITA Italy

FTA's or CU's: European Union.

JAM Jamaica

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

JAP Japan

FTA's or CU's: Chile – Japan; Japan – Indonesia; Japan – Malaysia; Japan – Mexico; Japan – Singapore; Japan – Thailand.

Other: Japan GSP.

JOR Jordan

FTA's or CU's: EFTA – Jordan; EU – Jordan; Pan-Arab Free Trade Area (PAFTA); United States – Jordan; Agadir Agreement; EC - Jordan Cooperation Agreement.

KAZ Kazakhstan

FTA's or CU's: Armenia – Kazakhstan; Common Economic Zone (CEZ); Commonwealth of Independent States (CIS); Georgia – Kazakhstan; Kyrgyz Republic – Kazakhstan; Russian Federation - Belarus – Kazakhstan; Russian Federation – Kazakhstan; Ukraine - Kazakhstan.

Other: Kazakhstan GSP.

KEN Kenya

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC).

KOR Korea, Rep.

FTA's or CU's: EFTA - Korea, Republic of; Korea, Republic of – Chile; Korea, Republic of - Singapore.

Other: Asia Pacific Trade Agreement (APTA); Global System of Trade Preferences among Developing Countries (GSTP).

KWT Kuwait

FTA's or CU's: Gulf Cooperation Council (GCC); Pan-Arab Free Trade Area (PAFTA).

KGZ Kyrgyz Republic

FTA's or CU's: Commonwealth of Independent States (CIS); Kyrgyz Republic – Armenia; Kyrgyz Republic – Kazakhstan; Kyrgyz Republic - Moldova, Republic of; Kyrgyz Republic - Russian Federation; Kyrgyz Republic – Ukraine; Kyrgyz Republic – Uzbekistan.

Other: Kyrgyz Republic GSP.

LAO Lao PDR

FTA's or CU's: ASEAN – China; ASEAN Free Trade Area (AFTA).

LVA Latvia

FTA's or CU's: European Union; Czech Republic – Latvia; EC - Latvia Agreement; EFTA – Latvia; Finland - Latvia Protocol; Hungary – Latvia; Latvia - Norway Free Trade Agreement; Latvia - Sweden Free Trade Agreement; Latvia - Switzerland Free Trade Agreement; Poland – Latvia; Slovak Republic – Latvia; Slovenia - Latvia.

LBN Lebanon

FTA's or CU's: Pan-Arab Free Trade Area (PAFTA).

LSO Lesotho

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Southern African Customs Union (SACU); EFTA – SACU; Southern African Development Community (SADC).

LBR Liberia

FTA's or CU's: Economic Community of West African States (ECOWAS).

LBY Libya

No data.

LTU Lithuania

FTA's or CU's: European Union; Bulgaria – Lithuania; Czech Republic – Lithuania; EC – Lithuania; EFTA – Lithuania; Estonia - Latvia – Lithuania; Finland - Lithuania Protocol; Hungary – Lithuania; Lithuania - Norway Free Trade Agreement; Lithuania - Sweden Free Trade Agreement; Lithuania - Switzerland Free-Trade Agreement; Poland – Lithuania; Slovak Republic – Lithuania; Slovenia – Lithuania; Turkey - Lithuania.

LUX Luxembourg

FTA's or CU's: European Union.

MAC Macao

No data.

MDG Madagascar

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Southern African Development Community (SADC).

MWI Malawi

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Southern African Development Community (SADC).

MYS Malaysia

FTA's or CU's: ASEAN – China; ASEAN – Japan; ASEAN - Korea, Republic of; ASEAN Free Trade Area (AFTA); Japan – Malaysia; Pakistan - Malaysia.

MDV Maldives

No data.

MLI Mali

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

MTQ Martinique

FTA's or CU's: European Union.

MRT Mauritania

No data.

MUS Mauritius

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Southern African Development Community (SADC).

Other: Mauritius - Pakistan.

MYT Mayotte

FTA's or CU's: European Union.

MEX Mexico

FTA's or CU's: Chile – Mexico; Colombia – Mexico; EFTA – Mexico; EU – Mexico; Israel – Mexico; Japan – Mexico; Mexico – Panama; Mexico – Uruguay; North American Free Trade Agreement (NAFTA).

Other: Argentina – Mexico; Brazil – Mexico; Ecuador – Mexico; Latin American Integration Association (LAIA); Mexico - Bolivia, Plurinational State of; Mexico – Cuba; Mexico – Paraguay; Protocol on Trade Negotiations (PTN).

MDA Moldova

FTA's or CU's: Albania – Moldova; Armenia - Moldova, Republic of; Central European Free Trade Agreement (CEFTA); GUAM; Kyrgyz Republic - Moldova, Republic of; Moldova - Bosnia and Herzegovina; Moldova – Bulgaria; Moldova – Croatia; Moldova - North Macedonia; Moldova - Serbia and Montenegro; Russian Federation - Republic of Moldova; Treaty on a Free Trade Area between members of the Commonwealth of Independent States (CIS); Ukraine - Moldova, Republic of.

MNE Montenegro

FTA's or CU's: Albania - Serbia and Montenegro; Bulgaria - Serbia and Montenegro; Central European Free Trade Agreement (CEFTA); Croatia - Serbia and Montenegro; EU – Montenegro; Moldova - Serbia and Montenegro; Romania - Serbia and Montenegro; Turkey - Montenegro.

MSR Montserrat

No data.

MAR Morocco

FTA's or CU's: Agadir Agreement; EFTA – Morocco; EU – Morocco; Morocco - United Arab Emirates; Pan-Arab Free Trade Area (PAFTA); Turkey – Morocco; United States - Morocco.

MOZ Mozambique

FTA's or CU's: Southern African Development Community (SADC).

MMR Myanmar

FTA's or CU's: ASEAN – China; ASEAN Free Trade Area (AFTA).

NAM Namibia

FTA's or CU's: Southern African Customs Union (SACU); EFTA – SACU; Namibia – Zimbabwe; Southern African Development Community (SADC).

NPL Nepal

Other: South Asian Preferential Trade Arrangement (SAPTA).

NLD Netherlands

FTA's or CU's: European Union.

NZL New Zealand

FTA's or CU's: ASEAN - Australia - New Zealand; Australia - New Zealand Closer Economic Relations Trade Agreement (ANZCERTA); China - New Zealand; New Zealand – Malaysia; New Zealand – Singapore; Thailand - New Zealand; Trans-Pacific Strategic Economic Partnership.

Other: South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA).

NIC Nicaragua

FTA's or CU's: Central American Common Market (CACM); Dominican Republic - Central America; Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); Mexico – Nicaragua; Nicaragua - Chinese Taipei; Panama - Nicaragua (Panama - Central America).

NER Niger

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

NGA Nigeria

No data.

MKD North Macedonia

FTA's or CU's: Albania - North Macedonia; Bulgaria - North Macedonia; Central European Free Trade Agreement (CEFTA); Croatia - North Macedonia; Moldova - North Macedonia; North Macedonia - Bosnia and Herzegovina; North Macedonia – EFTA; North Macedonia – EU; North Macedonia – Turkey; North Macedonia – Ukraine; Romania - North Macedonia; Slovenia - North Macedonia.

NOR Norway

FTA's or CU's: EFTA – Bulgaria; EFTA – Canada; EFTA – Chile; EFTA – Croatia; EFTA - Czech Republic Agreement; EFTA – Egypt; EFTA - Estonia Free Trade Agreement; EFTA - Hungary Agreement; EFTA – Israel; EFTA – Jordan; EFTA - Korea, Republic of; EFTA – Latvia; EFTA – Lebanon; EFTA – Lithuania; EFTA – Mexico; EFTA – Morocco; EFTA - North Macedonia; EFTA – Palestine; EFTA - Poland Agreement; EFTA - Romania Free Trade Agreement; EFTA – SACU; EFTA – Singapore; EFTA - Slovak Republic Agreement; EFTA – Slovenia; EFTA – Tunisia; EFTA – Turkey; Estonia - Norway Free Trade Agreement; EU – Norway; European Free Trade Association (EFTA); Faroe Islands – Norway; Finland-European Free Trade Association (FINEFTA); Latvia - Norway Free Trade Agreement; Lithuania - Norway Free Trade Agreement.

Other: Norway GSP.

OMN Oman

FTA's or CU's: Gulf Cooperation Council (GCC); Pan-Arab Free Trade Area (PAFTA); United States - Oman.

PAK Pakistan

FTA's or CU's: Pakistan – China; Pakistan – Malaysia; Pakistan - Sri Lanka.

Other: Economic Cooperation Organization (ECO); Mauritius – Pakistan; South Asian Preferential Trade Arrangement (SAPTA).

PLW Palau

No data.

PAN Panama

FTA's or CU's: Panama – Chile; Panama - Chinese Taipei; Panama - Costa Rica (Panama - Central America); Panama - El Salvador (Panama - Central America); Panama - Guatemala (Panama - Central America); Panama - Honduras (Panama - Central America); Panama - Nicaragua (Panama - Central America); Panama - Singapore.

Other: Panama - Dominican Republic.

PNG Papua New Guinea

Other: Melanesian Spearhead Group (MSG).

PRY Paraguay

FTA's or CU's: MERCOSUR.

Other: Latin American Integration Association (LAIA); Mexico - Paraguay.

PER Peru

FTA's or CU's: Andean Community (CAN); Peru – Chile.

Other: Latin American Integration Association (LAIA).

PHL Philippines

FTA's or CU's: ASEAN – China; ASEAN Free Trade Area (AFTA).

POL Poland

FTA's or CU's: European Union; Poland – EFTA; Poland – EU; Poland - Faeroe Islands; Poland – Finland; Poland – Israel; Poland – Latvia; Poland – Lithuania; Poland – Turkey.

Other: GSP Scheme Poland.

PRT Portugal

FTA's or CU's: European Union.

QAT Qatar

FTA's or CU's: Gulf Cooperation Council (GCC); Pan-Arab Free Trade Area (PAFTA).

REU Reunion

FTA's or CU's: European Union.

ROU Romania

FTA's or CU's: Central European Free Trade Agreement (CEFTA); Romania – Albania; Romania - Bosnia and Herzegovina; Romania - Czech Republic; Romania – EFTA; Romania – EU; Romania – Israel; Romania – Moldova; Romania - North Macedonia; Romania - Serbia and Montenegro; Romania - Slovak Republic; Romania - Turkey.

Other: Global System of Trade Preferences among Developing Countries (GSTP); Protocol on Trade Negotiations (PTN).

RUS Russian Federation

FTA's or CU's: Russian Federation - Belarus – Kazakhstan; Armenia - Russian Federation; Common Economic Zone (CEZ); Commonwealth of Independent States (CIS); Georgia - Russian Federation; Kyrgyz Republic - Russian Federation; Russian Federation – Azerbaijan; Russian Federation – Belarus; Russian Federation – Kazakhstan; Russian Federation - Republic of Moldova; Russian Federation – Serbia; Russian Federation – Tajikistan; Russian Federation – Turkmenistan; Russian Federation – Uzbekistan; Ukraine - Russian Federation.

Other: Russian GSP.

RWA Rwanda

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC).

SMR San Marino

FTA's or CU's: European Union.

SAU Saudi Arabia

FTA's or CU's: Gulf Cooperation Council (GCC); Pan-Arab Free Trade Area (PAFTA).

SEN Senegal

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

SRB Serbia

No data.

SYC Seychelles

No data.

SLE Sierra Leone

FTA's or CU's: Economic Community of West African States (ECOWAS).

SGP Singapore

FTA's or CU's: ASEAN - Australia - New Zealand; ASEAN – China; ASEAN Free Trade Area (AFTA); China – Singapore; EFTA – Singapore; India – Singapore; Japan – Singapore; Jordan – Singapore; Korea, Republic of – Singapore; New Zealand – Singapore; Panama – Singapore; Singapore – Australia; Trans-Pacific Strategic Economic Partnership; United States - Singapore.

SVK Slovak Republic

FTA's or CU's: European Union; Czech Republic - Slovak Republic; Central European Free Trade Agreement (CEFTA); Slovak Republic – EFTA; Slovak Republic – Bulgaria; Slovak Republic – Estonia; Slovak Republic – EU; Slovak Republic – Finland; Slovak Republic – Israel; Slovak Republic – Latvia; Slovak Republic – Lithuania; Slovak Republic – Romania; Slovak Republic - Slovenia; Slovak Republic - Turkey.

Other: GSP Scheme Slovak Republic.

SVN Slovenia

FTA's or CU's: European Union; Central European Free Trade Agreement (CEFTA); Slovenia - Bosnia and Herzegovina; Slovenia – Bulgaria; Slovenia – Croatia; Slovenia - Czech Republic; Slovenia – EFTA; Slovenia – Estonia; Slovenia – EU; Slovenia – Hungary; Slovenia – Israel; Slovenia – Latvia; Slovenia – Lithuania; Slovenia - North Macedonia; Slovenia - Slovak Republic; Slovenia - Turkey.

SLB Solomon Islands

Other: Melanesian Spearhead Group (MSG).

ZAF South Africa

FTA's or CU's: Southern African Customs Union (SACU); EFTA – SACU; EU - South Africa; Southern African Development Community (SADC).

ESP Spain

FTA's or CU's: European Union.

LKA Sri Lanka

FTA's or CU's: India - Sri Lanka; Pakistan - Sri Lanka.

Other: Asia Pacific Trade Agreement (APTA); Global System of Trade Preferences among Developing Countries (GSTP); South Asian Preferential Trade Arrangement (SAPTA).

KNA St Kitts and Nevis

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

LCA St Lucia

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

VCT St Vincent and the Grenadines

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

SDN Sudan

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Pan-Arab Free Trade Area (PAFTA).

SUR Suriname

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

SWE Sweden

FTA's or CU's: European Union; EC - Sweden Agreement; EFTA; Estonia - Sweden Free Trade Agreement; Latvia - Sweden Free Trade Agreement; Lithuania - Sweden Free Trade Agreement.

Other: Sweden GSP.

CHE Switzerland

FTA's or CU's: EFTA – Bulgaria; EFTA – Canada; EFTA – Chile; EFTA – Croatia; EFTA - Czech Republic Agreement; EFTA – Egypt; EFTA - Estonia Free Trade Agreement; EFTA - Hungary Agreement; EFTA – Israel; EFTA – Jordan; EFTA - Korea, Republic of; EFTA – Latvia; EFTA – Lebanon; EFTA – Lithuania; EFTA – Mexico; EFTA – Morocco; EFTA - North Macedonia; EFTA – Palestine; EFTA - Poland Agreement; EFTA - Romania Free Trade Agreement; EFTA – SACU; EFTA – Singapore; EFTA - Slovak Republic Agreement; EFTA – Slovenia; EFTA – Tunisia; EFTA – Turkey; Estonia - Switzerland Free Trade Agreement; EU - Switzerland – Liechtenstein; European Free Trade Association (EFTA); Finland-European Free Trade Association (FINEFTA); Japan – Switzerland; Latvia - Switzerland Free Trade Agreement; Lithuania - Switzerland Free-Trade Agreement.

Other: Switzerland GSP.

SYR Syria

FTA's or CU's: Pan-Arab Free Trade Area (PAFTA).

TWN Taiwan

FTA's or CU's: El Salvador- Honduras - Chinese Taipei; Guatemala - Chinese Taipei; Nicaragua - Chinese Taipei; Panama - Chinese Taipei; Singapore - Chinese Taipei.

Other: Taiwan GSP.

TJK Tajikistan

FTA's or CU's: Commonwealth of Independent States (CIS); Russian Federation – Tajikistan; Ukraine - Tajikistan.

Other: Tajikistan GSP.

TZA Tanzania

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC); Southern African Development Community (SADC).

THA Thailand

FTA's or CU's: ASEAN Free Trade Area (AFTA).

TLS Timor-Leste

No data.

TGO Togo

FTA's or CU's: West African Economic and Monetary Union (WAEMU).

TON Tonga

No data.

TTO Trinidad and Tobago

FTA's or CU's: Caribbean Community and Common Market (CARICOM).

Other: Global System of Trade Preferences among Developing Countries (GSTP).

TUN Tunisia

FTA's or CU's: Agadir Agreement; EFTA – Tunisia; EU – Tunisia; Pan-Arab Free Trade Area (PAFTA).

TUR Turkey

FTA's or CU's: EC - Turkey Association Agreement of 1973; EU – Turkey; Bulgaria – Turkey; Czech Republic – Turkey; EFTA – Turkey; Egypt – Turkey; Hungary – Turkey; Romania – Turkey; Slovak Republic – Turkey; Turkey – Albania; Turkey - Bosnia and Herzegovina; Turkey – Croatia; Turkey – Estonia; Turkey – Georgia; Turkey – Israel; Turkey – Latvia; Turkey – Lithuania; Turkey – Morocco; Turkey - North Macedonia; Turkey – Palestine; Turkey – Poland; Turkey – Slovenia; Turkey – Syria; Turkey - Tunisia.

Other: Turkey GSP.

TKM Turkmenistan

No data.

TUV Tuvalu

FTA's or CU's: Pacific Island Countries Trade Agreement (PICTA).

UGA Uganda

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); East African Community (EAC).

UKR Ukraine

FTA's or CU's: Armenia – Ukraine; Common Economic Zone (CEZ); Commonwealth of Independent States (CIS); Georgia – Ukraine; GUAM; Kyrgyz Republic – Ukraine; Ukraine – Azerbaijan; Ukraine – Belarus; Ukraine – Kazakhstan; Ukraine - Moldova, Republic of; Ukraine - North Macedonia; Ukraine - Russian Federation; Ukraine – Tajikistan; Ukraine – Uzbekistan; Ukraine -Turkmenistan.

ARE United Arab Emirates

FTA's or CU's: Gulf Cooperation Council (GCC); Morocco - United Arab Emirates; Pan-Arab Free Trade Area (PAFTA).

GBR United Kingdom

FTA's or CU's: European Union.

USA United States

FTA's or CU's: Canada - US Free Trade Agreement (CUSFTA); Dominican Republic - Central America - United States Free Trade Agreement (CAFTA-DR); North American Free Trade Agreement (NAFTA); United States – Australia; United States – Bahrain; United States – Chile; United States – Israel; United States – Jordan; United States – Morocco; United States – Oman; United States – Panama; United States – Peru; United States - Singapore.

Other: United States GSP; United States Non-MFN.

URY Uruguay

FTA's or CU's: Southern Common Market (MERCOSUR); Mexico – Uruguay.

Other: Latin American Integration Association (LAIA).

UZB Uzbekistan

FTA's or CU's: Commonwealth of Independent States (CIS); Kyrgyz Republic – Uzbekistan; Russian Federation – Uzbekistan; Ukraine - Uzbekistan.

VUT Vanuatu

Other: Melanesian Spearhead Group (MSG).

VEN Venezuela

FTA's or CU's: Andean Community (CAN).

Other: Latin American Integration Association (LAIA).

VNM Vietnam

FTA's or CU's: ASEAN – China; ASEAN – India; ASEAN – Japan; ASEAN - Korea, Republic of; ASEAN Free Trade Area (AFTA); Japan - Viet Nam.

YEM Yemen

FTA's or CU's: Pan-Arab Free Trade Area (PAFTA).

ZMB Zambia

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); Southern African Development Community (SADC).

ZWE Zimbabwe

FTA's or CU's: Common Market for Eastern and Southern Africa (COMESA); EU - Eastern and Southern Africa States; Namibia – Zimbabwe; Southern African Development Community (SADC).