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Theory-Consistent Tariff Aggregation

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We propose a theory-consistent procedure to aggregate tariffs. Theory implies that the weights on disaggregated tariffs should be a function of tariff-free trade and trade elasticities. Our aggregator nests as special cases and corrects the deficiencies of the two existing alternatives – the simple-average and import-weighted tariffs. We create a *Theory-Consistent Tariff Database (TCTD)* by aggregating HS 6-digit tariffs to the industry level of the International Trade and Production databases of the USITC. Several applications highlight the advantages of the theory-consistent tariffs.

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1 Introduction

Tariff indexes are widely used in empirical trade policy work, such as estimating trade elasticities and simulating counterfactual tariff changes in typical models. Tariff aggregation is unavoidable for most objectives due to the large number of individual tariffs for thousands of products and as many as 200 partners.[1] Therefore, the vast majority of academic and policy analyses of the effects of tariffs are done at a more aggregate level and use aggregated tariffs.[2] In the absence of theoretical guidance, tariff aggregates in current practice are constructed using one of two approaches – either arithmetic equal-weight simple average tariffs (SATs) or import-weighted average tariffs (IWTs).

However, both SATs and IWTs are well known to be biased due to the substitution effect in demand, whereby higher tariffs reduce import demand. The SAT typically overstates the aggregate tariff when one product's tariff is much larger than the others and trade volumes differ (with lower flows observed for products with higher tariffs), while the IWTs typically assign smaller weights to products with high tariffs, as observed trade flows tend to be lower (or even zero) for products with high tariffs. The resulting biases are important due to the high heterogeneity of tariffs across both partners and products. Despite these drawbacks, the SATs and IWTs are the only methods used to aggregate tariffs, and we are not aware of any alternatives. Our contribution is to develop a theory-consistent approach to aggregating tariffs that addresses the deficiencies of SATs and IWTs while nesting them as special cases.[3]

We develop the analysis in three steps. First, in Section 2, we rely on the workhorse model of trade – the structural gravity model – to construct the following theory-consistent

[1] The Harmonized System 6-digit code has 5612 elements. Individual countries expand the list to tens of thousands of elements.

[2] One of the practical limitations is the lack of disaggregated production data, which is required for general equilibrium analysis and the construction of domestic trade. Another limitation is the computational complexity when the production and consumption of different goods are interconnected.

[3] See Bethmann and Jestrab (2026) for a discussion on tariff aggregation when analyzing recent U.S. trade policy.

tariff (TCT) aggregator:

$$\tau_{ij}^{s} = \left(\sum_{k \in \mathcal{K}_s} \omega_{ij}^{k} \left(\tau_{ij}^{k} \right)^{\eta^k} \right)^{\frac{1}{\eta^s}}. \tag{1}$$

Here, τ_{ij}^{s} is the tariff at the desired level of aggregation s (e.g., industry, sector, etc.), and η^s is the corresponding aggregate trade elasticity. τ_{ij}^{k} is the disaggregated tariff (e.g., at the 6-digit HS product level) and η^k is the corresponding product-level trade elasticity for product k, where $\mathcal{K}_s$ denotes the set of products belonging to sector s. Finally, ω_{ij}^{k} denotes the theory-consistent *tariff-free* import weights, i.e., based on the value of imports net of the tariff effects.[4]

The TCT aggregator nests the two standard atheoretical aggregators, SAT and IWT, as special cases. Specifically, when observed imports are used as weights and $\eta^s = \eta^k = 1$, our TCTs collapse to the corresponding IWTs. Moreover, with uniform weights and when $\eta^s = \eta^k = 1$, the TCTs become SATs. Two main differences between our theory-consistent tariffs and the corresponding simple-average and import-weighted tariffs highlight the importance of theory. First, the theory-consistent aggregation takes into account the trade elasticities within product categories (η^k) and within broad industries (η^s). The relationship between the aggregate tariff and the trade elasticities is intuitive, e.g., from a demand-side perspective, substitutability within and across industries should matter for the aggregation of tariffs. Second, in contrast to standard import-weighted tariffs, which use observed import shares as weights, the theory-consistent weights are based on product import shares projected under the assumption that tariffs are removed, all else being equal. This TCT property is important because it overcomes the main deficiency of import-weighted tariffs, i.e., that products with the largest tariffs are assigned the smallest weights.

In Section 3, we apply our methods to construct a new database of aggregated tariffs. While our methods can be applied at any level, we chose to aggregate 6-digit HS tariffs to the industry level of the International Trade and Production databases of the U.S. International

[4] $\omega_{ij}^{k} \in [0,1]$ and $\sum_k \omega_{ij}^{k} = 1$. We elaborate on the construction of the *tariff-free* import weights in Section 2.

Trade Commission (USITC). We decided to complement the existing USITC datasets for two reasons. First, the USITC offers consistently constructed datasets that can be used to perform both partial equilibrium estimations (with the International Trade and Production Database for Estimation, ITPD-E) and general equilibrium (GE) counterfactual analysis (with the International Trade and Production Database for Simulation, ITPD-S). Second, the USITC datasets have rich dimensions, including 170 industries (153 goods and 17 services), more than 200 countries, and a long time period, 1986-2023. The result is a new tariff database – the *"Theory-Consistent Tariff Database"* (TCTD), which includes bilateral tariffs for 153 goods industries and more than 200 countries over the period 1986-2023.

Section 4 highlights some key features and advantages of the TCTs. First, a descriptive analysis reveals that although the correlation among the TCTs, SATs, and IWTs is generally high, industry-level TCTs can be substantially different from the corresponding SATs and IWTs. Overall, we find that the TCTs are systematically lower than the corresponding SATs and IWTs; the theory-consistent tariff is the smallest of the three for 73.6% of importers and 66.4% of industries, lying on average about 0.53 percentage points below the simple average tariff and as much as 4–8 points lower for individual importers and industries.[5]

Second, an estimation analysis with the new TCT database delivers three sets of trade elasticity estimates. Based on this analysis, we conclude that, with an average value of -5.25, the TCTs deliver trade elasticity estimates that are comparable to benchmarks in the existing literature. More important for our purposes, this analysis reveals that the differences between the TCTs, SATs, and IWTs translate into substantial differences between the corresponding trade-elasticity estimates. In turn, the large differences in the elasticity estimates have direct implications for the quantification of both the partial and general equilibrium effects of various trade policies on trade and welfare.

Third, we demonstrate that the TCTs are preferable to the corresponding SATs and IWTs. To do this, we proceed in two steps. First, we focus on several specific examples

[5]The reasons why TCTs are most often lower than IWTs and SATs are discussedlater in the paper.

directly from the data, which highlight the advantages of the TCTs and their ability to correct the deficiencies of both the SATs and IWTs. Then, we extend the analysis to calculate the deadweight losses from the imposition of tariffs. By benchmarking against the 'true' deadweight loss that is constructed from the fully disaggregated data, we show that the TCTs deliver deadweight losses that are closest to the 'true' benchmark, while the deadweight losses of the SATs and IWTs are orders of magnitude smaller or larger than the benchmark. In sum, we conclude that the TCTs differ from the corresponding SATs and IWTs, with important implications for both partial equilibrium estimations and GE analysis.

By proposing a theory-consistent alternative to the simple-average and import-weighted tariffs, we relate to all papers that use SATs and IWTs for estimation purposes and in counterfactual analysis. In addition, our contribution relates to the tradition of the trade restrictiveness indices (TRIs) of Anderson and Neary (1994, 1996, 2003, 2005) and the corresponding empirical literature: Kee, Nicita and Olarreaga (2009) implement the TRIs empirically and explore their heterogeneity for large number of rich and poor countries, Pelikan and Brockmeier (2008) show that the choice among simple/weighted averages and the TRIs has significant welfare implications, Himics and Britz (2016) extend the TRIs to accommodate tariff dispersion over export regions and tariff-rate-quota regimes, Suwanprasert (2020) constructs TRIs for non-tariff barriers, and Soderbery (2021) incorporates exporter heterogeneity and importer market power to calculate TRIs. Most recently, Anderson and Yotov (2025) develop a reciprocal general-equilibrium True Cost of Protection (TCP) index, while Kee, Neagu and Yotov (2026) construct a uniform partial-equilibrium Balanced Trade Tariff (BTT) index that eliminates bilateral trade deficits.

Similar to this literature, we develop a theory-based tariff aggregation procedure and, consistent with Anderson (2009), we show that atheoretic aggregation may contaminate empirical trade-policy work. However, our contribution differs from the TRI literature in methods, object, and purpose. In terms of *methods*, our aggregation procedure is grounded in the workhorse structural gravity model and built on established econometric methods, deliv-

ering a transparent yet general, simple-to-implement aggregation rule whose weights depend only on tariff-free trade and trade elasticities. In terms of *object*, and unlike the TRIs—which are typically uniform, country-level indexes—we construct bilateral tariffs that nest the simple-average and import-weighted tariffs as special cases and correct their deficiencies. Finally, in terms of *purpose*, these tariffs are designed to serve as a direct input to gravity estimation and policy analysis. As a proof of concept, we build the new, publicly available Theory-Consistent Tariff Database.

2 Theoretical Foundations

We develop the theoretical analysis in three steps. First, in Subsection 2.1, we briefly review the structural gravity model, which is the foundation for our aggregation procedure. Next, in Subsection 2.2, we develop our aggregation method. Finally, in Subsection 2.3, we offer a numerical analysis that highlights some key features and advantages of the TCTs over the SATs and IWTs.

2.1 The New Quantitative Trade Model: A Brief Review

The theoretical foundation for our analysis is the workhorse structural gravity model of trade (Eaton and Kortum, 2002; Anderson and van Wincoop, 2003), which can be derived from many alternative theoretical foundations (Arkolakis, Costinot and Rodríguez-Clare, 2012; Allen, Arkolakis and Takahashi, 2020). Using the notation of Anderson and van Wincoop (2003), our starting point is the following generic version of the structural gravity model, where we have replaced the structural coefficients with elasticities:

$$X_{ij,t}^k = Y_{i,t}^k E_{j,t}^k \frac{\left(d_{ij,t}^k\right)^{\eta_t^k}}{\left(\Pi_{i,t}^k\right)^{\eta_\Pi^k} \left(P_{j,t}^k\right)^{\eta_P^k}} \left(\tau_{ij,t}^k\right)^{\eta_\tau^k}. \tag{2}$$

Here, $X_{ij,t}^k$ is the nominal trade flow (in levels) at delivered prices from origin/exporter i to destination/importer j in class k at time t.[6] Since the gravity model is separable, class k can be defined at any level of aggregation (Anderson and van Wincoop, 2004; Costinot, Donaldson and Komunjer, 2012).[7] For the remainder of the paper, we will refer to k as a product. $Y_{i,t}^k$ is the value of output at time t and product k in origin i. $E_{j,t}^k$ is the expenditure at time t and product k in destination j. $d_{ij,t}^k$ denotes the bilateral non-tariff trade frictions between i and j in product k at time t. $\Pi_{i,t}^k$ and $P_{j,t}^k$ are the multilateral resistances of Anderson and van Wincoop (2003). Finally, $\tau_{ij,t}^k$ is the bilateral *ad valorem* tariff factor for product k between i and j at time t (so $\tau = 1.8$ corresponds to an 80% ad valorem tariff).[8] $\tau_{ij,t}^k$ varies with preferences and free trade agreements and equals one for internal trade, $\tau_{ii,t}^k = 1$. For simplicity, we assume that the tariff is predetermined with respect to current trade flows, reflecting past agreements.

Finally, the η's in equation (2) are the elasticities of trade with respect to the various determinants. Most important for our purposes, η_τ^k is the tariff elasticity, which is related to the elasticity of substitution σ^k by $\eta_\tau^k = -\sigma^k$ if tariffs are viewed as price shifters. In the CES demand system interpretation of CES-type gravity (Anderson, 1979; Anderson and van Wincoop, 2003), it is then also directly related to the trade elasticity, $\eta_\tau^k = 1 - \sigma^k$. Alternatively, it relates to the dispersion parameter of the productivity draws distribution in the Eaton and Kortum (2002) version of the structural gravity model, $\eta_\tau^k = -\theta^k$. For our aggregation procedure, we do not need to take a stance on the structural interpretation of η_τ^k.

[6] We note that the gravity model applies equally in a cross-section and in a panel setting. We chose to present and use the panel version of the gravity model, as we will rely on panel data to capture bilateral trade frictions more comprehensively. We refer the reader to Eaton et al. (2016) and Anderson, Larch and Yotov (2020) for recent derivations of theory-consistent dynamic gravity frameworks.

[7] Separable means that the gravity relationship can be derived for each industry.

[8] For practical purposes, the reader should think of $\tau_{ij,t}^k$ as bilateral *ad valorem* tariffs at the HS six-digit level, which is the most disaggregated product level for which internationally consistent tariff data are available and which are the main data to be used in our empirical analysis.

2.2 Theory-Consistent Tariff Aggregation

Consider the aggregation of tariffs over products k within a representative sector s, where $\mathcal{K}_s$ denotes the set of products belonging to sector s:

$$\sum_{k\in\mathcal{K}_s} X_{ij,t}^k = \sum_{k\in\mathcal{K}_s} Y_{i,t}^k E_{j,t}^k \frac{\left(d_{ij,t}^k\right)^{\eta_d^k}}{\left(\Pi_{i,t}^k\right)^{\eta_\Pi^k}\left(P_{j,t}^k\right)^{\eta_P^k}} \left(\tau_{ij,t}^k\right)^{\eta_\tau^k}. \tag{3}$$

The goal is to construct an aggregate sectoral tariff index, $\tau_{ij,t}^s$, such that the total sum of trade over all products $k \in \mathcal{K}_s$ remains constant, holding fixed output, expenditure, trade costs, and multilateral resistances for each product within sector s, in each year t, and for all exporters i and importers j. This implies:

$$\sum_{k\in\mathcal{K}_s} Y_{i,t}^k E_{j,t}^k \frac{\left(d_{ij,t}^k\right)^{\eta_d^k}}{\left(\Pi_{i,t}^k\right)^{\eta_\Pi^k}\left(P_{j,t}^k\right)^{\eta_P^k}} \left(\tau_{ij,t}^k\right)^{\eta_\tau^k} = \sum_{k\in\mathcal{K}_s} Y_{i,t}^k E_{j,t}^k \frac{\left(d_{ij,t}^k\right)^{\eta_d^k}}{\left(\Pi_{i,t}^k\right)^{\eta_\Pi^k}\left(P_{j,t}^k\right)^{\eta_P^k}} \left(\tau_{ij,t}^s\right)^{\eta_{ij,t,\tau}^s}, \tag{4}$$

where, the set of product-level tariffs $\tau_{ij,t}^k$ with elasticity η_τ^k are replaced with the sectoral tariff $\tau_{ij,t}^s$ with elasticity $\eta_{ij,t,\tau}^s$,[9] and all other variables remain constant at the product level.

Since the aggregated sectoral tariff in equation (4) does not vary across products k, we can solve for it from equation (4) as follows:

$$\tau_{ij,t}^s = \left(\sum_{k\in\mathcal{K}_s} \frac{Y_{i,t}^k E_{j,t}^k \frac{\left(d_{ij,t}^k\right)^{\eta_d^k}}{\left(\Pi_{i,t}^k\right)^{\eta_\Pi^k}\left(P_{j,t}^k\right)^{\eta_P^k}}}{\sum_{l\in\mathcal{K}_s} Y_{i,t}^l E_{j,t}^l \frac{\left(d_{ij,t}^l\right)^{\eta_d^l}}{\left(\Pi_{i,t}^l\right)^{\eta_\Pi^l}\left(P_{j,t}^l\right)^{\eta_P^l}}} \left(\tau_{ij,t}^k\right)^{\eta_\tau^k} \right)^{\frac{1}{\eta_{ij,t,\tau}^s}}. \tag{5}$$

Recognizing that the weights in equation (5) are tariff-free imports, $f_{ij,t}^k \equiv X_{ij,t}^k / \left(\tau_{ij,t}^k\right)^{\eta_\tau^k}$, we

[9] We discuss the motivation, nature, and construction of the bilateral tariff elasticity $\eta_{ij,t,\tau}^s$ in the next section.

can rewrite (5) as follows:

$$\tau_{ij,t}^{s}=\left(\sum_{k\in\mathcal{K}_s}\frac{X_{ij,t}^{k}/\left(\tau_{ij,t}^{k}\right)^{\eta_{\tau}^{k}}}{\sum_{l\in\mathcal{K}_s}X_{ij,t}^{l}/\left(\tau_{ij,t}^{l}\right)^{\eta_{\tau}^{l}}}\left(\tau_{ij,t}^{k}\right)^{\eta_{\tau}^{k}}\right)^{\frac{1}{\eta_{ij,t,\tau}^{s}}}=\left(\sum_{k\in\mathcal{K}_s}\frac{f_{ij,t}^{k}}{\sum_{l\in\mathcal{K}_s}f_{ij,t}^{l}}\left(\tau_{ij,t}^{k}\right)^{\eta_{\tau}^{k}}\right)^{\frac{1}{\eta_{ij,t,\tau}^{s}}}. \quad (6)$$

Here, $f_{ij,t}^{k}$ denotes tariff-free imports of product k in destination j from source i at time t, conditional on multilateral resistance terms, income, and expenditure. These tariff-free imports can be calculated from actual imports and tariffs or from model-predicted imports and tariffs. See Section 2.2.2 for further discussion. If we define $\omega_{ij,t}^{k}\equiv f_{ij,t}^{k}/\sum_{l}f_{ij,t}^{l}$ ($\omega_{ij,t}^{k}>0$ and $\sum_{k\in\mathcal{K}_s}\omega_{ij,t}^{k}=1$), then equation (6) transforms into equation (1) from the introduction, i.e., our theory-consistent tariff aggregator:

$$\tau_{ij,t}^{s}=\left(\sum_{k\in\mathcal{K}_s}\omega_{ij,t}^{k}\left(\tau_{ij,t}^{k}\right)^{\eta_{\tau}^{k}}\right)^{\frac{1}{\eta_{ij,t,\tau}^{s}}}. \quad (7)$$

2.2.1 Comparison to Simple and Import-Weighted Tariff Aggregators

Our TCT index nests as special cases the standard simple and import-weighted average procedures for aggregating tariffs. Thus, equation (7) enables us to clearly highlight several important differences between theory-consistent vs. atheoretical aggregations and to decompose their implications. First, and perhaps most importantly, the theory-consistent aggregation takes into account the substitutability across varieties within product categories (η_{τ}^{k}) and also within broad sectors ($\eta_{ij,t,\tau}^{s}$). The relevance of this property is intuitive, and it has two implications for tariff aggregation that depend on the ratio between the product-level and industry-level elasticities, as well as the non-linear terms in the aggregation of tariffs implied by equation (7).

Second, we note that without the tariff elasticities, equation (7) is reminiscent of the

expression for import-weighted tariff aggregation, i.e.:

$$\tau_{ij,t}^{s} = \sum_{k \in \mathcal{K}_s} \omega_{ij,t}^{k} \left(\tau_{ij,t}^{k} \right). \tag{8}$$

The key difference between (8) and the atheoretical import-weighted tariff aggregation is that theory implies that the weights should be constructed without taking into account the impact of tariffs. Thus, from a methodological perspective, theory resolves a crucial deficiency of import-weighted tariffs, i.e., when tariffs increase, imports decrease; therefore, smaller and smaller weights are assigned to larger and larger tariffs (zero at the extreme when tariffs are prohibitive). The theory-consistent weights in our aggregation procedure address this challenge by excluding the impact of tariffs on imports.

2.2.2 Calculation of TCTs

Equation (7) can be implemented in different ways. For example, one can 'borrow' the tariff/trade elasticities from existing studies and then construct the tariff-free weights directly from the observed imports. However, we recommend that the aggregation be performed with predicted trade flows obtained from product-level gravity regressions estimated using the Poisson pseudo-maximum-likelihood (PPML) estimator for the following reasons.

The use of predicted trade flows enables us to estimate appropriate weights for product-level tariffs, even if the current product-level trade is zero or missing. As shown in the previous section, the appropriate weights are given by predicted tariff-free trade, which is calculated from current trade and estimated elasticities. If the current trade is zero or missing, the weights from IWTs are also zero. We circumvent this limitation by using model-predicted current trade to estimate tariff-free trade. Thus, unlike IWTs, our methodology allows positive weights on products with zero or missing current trade, overcoming the main

deficiency of the IWTs.[10]

We are comfortable using the model-predicted trade because the gravity model has been shown to perform well in predicting trade flows, and gravity estimations with many fixed effects are now standard and easy to perform. Moreover, due to the additive property of the PPML estimator (Fally, 2015), the predicted trade flows from the PPML regressions are perfectly consistent with the structural weights. As a result, the following three procedures deliver theoretically identical weights for our aggregator: (i) Construct the multilateral resistances by solving the non-linear structural gravity system, and then combine them with the size variables and the estimates of the bilateral trade costs net of tariffs; (ii) Use the exporter-time and importer-time fixed effects from the PPML estimation and combine them with the estimates of the bilateral trade costs net of tariffs; and (iii) Predict bilateral trade directly from the PPML regression and then net out the tariff effects. Due to its simplicity, we recommend and rely on option (iii).

Finally, we note that the same gravity regressions that are used for the predicted trade flows can also deliver the tariff elasticities that are needed for our aggregation procedure. Thus, all elements needed for the aggregation are based on the same raw data.

2.3 A Numerical Example

To highlight the key features and implications of our theory-consistent tariff aggregation procedure, we provide a simple numerical example that extends the analysis of Bacchetta et al. (2012) and compares the simple vs. import-weighted tariffs. The stylized data are summarized in Table 1. It consists of three products observed across eleven country pairs. Product 1 is the key product whose ad valorem tariff rises from 0% to 500% while its corresponding imports decline from $1,000$ to 7. The tariffs and imports for products 2 and

[10] At the same time, the model cannot always predict positive trade. For example, if a country does not import a particular product from *any* source, the importer fixed effect cannot be estimated and the predicted imports of this product cannot be calculated for this country. In such a case, we assume that there would not be imports in this country of this product even with zero tariffs. Consequently, this product would get zero weight when calculating the average tariff.

3 are held fixed across all pairs. Holding these variables fixed enables us to isolate the contribution of product 1's tariff to the aggregate tariff. Consistent with our theory, we extend the data and analysis of Bacchetta et al. (2012) to incorporate product-level tariff elasticities. Specifically, the product-level tariff elasticities are set to $\eta^1 = 2$, $\eta^2 = 6$, and $\eta^3 = 4$.

Table 1: Tariff Aggregation: Data of Numerical Example

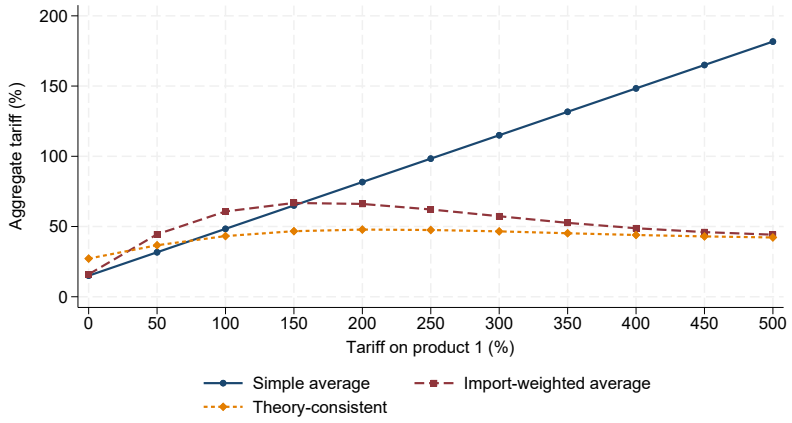
	Product 1 ($\eta^1 = 2$)		Product 2 ($\eta^2 = 6$)		Product 3 ($\eta^3 = 4$)	
Pair	Tariff (%)	Imports	Tariff (%)	Imports	Tariff (%)	Imports
1	0	1,000	40	670	5	10
2	50	607	40	670	5	10
3	100	368	40	670	5	10
4	150	223	40	670	5	10
5	200	135	40	670	5	10
6	250	82	40	670	5	10
7	300	50	40	670	5	10
8	350	30	40	670	5	10
9	400	18	40	670	5	10
10	450	11	40	670	5	10
11	500	7	40	670	5	10

Notes: This table replicates and extends the analysis from Bacchetta et al. (2012). The table reports trade and tariff values for three products observed across eleven country pairs. Product 1 is the key product, whose ad valorem tariff varies from 0% to 500%, and its corresponding imports decline (approximately exponentially) as the tariff rises. The trade and tariff values for products 2 and 3 are held fixed across pairs. The product-level tariff elasticities, η^k for $k \in \{1, 2, 3\}$, are reported in the column headers. See the main text for further details.

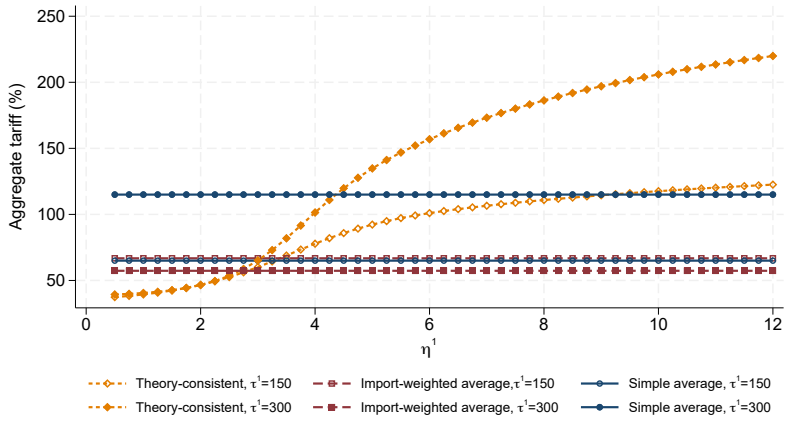
Figure 1 illustrates our findings. Panel A compares the simple-average, import-weighted, and theory-consistent aggregators against the observed tariff on product 1. Each x-axis value corresponds to a different pair in the data: the tariff on product 1 ranges from 0% to 500% across pairs, while products 2 and 3 retain fixed tariffs of 40% and 5%, and the observed import vector is taken as given. The simple average is linear in τ^1 by construction, climbing from 15% at $\tau^1 = 0$ to roughly 182% at $\tau^1 = 500\%$. The slope is $1/3$, mechanically reflecting that only one of the three product tariffs changes. By ignoring trade weights altogether, the simple-average tariff index overstates the aggregate tariff once one product's rate diverges from the others.

Figure 1: Simple-average vs. Import-weighted vs. Theory-consistent Tariffs

(a) Tariff aggregates for different values of product 1 tariff



(b) Tariff aggregates for different values of product 1 elasticity



Notes: This figure compares the simple-average, import-weighted, and theory-consistent aggregate tariffs based on the data from Table 1. Panel A uses the simple-average industry elasticity $\bar{\eta} = 4$ and plots the aggregate tariffs for different values of the product 1 tariff. Panel B plots the aggregated tariffs against different product-level elasticities η^1 for product 1 for two tariff levels of product 1 ($\tau^1 = 150\%$ and $\tau^1 = 300\%$).

The import-weighted and theory-consistent aggregators both diverge sharply from this linear benchmark and share a non-monotonic shape. The import-weighted average rises from about 16% at $\tau^1 = 0$ to a peak near 67% at $\tau^1 \approx 150$–200%, then declines to 44% at $\tau^1 = 500\%$. The theory-consistent aggregator follows the same qualitative pattern at a uniformly lower level: it peaks near 48% at $\tau^1 \approx 200\%$ before declining to 42% at $\tau^1 = 500\%$. The non-monotonicity in both curves reflects the substitution effect: as τ^1 rises, observed imports of product 1 collapse, eventually shrinking its weight in either aggregator toward zero, so both indices become dominated by the fixed tariffs on products 2 and 3. This is the well-known endogeneity problem of trade-weighted aggregation, in which the products with the largest tariffs receive the smallest weights. The economic message is that the simple arithmetic average dramatically overstates the welfare-relevant tariff burden when one product is heavily taxed but barely imported, because it gives the same weight to nearly extinct trade flows as to active ones; both trade-weighted measures correctly downweight highly taxed varieties that consumers have already substituted away from.

The theory-consistent aggregator from equation (7) shares this qualitative pattern with the import-weighted average but applies a model-based correction that has a transparent ceiling: as $\eta^1 \to \infty$, the theory-consistent aggregate converges to $\max_k \tau^k$. Panel A shows the theory-consistent curve lying below the import-weighted curve throughout the entire range of τ^1. The wedge between the two reflects two countervailing forces in the CES generalized mean $\left(\sum_k s^k \left(\tau^k\right)^{\eta^k}\right)^{1/\bar{\eta}}$: the inner $\left(\tau^k\right)^{\eta^k}$ amplification gives more weight to high-tariff varieties, but the outer $1/\bar{\eta}$ root dampens the resulting index. In this dataset, the dampening dominates, so the theory-consistent index sits below the import-weighted one. Panel B isolates this dampening mechanism by varying the elasticity η^1 while holding observed trade flows and tariffs fixed. Two representative pairs are shown: a moderate-tariff pair ($\tau^1 = 150\%$) and a high-tariff pair ($\tau^1 = 300\%$). The simple-average and import-weighted aggregators are horizontal because, by construction, they depend only on observed tariffs and trade volumes. For the moderate-tariff pair, the simple average (65%) and the import-

weighted average (67%) are essentially indistinguishable because the trade weight of product 1 is close to its uniform share. For the high-tariff pair, the two diverge sharply: the simple average is 115% while the import-weighted average is only 57%, because the substitution effect has already collapsed observed imports of product 1. The theory-consistent aggregator rises monotonically with η^1 for both pairs and saturates at τ^1 itself – the highest tariff in the basket. For the moderate-tariff pair, the theory-consistent curve crosses both horizontal benchmarks near $\eta^1 \approx 3.3$; for the high-tariff pair, it crosses the import-weighted benchmark already near $\eta^1 \approx 2.7$ and the simple-average benchmark near $\eta^1 \approx 4.3$. The takeaway is that the theory-consistent aggregator provides a coherent, model-based bridge between the simple and import-weighted tariffs, with the level of tariffs relative to the SATs and IWTS depending on the elasticities. For empirically reasonable elasticities $\eta^1 \in [3, 8]$, this measure can lie above either benchmark while remaining bounded by the maximum tariff in the basket. Appendix A derives these limiting properties formally.

3 The TCT Database

This section proceeds in three steps. First, in Subsection 3.1, we describe the main raw data and sources that we use to apply our aggregation methods.[11] Then, in Subsection 3.2, we discuss the specific steps that we take to construct the new *Theory-Consistent Tariff Database*, summarize the new dataset, and highlight some of the advantages of the TCTs.

3.1 Data Sources

We rely on two main data sources (one for tariffs and one for trade) to construct the TCT database. The data on tariffs come from the United Nations' Trade Analysis and Information

[11] While our methods can be applied at any level, we chose to aggregate 6-digit HS tariffs to the industry level of the International Trade and Production databases of the USITC. We decided to complement the existing USITC datasets for two reasons: (i) because the USITC offers consistently constructed datasets that can be used to perform both partial equilibrium estimations (with the ITPD-E) as well as GE counterfactual analysis (with the ITPD-S); and (ii) because the USITC datasets have rich dimensions, including 170 industries (153 goods and 17 services), more than 200 countries, and a long period of time, 1986-2023.

System (TRAINS).[12] We selected TRAINS as our source of tariff data for the following reasons. First, TRAINS is the most comprehensive and internationally consistent database of tariff data. Second, TRAINS is updated regularly, which enables us and other researchers to apply our methods to obtain current aggregated tariff datasets. Third, TRAINS contains HS-based tariff data for nearly all countries from 1988 to the present. This long time span makes it particularly well-suited to match the USITC's trade and production datasets that cover similarly long periods.

Tariffs are imposed at the tariff-line level, which is typically the 8-, 9-, or 10-digit HS level. However, tariff lines are unique to each country, and only the 6-digit HS codes are harmonized across countries, so tariffs are reported at the HS 6-digit level in TRAINS. Therefore, our most disaggregated tariffs will be at the 6-digit level. The TRAINS tariff data reports four types of tariffs, including Most-Favored-Nation (MFN) tariffs, MFN tariffs with ad-valorem equivalents (AVEs), preferential tariffs, and preferential tariffs with AVEs. To construct our data, we rely only on 'raw' tariff data, i.e., we do not utilize the estimated ad-valorem equivalents of non-ad-valorem tariffs. However, this information can be incorporated with our methods.

Constructing a comprehensive and cohesive disaggregated bilateral tariff database required us to address several well-known challenges with TRAINS (Teti, 2024). First, we use the raw TRAINS data directly rather than the WITS "effectively applied tariff" series; the latter interpolates with the MFN data in years when preferential rates are unreported, generating artificial spikes that our construction avoids. Moreover, the WITS series only retains tariffs in years with positive trade flows, whereas we keep tariff entries for every country-partner-product-year cell in which a tariff has been reported, even when observed trade is zero or missing. This highlights one key advantage of our methods relative to the import-weighted tariffs. Specifically, we will be able to utilize the information in all disaggregated tariffs, even when trade/imports are not available, while this is not the case for

[12] https://trainsonline.unctad.org/home.

import-weighted tariffs.

Second, the tariff data are frequently reported in different revisions of the HS classification. This means that we need to convert all data to the same HS revision, and we converted all tariff data into the 1988/92 H0 revision of the HS. H0 was selected because it created the fewest concordance problems over time. Specifically, for the most part, as the HS is revised, existing product codes are more frequently split (creating a 1:n observation going from one six-digit H0 code to more than one product code in a later revision), with less frequent instances of them being combined into one (creating an n:1 observation), and even less common n:n changes (in which multiple H0 codes are combined and re-divided in a different way to form multiple later codes). Furthermore, WITS created HX to H0 concordances that contain only n:1 matches between the later concordances and H0.[13]

Third, some countries in TRAINS did not report tariffs every year. To construct the disaggregated bilateral data on tariffs, we first create a complete bilateral matrix based on all countries in TRAINS, all possible years (37 years, 1988-2024), and all possible product codes (5,659 H0 six-digit product codes). After we fill in available data for MFN and preferential tariffs (separately), we fill in observations for missing years by using step interpolation.[14] We assume that the MFN tariff rate is available to all countries, not just WTO members.[15]

After filling in the MFN and preferential tariff data separately, the applied tariff is set to be the minimum of the MFN and the preferential rates in a given year. Although using the minimum of the MFN and the preferential tariff rate as the applied tariff is not a perfect measure of the applied tariff rate, it is a common approach in the literature.[16] For consistency, we cross-check the availability of preferential tariffs against Mario Larch's Regional Trade

[13] https://wits.worldbank.org/product_concordance.html.

[14] This means that the same tariff rate is assumed in subsequent years unless a new tariff rate is reported.

[15] This is not an uncommon simplification, given that TRAINS does not report non-MFN tariff rates. See Gonciarz and Verbeet (2025) and https://www.intracen.org/resources/publications/world-tariff-profiles-2025, for example.

[16] See World Bank's WITS Technical Note on Bilateral Applied Tariff (https://wits.worldbank.org/Bilateral-Tariff-Technical-Note.html and https://wits.worldbank.org/WITS/wits/WITSHELP/Content/Data_Retrieval/P/Intro/C2.Types_of_Tariffs.htm), or CEPII's "Country Profiles: indicators, databases and classifications" documentation (https://cepii.fr/PDF_PUB/panorama/pa2022-01_en.pdf).

Agreements Database from Egger and Larch (2008).[17]

We are aware that the tariff dataset of Teti (2024) improves further on the data from TRAINS by including additional tariffs from several sources and using actual phase-in schedules instead of linear stair-step interpolation. We recognize that implementing such improvements may result in a better disaggregated tariffs dataset. However, these are major efforts that go beyond our main methodological objective. Therefore, instead of attempting to fully duplicate the methods from Teti (2024), we note that we could have implemented our procedures to aggregate the tariffs from Teti's database should we have had access to it. Thus, from a broader perspective, our paper is complementary to Teti's in the sense that she constructs an improved raw tariff dataset while we offer theory-consistent methods to aggregate tariffs.[18]

Our methods also require trade flows data at the same level of aggregation as the disaggregated tariff data. These trade data come from the United Nations' COMTRADE database. Consistent with trade theory (Larch, Shikher and Yotov, 2025) and because import data is viewed as more reliable than export data,[19] we first use data on c.i.f. imports, and then we supplement the missing import data with mirrored export data. Based on the COMTRADE documentation, we replace missing trade flows with zeroes. To make the disaggregated trade data internally consistent, we use the same internal HS concordance (i.e., H0) that we created for the tariff data, and then we combine the product-level trade and tariff data. At the country level, the final grid is determined by the tariff data coverage, so the grids are not necessarily the same for all countries. Furthermore, within a country, the years covered vary from product to product.

In addition to the disaggregated data on tariffs and trade at the HS 6-digit level, we need a concordance between the H0 product codes and the aggregate ITPD-E industries. To con-

[17]Downloadable at https://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html.

[18]In Teti (2024) "[...], all aggregation steps are done with unweighted averages." (p. 32).

[19]See for example https://wits.worldbank.org/wits/wits/witshelp/Content/Data_Retrieval/T/ Intro/B2.Imports_Exports_and_Mirror.htm and Timmer et al. (2012). Specifically, for developing countries, Rozanski and Yeats (1994) show that export data are less reliable than import data.

struct this concordance, we capitalize on the fact that the ITPD-E database was constructed based on the ISIC Rev. 3 classification for forestry, fishing, mining, and manufacturing, and on FAO's FCL classification for agriculture. Thus, we used the concordances from ISIC Rev. 3 to H0 (from WITS) and from FCL items to H0 (from FAO) to create the final ITPD to H0 concordance.

3.2 Construction of the TCT Database

The objective of this section is to construct the *Theory-Consistent Tariff Database (TCTD)*. We rely on the methods from Section 2 and the data described in Section 3.1 and proceed in three steps. First, we obtain the product-level trade elasticities and the predicted tariff-free imports that will be used as weights, which are two of the three inputs needed to implement our aggregation procedure. Second, we construct the aggregate trade elasticities, which are the third and last input needed to implement our methods. Third, we feed the elasticities and the weights from the previous two steps into our aggregator to aggregate the product-level tariffs to the ITPD-E level.

To obtain the product-level trade elasticities and the net-of-tariff predicted trade flows, we specify the following econometric model, which is similar to Fontagné, Guimbard and Orefice (2022) and is estimated for each product in our sample:

$$X_{ij,t}^k = \exp\big[\,\eta^k\,\ln(\tau_{ij,t}^k) + GRAV_{ij}\,\gamma^k + POLICY_{ij,t}\,\alpha^k + \phi_{i,t}^k + \psi_{j,t}^k\big]\,\epsilon_{ij,t}^k. \tag{9}$$

Here, $X_{ij,t}^k$ denotes trade (at delivered prices) of product k from exporter i to importer j in year t;[20] $\tau_{ij,t}^k$ denotes product-level tariffs; η^k is the product-level tariff elasticity; $GRAV_{ij}$ collects time-invariant bilateral gravity variables (distance, contiguity, common language, and colonial ties); $POLICY_{ij,t}$ includes time-varying bilateral policies (RTAs, WTO mem-

[20]For convergence and computational reasons, we eliminate very small countries by keeping the largest countries which account for 98% of the observed trade at the product-exporter-year level. Whenever convergence is possible, our results are robust to including all countries in the estimating sample.

bership, EU membership, customs unions, economic integration agreements, and complete and partial trade sanctions);[21] finally, $\phi_{i,t}^k$ and $\psi_{j,t}^k$ are exporter-industry-time and importer-industry-time fixed effects. Capitalizing on the theoretical separability property of the structural gravity model (Anderson and van Wincoop, 2004; Costinot, Donaldson and Komunjer, 2012), we estimate (9) product by product (i.e., 4,906 times) with the PPML estimator (Santos Silva and Tenreyro, 2006) while clustering standard errors by country-pair (Egger and Tarlea, 2015).

As noted earlier, subject to standard methods with standard caveats,[22] this step delivers two of the three elements that are needed to implement our aggregation procedure, i.e., the tariff-free predicted trade flows that will be used as weights and the product-level trade elasticities. The correlation between all non-missing values of actually observed and predicted trade flows smaller than 1^{10} is 0.83.[23] Concerning the product-level tariff elasticity estimates, we obtain plausible values, both in terms of sign and magnitude. Specifically, as in Fontagné, Guimbard and Orefice (2022), three-quarters of our estimates are negative, and the vast majority are also statistically significant. Nevertheless, about 1/4 (1,096) of the tariff-elasticity estimates are positive, which is not consistent with theory, and we also obtain some very large negative values. Hence, we replace the positive product-level estimates with the corresponding industry averages, and we cap the 533 estimates below -10 to -10. Figure 2 plots our 4,906 product tariff elasticities (η^k) sorted according to size.

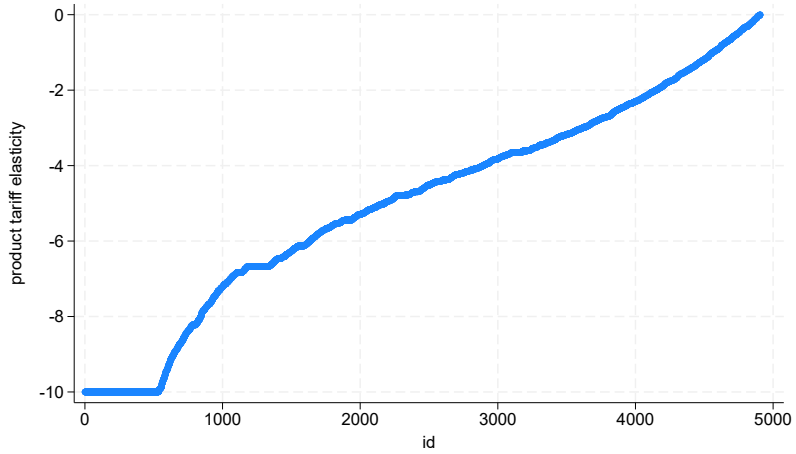
Before we continue, we remind readers that our procedure is flexible and that it is not

[21]The data on the time-invariant gravity variables, e.g., distance, contiguity, etc., as well as on EU and WTO membership come from the *Dynamic Gravity Dataset* of the USITC (Gurevich and Herman, 2018). The data on regional trade agreements (RTAs), customs unions, and economic integration agreements come from Mario Larch's RTA database (Egger and Larch, 2008). Finally, the data on economic sanctions is from the *Global Sanctions Database* (Felbermayr et al., 2020; Syropoulos et al., 2024).

[22]To obtain our disaggregated elasticities, we closely follow Fontagné, Guimbard and Orefice (2022). We recognize that, despite the rich set of fixed effects in our model, endogeneity concerns remain. However, we remind readers that the parameters needed to implement our model can be borrowed from external studies. Thus, the gravity estimations may be avoided altogether. Nevertheless, for reasons that we stated before, we still prefer to obtain our own elasticity estimates from the same data that will be used for the aggregation.

[23]There are a few very large predicted trade flows that we omit when calculating the correlation. Specifically, by dropping $1,551$ out of $1,777,292,569$, i.e. .00009%, of the observations when keeping only predicted trade flows below 1^{10}.

Figure 2: Product-level Tariff Elasticities



Notes: This figure plots the 4,906 product tariff elasticities (η_τ^k) sorted according to size. Note that we replace the 1,096 positive estimates with missing values and cap the 533 values below -10 for tariffs at -10. Missing values are then replaced at the product level with their industry averages.

necessary to estimate the 4,906 product-level gravity regressions to obtain the tariff elasticities and the trade weights. Instead, one can 'borrow' external product-level tariff elasticities, e.g., from Fontagné, Guimbard and Orefice (2022). In addition, instead of using predicted trade flows, $\hat{X}_{ij,t}^k$, one can use actual imports along with the corresponding tariff data and the tariff elasticities to construct the theory-consistent predicted tariff-free trade flows. Our preference is to estimate our own tariff elasticities and trade weights with the same data that is being aggregated for the reasons explained in Section 2.2.2.

The second step delivers the aggregate bilateral trade elasticities $\eta_{ij,t,\tau}^s$ based on a simple aggregation with inputs from the previous step. The bilateral industry-level elasticities are constructed as the weighted averages of the product-level elasticities $\hat{\eta}_\tau^k$ with the predicted tariff-free trade flows, $\hat{f}_{ij,t}^k$, as weights:

$$\hat{\eta}_{ij,t,\tau}^s = \sum_{k \in \mathcal{K}_s} \frac{\hat{f}_{ij,t}^k}{\sum_{l \in \mathcal{K}_s} \hat{f}_{ij,t}^l} \hat{\eta}_\tau^k. \tag{10}$$

This equation, which shows the bilateral nature of tariff elasticities, is motivated by both theoretical and empirical reasons. From a theoretical perspective, and consistent with Carrere, Mrazova and Neary (2020), who demonstrate that the trade elasticity in the gravity

model should be bilateral and time-varying, equation (10) has a transparent interpretation in terms of the composite-commodity theorem. For a uniform tariff change, in proportional terms across the products $k \in \mathcal{K}_s$, the exact elasticity of aggregate trade is the trade-share-weighted average of the product-level elasticities,

$$\frac{\partial \ln \sum_{k \in \mathcal{K}_s} X_{ij,t}^k}{\partial \ln \tau_{ij,t}^s} = \sum_{k \in \mathcal{K}_s} \frac{X_{ij,t}^k}{\sum_{l \in \mathcal{K}_s} X_{ij,t}^l} \frac{\partial \ln X_{ij,t}^k}{\partial \ln \tau_{ij,t}^k}. \tag{11}$$

Our procedure differs from (11) in one respect: it removes the impact of tariffs from the weights, replacing observed trade $X_{ij,t}^k$ with its predicted tariff-free value $\hat{f}_{ij,t}^k$. Removing the impact of tariffs from the weights makes the aggregate elasticity a fixed parameter rather than a quantity that itself moves with the tariffs being aggregated; this is essential for a tariff index that is comparable across country pairs and over time.

To motivate the dimensions, including the bilateral nature, of the industry-level tariff elasticity, we offer a concrete example from the raw data. Specifically, we focus on the exports of 'Cotton' (ITPD-E Industry 23) from Poland to Thailand in 1993. Industry 23 contains four HS six-digit products, and the inputs that are needed to aggregate tariffs are shown in Table 2.

Table 2: HS-Level Inputs and Estimates

k	$X_{ij,t}^k$	$t_{ij,t}^k$ (%)	$\hat{\eta}_\tau^k$	$\hat{X}_{ij,t}^k$	$\hat{f}_{ij,t}^k$
(1)	(2)	(3)	(4)	(5)	(6)
520210	0	80	−8.92	22.44	4,257.42
520291	0	80	−5.90		
520299	0	80	−8.50		
520100	0	80	−0.26		

Notes: This table reports the HS-level inputs and estimates that are needed to aggregate tariffs, for exports from Poland (POL) to Thailand (THA) in 1993, for the four HS six-digit products in industry 23 (cotton). Column (1) reports the six-digit HS product code, k; column (2) reports observed trade (in current USD), $X_{ij,t}^k$; $t_{ij,t}^k = 100 \times (\tau_{ij,t}^k - 1)$ in column (3) is the applied ad valorem tariff rate (so the tariff factor is $\tau_{ij,t}^k = 1 + t_{ij,t}^k/100$); column (4) reports the estimated product-level tariff elasticity, $\hat{\eta}_\tau^k$; and columns (5) and (6) report the predicted trade flow, $\hat{X}_{ij,t}^k$, and the predicted net-of-tariff trade flow, $\hat{f}_{ij,t}^k = \hat{X}_{ij,t}^k / (\tau_{ij,t}^k)^{\hat{\eta}_\tau^k}$, which serves as the weight in the aggregation. All decimal values are rounded to two places. Empty cells indicate missing values (no gravity prediction available). See text for further details.

The following patterns, which have implications for tariff aggregation, stand out from the data. First, the tariffs on all HS products are equal to 80%, and this is also the 'true' aggregate tariff for the industry. Since the tariffs for all products are the same, the 'true' tariff coincides with the simple-average tariff. Second, the actual exports of each of the four HS products are all zero. The implication is that the import-weighted tariffs will be undefined – an extreme manifestation of the main deficiency of the import-weighted tariffs.

Third, and most importantly, this example demonstrates why it is necessary to construct industry elasticities as weighted averages of product-specific elasticities, leading to industry elasticities that vary by pair and over time. Only one of the four predicted trade flows in Table 2 is non-missing. This is product HS 520210, and it forms the weight in the aggregation; for the other three products, the weight is missing because the gravity prediction is unavailable.[24] Equation (10) is a weighted average of the product-level elasticities $\hat{\eta}^k_\tau$ using exactly these weights, so it collapses to the single product elasticity that carries weight: $\hat{\eta}^s_{ij,t,\tau} = \hat{\eta}^{k=520210}_\tau = -8.92$. This is exactly what one wants from the procedure. If only one HS code in the industry has non-zero predicted trade, the bilateral aggregate elasticity should reflect the elasticity estimated for *that* code; it should not be a simple average over all HS codes in the industry that would also load on the codes for which there is no predicted trade.

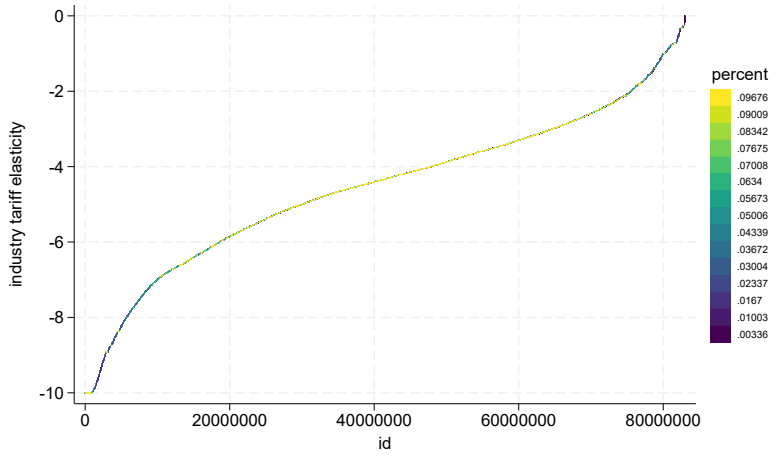
The same property delivers a sharp sanity check on the tariff side: under the same weights, equation (7) reduces to $\hat{\tau}^s_{ij,t} = \tau^{k=520210}_{ij,t} = 80\%$ ad valorem tariff rate, which coincides with the 'true' industry tariff as well as with the simple-average tariff. The contrast between the TCTs and SATs would be more informative when HS-level tariffs vary across products, which will work against the simple-average tariffs. However, the corner case here confirms that the theory-consistent procedure recovers exactly the 'true' tariff using the elasticity of the only HS code that carries weight in the aggregation.

Figure 3 plots our 83,001,904 bilateral industry-level tariff elasticities ($\eta^s_{ij,t,\tau}$) sorted by

[24] The reason for the missing predictions in the three HS products is missing exporter fixed effect estimates because Poland does not export positive amounts in those HS products to any country.

size.[25] By construction, the range of the industry-level tariff elasticities is determined by the range of the product elasticities, as the industry-level tariff elasticities are weighted averages of the corresponding product-level elasticities. The color highlights the share of observations for the given elasticity plotted. As can be seen from Figure 3, we only have a small share of observations on both ends of the spectrum, with about 70% of the estimates in the range of -6 and -2, which is standard in the trade literature.[26]

Figure 3: Industry-level Tariff Elasticities



Notes: This figure plots the 83,001,904 industry tariff elasticities ($\eta^s_{ij,t,\tau}$) sorted according to size.

The final step of our methods delivers the aggregated tariffs for the *Theory-Consistent Tariff Database*. To this end, we collect the estimates of the product-level tariff elasticities (η^k), the industry-level bilateral tariff elasticities (η^s_{ij}), and the net-of-tariff predicted imports that will be used as weights ($\omega^k_{ij,t}$) from the first two steps, and we aggregate the product level tariffs ($\tau^k_{ij,t}$) to construct the aggregate tariffs at the ITPD-E level ($\tau^s_{ij,t}$) according to:

$$\tau^s_{ij,t} = \left(\sum_{k \in \mathcal{K}_s} \omega^k_{ij,t} \left(\tau^k_{ij,t} \right)^{\eta^k_\tau} \right)^{\frac{1}{\eta^s_{ij,t,\tau}}} . \tag{12}$$

Equation (12) delivers the set of theory-consistent tariffs, which, along with the cor-

[25] Among the 83,001,904 elasticities are 22,674,732 distinct bilateral industry-level tariff elasticities.

[26] Similar to the discussion of the product-level elasticities, we note that the bilateral tariff elasticities that are needed for the aggregation procedure can also be taken from outside.

responding simple-average tariffs and import-weighted tariffs, comprise the new *Theory-Consistent Tariff Database* (TCTD). Table 3 provides summary statistics of the TCTD. In addition to the ID variables for the ITPD-E industries (industry_id), the exporters (exporter_iso3), the importers (importer_iso3), and the years (year), Table 3 reports the theory-consistent tariffs (tariff_theory), the import-weighted tariffs (tariff_weighted), and the simple average tariffs (tariff_simple).

Table 3: Summary Statistics of the TCT Database

Variable	Obs	Mean	Std. dev.	Min	Max
industry_id	90,650,530	81.32268	42.08258	1	153
exporter_iso3	string variable; not summarized				
importer_iso3	string variable; not summarized				
year	90,650,530	2010.173	8.919493	1988	2024
tariff_theory	84,451,058	10.18055	22.94209	0	3000
tariff_weighted	25,972,993	8.618242	23.3735	0	3000
tariff_simple	89,466,933	10.69645	22.6452	0	2314.286

Notes: The full database has 90,650,530 observations at the bilateral-industry-year level (270 partners × 270 partners × 153 industries × 37 years), where at least one of the tariffs has non-missing values. `exporteriso3` and `importeriso3` are string variables and are not numerically summarized.

Two features of the tariff variables are worth noting. First, the number of observations is much higher for the theory-consistent tariffs than for the import-weighted tariffs (i.e., 85 million vs. 26 million). As discussed in Section 2.2.2, the reason is that the theory-consistent weights are constructed from predicted trade flows, which are available even when observed trade is missing, whereas the import-weighted tariffs are computed directly from observed trade. The simple-average tariffs are available for the largest number of cells, since no information beyond the tariffs themselves is needed.[27] Second, although the means of the three series are close, individual observations differ substantially, and so does the cross-

[27]Because the three aggregated tariffs are available for different sets of cells, the means reported in Table 3 are not computed over a common sample and are therefore not directly comparable across the three measures. Table 6 in Appendix B reports the same statistics for the 25,050,077 observations for which all three tariffs are simultaneously available. The relative ranking of the simple-average and the import-weighted tariffs is preserved, with the simple average the largest (8.67%) and the import-weighted tariff below it (8.58%). The theory-consistent tariff, however, which lies between the two in Table 3, becomes the smallest of the three (8.14%) once all measures are computed over the same cells. The differences between the three measures are also considerably smaller than those implied by Table 3.

sectional dispersion. The correlation is 0.88 between the theory-consistent tariffs and the import-weighted tariffs, and 0.89 between the theory-consistent tariffs and the simple-average tariffs. We offer more comparisons between the three sets of tariffs in the next section.

4 Aggregation Methods Matter: Some Applications

This section has three related objectives. First, we want to demonstrate that our theory-consistent tariffs are different from both their simple-average and import-weighted counterparts. To this end, we offer some descriptive analysis based on the TCT database. Second, we want to show that the differences between the aggregated tariffs have important empirical/policy implications. To this end, we obtain and compare three sets of trade-elasticity estimates that correspond to the three aggregated tariff variables in the TCTD. Finally, and most difficult and important, we want to show that the theory-consistent tariffs are better than the available alternatives. To pursue this objective, we focus on some specific examples where the TCTs clearly dominate the SATs and IWTs, and we offer further evidence for the benefits of using TCTs over SATs and IWTs for calculating the deadweight loss of protection.

4.1 TCTs Are Different: A Descriptive Analysis

To highlight the differences between the theory-consistent tariffs vs. the simple-average and the import-weighted tariffs, we compare these three variables based on the TCT database.[28] We find the following. In terms of co-movement, the three sets of tariffs are highly, but not perfectly, correlated. Specifically, as discussed before, the correlation is 0.89 between the TCTs and SATs and 0.88 between the TCTs and IWTs. The correlations remain high across countries and across sectors too, but they are also quite heterogeneous, including correlations

[28] In the previous section, we already saw that the three sets of tariffs can be quite different based on the full TCT database. However, for a clearer and more consistent comparison, the analysis in this section is based on a sample of 25,050,077 observations that only include non-missing values for all three aggregated tariffs.

below 0.6 between both the TCTs vs. SATs and TCTs vs. IWTs.[29]

In terms of aggregate tariff levels, and as reported in Table 6, the mean TCT over the common sample of 25,050,077 bilateral-industry-year observations is 8.14%, the mean SAT is 8.67%, and the mean IWT is 8.58%. The finding that TCTs are lower is systematic; the theory-consistent tariff is the smallest of the three for 73.6% of importers and 66.4% of industries, lying on average about 0.53 percentage points below the simple average tariff and as much as 4–8 points below in individual importers and industries.[30] Based on this analysis, we conclude that, while the correlations between the theory-consistent tariffs and the simple-average and import-weighted tariffs are generally high, there are many instances in which the TCTs are quite different from the corresponding SATs and IWTs.

4.2 TCTs Have Important Implications: The Trade Elasticity

To demonstrate the importance of the differences between the theory-consistent vs. other tariffs, we obtain and compare three sets of corresponding estimates of the most important parameter in international trade – the trade elasticity. To this end, we combine the newly constructed TCT database with the latest edition of the ITPD-E, and we rely on the following econometric specification, which is based on the recommendations of Larch, Shikher and Yotov (2025), to estimate the impact of tariffs (and the corresponding tariff elasticities) for each of the goods industries in the ITPD-E.[31]

$$X^s_{ij,t} = \exp\big[\,\eta^s_\tau \,\ln \hat{\tau}^s_{ij,t} + GRAV_{ij}\,\gamma^s + POLICY_{ij,t}\,\alpha^s + GLOB^s_{ij,t}\,\beta^s + \phi^s_{i,t} + \psi^s_{j,t}\big]\,\epsilon^s_{ij,t}. \quad (13)$$

[29]For example, the correlations between TCTs and IWTs for 'Grain mill products' and 'Animal feed ingredients and pet foods' are 0.5 and 0.58, respectively. Similarly, the correlation between TCTs and SATs for 'Processing/preserving of meat' is 0.53.

[30]Table 7 reports the average tariffs by ITPD-E industry together with the corresponding number of observations over the complete TCT database. Industry 34 (Electricity production, collection, and distribution) is dropped. The reason is that trade is observed only in one year (1988), which is insufficient to estimate the product-level gravity model. For the remaining 152 industries, both the mean tariffs and the observation counts vary substantially across industries, which underscores the value of using a consistent aggregation method to capture the relevant tariff burden in each one.

[31]This specification is the sector-level analogue of the product-level econometric model of Fontagné, Guimbard and Orefice (2022), which we implemented in Section 3.2.

Here, $\hat{\tau}^s_{ij,t}$ denotes aggregated tariffs, and we will experiment with each of the three tariff variables in the TCTD, i.e., the TCTs, the SATs, and the IWTs; η^s_τ is the industry-specific tariff elasticity; as before, $GRAV_{ij}$ collects time-invariant bilateral gravity variables (distance, contiguity, common language, and colonial ties), and $POLICY_{ij,t}$ includes time-varying bilateral policies (RTAs, WTO membership, EU membership, customs unions, economic integration agreements, and complete and partial trade sanctions); $GLOB^s_{ij,t}$ is a new term, which is a vector of industry-time-varying indicators for international borders;[32] finally, $\phi^s_{i,t}$ and $\psi^s_{j,t}$ are exporter-industry-time and importer-industry-time fixed effects (analogous to $\phi^k_{i,t}$ and $\psi^k_{j,t}$ in Section 2). As before, we estimate (13) industry by industry with the PPML estimator (Santos Silva and Tenreyro, 2006) and cluster the standard errors by country-pair (Egger and Tarlea, 2015).

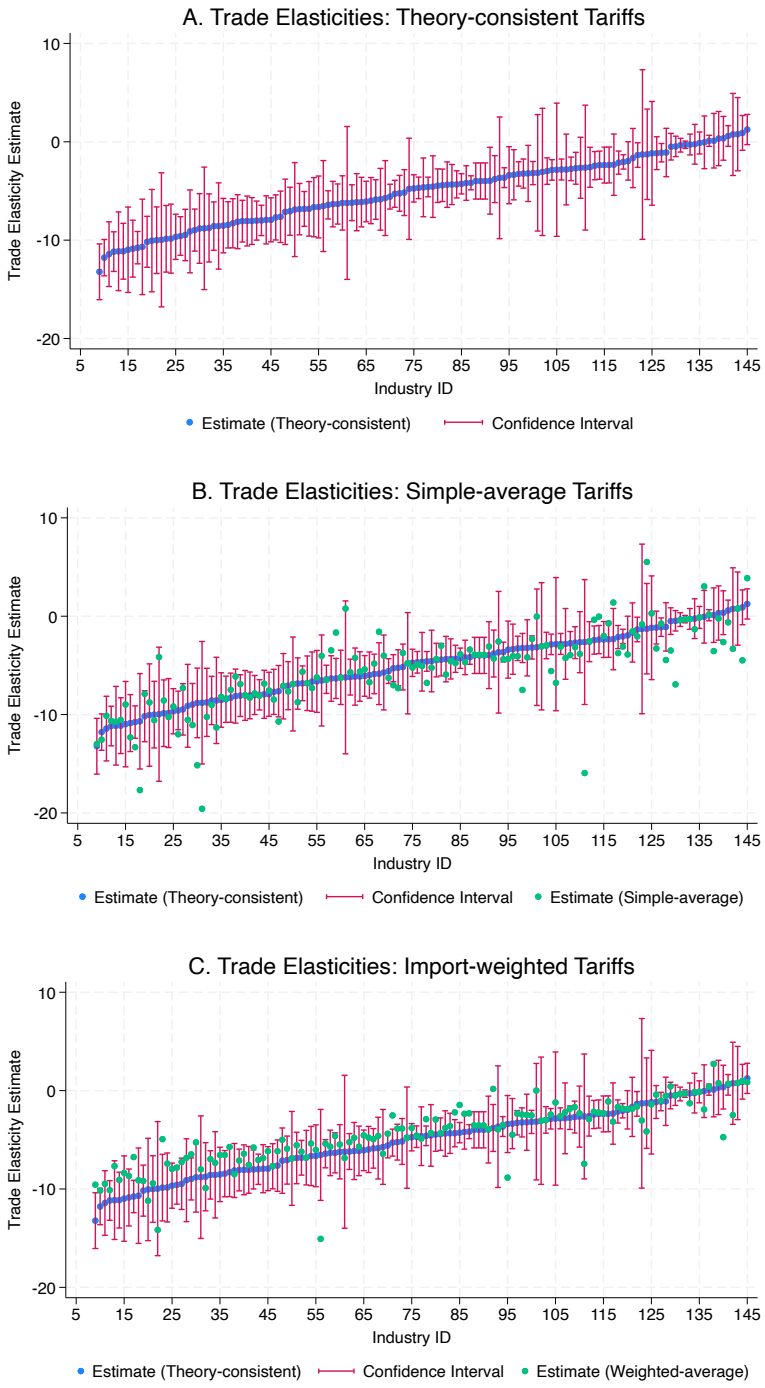
Given the objective of our paper, we focus the discussion of our results exclusively on the impact of tariffs. We do note, however, that the estimates of the remaining covariates are plausible in terms of magnitudes and when compared to corresponding results from the existing literature. Our tariff-elasticity estimates and their standard errors for each of the ITPD-E goods industries are visualized in Figure 4, after dropping the top and bottom 5% of the TCT estimates for clarity.[33]

We draw three conclusions from the estimates in panel A of Figure 4, which are obtained with the theory-consistent tariffs. First, the vast majority of the tariff elasticities are negative and statistically significant, as expected: tariffs are a significant impediment to international trade. Second, with an average value of -5.25, our estimates are comparable to benchmarks in the existing literature. Third, the elasticity estimates vary substantially across the ITPD-E industries; some of this variation – e.g., the smaller (in absolute value) tariff elasticities

[32]The main difference between specification (13) and the corresponding product-level estimating equation (9) is that the dependent variable in (13) includes domestic trade. To account for domestic trade frictions, we include domestic distance in $GRAV_{ij}$. The border-indicator vector $GLOB^s_{ij,t}$ captures common (across countries) border effects and globalization trends.

[33]We could not obtain convergence for two industries, namely '15. Prepared vegetables', due to convergence issues, and '34. Electricity production, collection, and distribution', since we did not have elasticity estimates for it. The full set of estimates appears in Table 8 of the Appendix.

Figure 4: ITPD-E Industry-Level Tariff Elasticity Estimates



Note: This figure visualizes the estimates from Table 8, which are obtained from specification (13). The dependent variable is nominal industry-level bilateral trade in levels. The estimator is PPML, and all estimates are obtained with exporter-industry-time fixed effects, importer-industry-time fixed effects, and a rich set of time-varying and time-invariant gravity variables, whose estimates are omitted for brevity. The standard errors are clustered by country-pair. For clarity, the figure omits industries with the bottom and top 5% of the trade elasticity estimates that are based on the TCTs. Panel A reports the estimated tariff elasticities and their corresponding confidence intervals when the key tariff covariate is the theory-consistent tariff variable. Panel B adds to the results from panel A the corresponding estimates that are based on simple-average tariffs. Finally, panel C adds to the results from panel A the elasticity estimates that are obtained with import-weighted tariffs. See text for further details.

for agriculture – is intuitive.

Turning to the estimates from panels B and C of Figure 4, which compare the trade elasticities from TCTs vs. SATs and TCTs vs. IWTs, respectively, we note the following. The estimates in panel B reveal that the TCT and SAT elasticities are highly correlated ($\rho = 0.92$). Moreover, the two sets of elasticities are very similar on average, i.e., 5.2 vs. 5.3. Most importantly for our purposes, panel B reveals many instances in which the TCT trade elasticities are quite different from the corresponding SAT indexes. The correlation between the TCT and IWT elasticities, which we plot in panel C of Figure 4, is also very high – $\rho = 0.96$. However, the figure shows a clear and systematic difference in the magnitudes of the two elasticities. Specifically, the average TCT elasticity is 5.2, which is larger than the corresponding IWT elasticity of 4.5.

Based on the analysis in this subsection, we conclude that, while the correlations between the trade elasticities that are obtained with the theory-consistent tariffs and those based on the simple-average and import-weighted tariffs are generally high, there are many instances in which the TCT trade elasticities are very different from the corresponding SAT and IWT elasticities. In turn, large differences in the trade elasticities translate into large differences in the corresponding trade and welfare GE indexes, even if the initial tariffs and their changes are identical.

4.3 TCTs Are Better: Some Data Examples and Applications

This section demonstrates that the TCTs outperform the SATs and IWTs. To this end, we offer two sets of analysis. First, we focus on extreme examples where the differences between the TCTs and SATs/IWTs are very large, highlighting the advantages of the TCTs and their ability to correct the deficiencies of the SATs and IWTs. We also use these cases to calculate the corresponding deadweight losses from the imposition of the different aggregated tariffs, and, by benchmarking against the corresponding fully disaggregated analysis, we show that the TCTs deliver results that are significantly closer to the benchmarks than SATs or IWTs.

We first demonstrate that the TCTs dominate the import-weighted tariffs. To this end, we focus on two specific examples in ITPD industry 53, "Tobacco products": (i) exports from Moldova to the United States in 2023, and (ii) exports from Georgia to the United States in 2010. We selected these cases because they have the largest differences between TCTs and IWTs among all observations with the United States as the importer. Note that in each case, there is only one observation with non-zero product-level trade, and the non-missing trade is associated with an extreme (min or max) level of product-level tariff. Panel A of Table 4 reports the HS-level inputs that are needed to aggregate the tariffs for the exports from Moldova to the United States in 2023, and panel B of the same table reports the corresponding statistics for the exports from Georgia to the United States in 2010.

According to panel A (exports from Moldova to the United States in 2023), the only product with positive observed trade is HS 240220 ("Cigarettes containing tobacco"), which enters duty free. The import-weighted tariff therefore equals 0%, even though the industry contains a line taxed at 350%. The net-of-tariff weights $\hat{f}^k_{ij,t}$ instead place 98.8% of the mass on HS 240310 ("Smoking tobacco"), the 350% line, whose predicted free-trade trade (72,011.20) dwarfs every other product. This implies that the theory-consistent tariff is 332.95%.[34] The import-weighted measure understates the tariff burden by the full 332.95 percentage points, because of the well-known deficiency of the IWTs, the high-tariff lines have been substituted down to zero observed trade, and so receive zero weight. The TCTs overcome this deficiency.

The second example (exports from Georgia to the United States in 2010, from panel B of Table 4) is the mirror image. Now the only line with observed non-zero trade is a high-tariff product, HS 240399 ("Other manufactured tobacco"), with a tariff rate of 350%.[35] Thus, the import-weighted tariff is 350%. However, the theory-consistent net-of-tariff weights load mostly (99.6%) on HS 240220, which enters duty free and whose predicted free-trade value

[34]The industry-level tariff elasticity needed for the aggregation is $\eta^s_\tau = -0.68$.

[35]The observed value in this product is only $5, which is likely to be data error in TRAINS, but it makes for a good example.

Table 4: HS-Level TCT Inputs for the United States, "53: Tobacco products"

k (1)	$X^k_{ij,t}$ (2)	$t^k_{ij,t}$ (%) (3)	$\hat{\eta}^k_\tau$ (4)	$\hat{X}^k_{ij,t}$ (5)	$\hat{f}^k_{ij,t}$ (6)	$\widehat{DWL}^k_{ij,t}$ (7)
A. Exports from MDA to USA, 2023						
240210	0	0	−0.59	0.51	0.51	0.00
240220	162,208	0	−0.99	729.17	729.17	0.00
240290	0	4.06	−0.32	2.54	2.58	0.00
240310	0	350	−0.68	25,912.47	72,011.20	59,237.35
240391	0	175	−2.48			
240399	0	2.5	−0.90	142.77	145.96	0.08
Total	162,208			26,787.46	72,889.42	59,237.43
B. Exports from GEO to USA, 2010						
240210	0	0	−0.59	1.56	1.56	0.00
240220	0	0	−0.99	349.43	349.43	0.00
240290	0	15.3	−0.32			
240310	0	350	−0.68			
240391	0	175	−2.48			
240399	5	350	−0.90	0.00	0.00	0.00
Total	5			350.99	350.99	0.00

Notes: This table reports the statistics for the various components that are needed to construct aggregated tariffs for industry "53: Tobacco products" according to equation (7), for the two observations with the largest theory-minus-import-weighted tariff gaps among all cells in which the United States is the importer. The data in panel A are for the exports from Moldova (MDA) to the United States (USA) in 2023, and the data in panel B are for the exports from Georgia (GEO) to the United States in 2010. Column (1) reports the six-digit HS product code; column (2) includes the observations for observed trade, $X^k_{ij,t}$, in current USD; $t^k_{ij,t} = 100 \times (\tau^k_{ij,t} - 1)$ in column (3) is the applied ad valorem tariff rate (so the tariff factor is $\tau^k_{ij,t} = 1 + t^k_{ij,t}/100$); the estimated product-level tariff elasticities, $\hat{\eta}^k_\tau$, are included in column (4); finally, the predicted trade flows, $\hat{X}^k_{ij,t}$, and the predicted net-of-tariff trade flows, $\hat{f}^k_{ij,t} = \hat{X}^k_{ij,t}/(\tau^k_{ij,t})^{\hat{\eta}^k_\tau}$, which serve as the weights in the aggregation, are reported in columns (5) and (6), respectively. Column (7) reports the product-level deadweight loss, $\widehat{DWL}^k_{ij,t}$, obtained by applying equation (14) to the predicted trade flows $\hat{X}^k_{ij,t}$ in column (5). Note that the elasticity entering that formula is the product-level elasticity of substitution, $\hat{\sigma}^k = 1 - \hat{\eta}^k_\tau$, and not the tariff elasticity reported in column (4) itself; see the discussion following equation (14). The *Total* rows report the corresponding column sums, and the sum in column (7) is the 'true' (disaggregated) industry-level deadweight loss based on the predicted trade flows. All trade values and deadweight losses are expressed in U.S. dollars. All decimal values are rounded to two places. Empty cells indicate missing values (no gravity prediction available). In panel B, the predicted trade of HS 240399 is positive but numerically negligible, so columns (5)-(7) round to zero. See text for further details.

(349.43) is by far the largest. As a result, the theory-consistent tariff is only 0.005%,[36] i.e., about 350 percentage points below the corresponding import-weighted tariff. Once again, this example supports our key argument from Section 2: because import weights are computed from realized trade, they load on whichever products happen to retain trade – the lowest- or the highest-tariff lines – and can err in either direction. Our theory-consistent weights, which net out the impact of tariffs, are immune to this and deliver aggregated tariffs that reflect the full within-industry tariff schedule.

The same exercise for the simple-average tariff is even more stark because the simple average ignores trade entirely. Table 5 reports the two cells with the largest theory-minus-simple gaps among the observations with the United States as the importer (panels A and B); in both cells, the observed trade is zero, so only the theory-consistent and simple measures are defined. In the first (Albania to the United States in 2024), essentially all of the free-trade weight falls on a single high-tariff line (HS 240310 with 350% tariff), so the theory-consistent tariff is 349.58%,[37] whereas the simple average, which puts equal weights on all six lines, four of which are taxed at 4.06% or less – is only 88.59%; the theory-consistent measure thus exceeds the simple average by 260.98 percentage points. In the second (North Macedonia to the United States in 1996), the only line that carries weight is the duty-free HS 240220, so the theory-consistent tariff is exactly 0%,[38] while the simple average is pushed up to 175% by the three lines with 175-350% tariffs that have no predicted trade and hence zero weight in the theory aggregator; here the theory-consistent tariff lies 175 percentage points below the simple average. The simple average thus errs in opposite directions – far too high in the second cell and far too low in the first – because it weights tariff lines without regard to their economic relevance.

We conclude the analysis by demonstrating that the TCTs perform better than the SATs

[36]The industry-level tariff elasticity for this calculation is $\eta_\tau^s = -0.99$.
[37]The industry-level tariff elasticity needed for the aggregation is $\eta_\tau^s = -0.68$.
[38]The industry-level tariff elasticity for this calculation is $\eta_\tau^s = -0.99$.

Table 5: HS-Level TCT Inputs for the United States, Theory-vs.-Simple-Average Extremes

k (1)	$X^k_{ij,t}$ (2)	$t^k_{ij,t}$ (%) (3)	$\hat{\eta}^k_\tau$ (4)	$\hat{X}^k_{ij,t}$ (5)	$\hat{f}^k_{ij,t}$ (6)	$\widehat{DWL}^k_{ij,t}$ (7)
A. Exports from ALB to USA, 2024, $s = 53$ ("Tobacco products")						
240210	0	0	−0.59			
240220	0	0	−0.99	3.38	3.38	0.00
240290	0	4.06	−0.32			
240310	0	350	−0.68	3,669.53	10,197.69	8,388.75
240391	0	175	−2.48			
240399	0	2.5	−0.90			
Total	0			3,672.91	10,201.07	8,388.75
B. Exports from MKD to USA, 1996, $s = 53$ ("Tobacco products")						
240210	0	0	−0.59			
240220	0	0	−0.99	979.94	979.94	0.00
240290	0		−0.32			
240310	0	350	−0.68			
240391	0	175	−2.48			
240399	0	350	−0.90			
Total	0			979.94	979.94	0.00

Notes: This table reports, in the format of Table 4, the HS-level inputs for the two observations with the largest theory-minus-simple-average tariff gaps among all cells in which the United States is the importer: panel A, exports from Albania (ALB) to the United States (USA) in 2024; panel B, exports from North Macedonia (MKD) to the United States in 1996. Both cells fall in sector $s = 53$ ("Tobacco products"). All columns are defined exactly as in Table 4; in particular, column (7) is built from the product-level elasticity of substitution $\hat{\sigma}^k = 1 - \hat{\eta}^k_\tau$ rather than from the tariff elasticity in column (4). The *Total* rows report the column sums, with the sum in column (7) the 'true' (disaggregated) industry-level deadweight loss based on the predicted trade flows. Observed trade is zero for every HS line in both cells, so the import-weighted tariff is undefined, and the relevant comparison is between the theory-consistent and the simple-average tariffs. Only lines with a gravity prediction carry weight: in panel A a single line (HS 240310) accounts for 99.97% of it, and in panel B a single duty-free line (HS 240220) carries all of it, while the remaining lines enter only the simple average. The tariff of HS 240290 is not reported in panel B, so that line is excluded from the simple average as well. All trade values and deadweight losses are expressed in U.S. dollars. All decimal values are rounded to two places; empty cells indicate no gravity prediction is available.

and IWTs when calculating the deadweight loss from protection.[39] To this end, we proceed in three steps. First, we use disaggregated (product-level) data to calculate the deadweight loss for an aggregate industry. By construction, this is the 'true' deadweight loss. Then, we use the aggregated data directly to calculate the corresponding industry-level deadweight losses with each of the three tariff measures. Finally, we compare the disaggregated (true) deadweight loss with each of the deadweight losses obtained with the aggregate tariffs. To perform this analysis, we build on the examples from Tables 4 and 5. Throughout, we evaluate deadweight loss at the predicted trade flows $\hat{X}^k_{ij,t}$ rather than at the observed trade. This choice is essential rather than incidental: when a tariff is close to prohibitive, observed trade is driven to zero precisely by the distortion whose cost we wish to measure, so evaluating at observed trade would mechanically assign a zero welfare loss to exactly those products that are most distorted. The predicted flows, which are available whenever a gravity prediction exists, provide the counterfactual base against which the deadweight loss can be assessed.

To perform the deadweight analysis, we follow Anderson and Neary (2005) and Kee, Nicita and Olarreaga (2008), and rely on the standard Harberger approximation of the deadweight loss from the imposition of a tariff relative to free trade in sector s:

$$DWL^s_{ij} \;\approx\; \tfrac{1}{2}\,\hat{\sigma}^s_{ij,t}\,\frac{\left(t^s_{ij}\right)^2}{1+t^s_{ij}}\,X^s_{ij}, \qquad t^s_{ij}=\tau^s_{ij}-1, \qquad \hat{\sigma}^s_{ij,t}=1-\hat{\eta}^s_{ij,t,\tau}, \tag{14}$$

which is linear in the aggregate elasticity of substitution $\hat{\sigma}^s_{ij,t}$ and *quadratic* in the aggregate tariff t^s_{ij}.[40]

The elasticity that enters (14) is the elasticity of substitution $\hat{\sigma}^s_{ij,t}$ and not the estimated tariff elasticity $\hat{\eta}^s_{ij,t,\tau}$ itself. The reason is that the deadweight loss is a triangle in the

[39] In principle, the structural gravity model can be used to perform welfare analysis in a full GE setting. However, since disaggregated production data are not available, we cannot calculate welfare indexes. Therefore, we focus on partial equilibrium deadweight losses.

[40] The $1/(1+t^s_{ij})$-refinement is a correction as we measure trade flows X^s_{ij} inclusive of tariffs. We will work directly with equation (14) to calculate the deadweight loss, implying that we assume a move from zero to the observed level of tariffs. To evaluate a change from $\tau^s_{ij,0}$ to $\tau^s_{ij,1}$ one differences (14); the induced trade response is, to first order $\Delta \ln X^s_{ij} \;\approx\; \hat{\sigma}^s_{ij,t}\,\Delta\tau^s_{ij}/\left[\tfrac{1}{2}\left(\tau^s_{ij,0}+\tau^s_{ij,1}\right)\right]$, the elasticity-weighted, midpoint proportional change in trade.

quantity response to the tariff, whereas $\hat{\eta}^s_{ij,t,\tau}$ is estimated on trade *values* at delivered prices and therefore corresponds to $1-\hat{\sigma}^s_{ij,t}$ in the CES interpretation of equation (2). Accordingly, we set $\hat{\sigma}^s_{ij,t} = 1 - \hat{\eta}^s_{ij,t,\tau}$ throughout, and we apply the same transformation to the product-level elasticities, $\hat{\sigma}^k = 1 - \hat{\eta}^k_\tau$, when we compute the disaggregated deadweight losses in column (7) of Tables 4 and 5. Note that this transformation rescales all four measures – the disaggregated benchmark and the three aggregate-based losses – by a comparable factor, so it affects the levels of the deadweight losses but not the comparisons that are of interest here.

Both ingredients – the tariff (change) and the elasticity – must be theory-consistent aggregates. Replacing them with a trade-weighted or simple average tariff and an a-theoretical elasticity introduces two errors that compound in (14). Because the deadweight loss is quadratic in the tariff, an aggregate that is off by an order of magnitude – as in the cells of Tables 4 and 5 – distorts the implied welfare cost by up to two orders of magnitude.[41]

We stress that (14) is a local approximation; at the very high (and often capped) tariffs that appear in these cells it is only indicative, and reliable magnitudes would require a structural general-equilibrium calculation. The qualitative lesson – that the tariff and the elasticity entering any such calculation must be the matched, theory-consistent aggregates – is independent of that caveat.

Column (7) of Tables 4 and 5 reports the product-level deadweight losses, which are calculated according to equation (14) and based on the predicted trade flows. Summing the product-level deadweight losses delivers the 'true' industry deadweight losses, which are reported in the rows *Total* and equal 59,237.43 for the Moldova-United States cell (panel A of Table 4) and essentially zero for the Georgia-United States cell (panel B of the same table).

Applying the Harberger formula (14) instead with each of the three aggregate tariffs (using the same predicted trade) yields markedly different numbers. In panel A of Table 4, the theory-consistent tariff implies a deadweight loss of 57,719.10 – within about 3% of the

[41] The same logic governs the domestic elasticity $\hat{\eta}^s_{jj,\tau}$, which drives domestic sales and employment and is central to the political economy of tariff changes.

true value – whereas the simple-average tariff implies only 9,381.70 and the import-weighted tariff implies exactly zero. The latter is the starkest possible illustration of the deficiency of the IWTs: because the import-weighted tariff is itself zero, this measure attributes no welfare cost whatsoever to an industry in which one line is taxed at 350%.

In panel B of Table 4 the errors run the other way: the theory-consistent tariff reproduces the true value of essentially zero, while the import-weighted and the simple-average tariffs imply entirely spurious welfare costs of 950.25 and 309.43, respectively. In both cells, the theory-consistent aggregate tracks the disaggregated (true) deadweight loss, whereas the import-weighted and simple-average measures err by orders of magnitude and in either direction – exactly as the quadratic dependence of (14) on the aggregate tariff predicts.

The theory-vs.-simple-average cells in Table 5 carry the same message, now with the import-weighted measure undefined because observed trade is zero throughout. Summing the product-level deadweight losses in column (7) gives a 'true' industry deadweight loss of 8,388.75 for the Albania-United States cell (panel A) and exactly zero for the North Macedonia-United States cell (panel B). Evaluating (14) with the theory-consistent aggregate tariff reproduces 8,384.48 in panel A – within 0.1% of the true value, because a single line (HS 240310) carries almost all the weight – and exactly zero in panel B, where the only line carrying weight is duty free. The simple-average tariff, by contrast, implies a deadweight loss of only 1,283.72 in panel A, less than a sixth of the true welfare cost, and a fictitious loss of 1,086.05 in panel B, where the true cost is zero. Once again, the theory-consistent aggregate stays close to the disaggregated (true) deadweight loss while the a-theoretical simple average is off by orders of magnitude and in either direction. Taken together, the four cells deliver our central message: the theory-consistent aggregate tracks the disaggregated deadweight loss closely, while the import-weighted and the simple-average measures err by orders of magnitude and in both directions.

5 Conclusion

Empirical trade and policy analysis uses aggregated tariffs, which have, until now, been constructed using one of two atheoretical procedures — simple averages or import-weighted averages — each carrying well-known deficiencies. We proposed and implemented a theory-consistent alternative tariff aggregator. Based on the workhorse structural gravity model, our aggregator (i) weights product-level tariffs by predicted tariff-free imports rather than observed imports, (ii) explicitly incorporates trade elasticities at both product and industry levels, and (iii) nests the simple-average and import-weighted tariffs as special cases, making the differences from each transparent. Implementing the procedure on 6-digit HS tariffs from TRAINS and trade from COMTRADE, mapped to the industry structure of the USITC's International Trade and Production databases, we constructed the Theory-Consistent Tariff Database, which reports theory-consistent, simple-average, and import-weighted tariffs (TCTs, SATs, and IWTs, respectively) for 153 goods industries and more than 200 countries over more than three decades (1986-2023).

Three findings underscore the significance of the method of aggregation. First, although the three tariff aggregates (TCTs, SATs, and IWTs) are highly correlated on average, they diverge significantly for many importers and industries, with the theory-consistent tariffs being systematically the lowest of the three. Second, alternative tariff aggregates lead to different estimates of the trade elasticity, with implications for both the partial and general-equilibrium effects of tariff changes on trade and welfare. Third, and most importantly, in a deadweight-loss exercise benchmarked against fully disaggregated data, the theory-consistent tariffs deliver deadweight losses that are closest to the 'true' benchmark, while the deadweight losses based on the simple-average and import-weighted tariffs diverge from the benchmark by up to several orders of magnitude, and in either direction. Because the TCT weights are constructed from predicted net-of-tariff trade rather than observed trade, they are available precisely where the import-weighted tariffs break down (i.e., when trade is thin, zero, or missing), which is exactly where mismeasurement of protection is most consequential.

Our contribution is methodological and complementary to ongoing efforts to improve the underlying raw tariff data: the aggregator can be applied to any disaggregated tariff source, at any level of aggregation, and with elasticities either estimated internally or borrowed from the literature. Given the renewed importance of tariffs in the global policy agenda, we hope that our methods and the freely available TCT database will provide researchers and policymakers with a theory-grounded and easy-to-implement foundation for measuring protection and its consequences.

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A Analytical Properties of the Theory-Consistent Tariff Aggregator

This appendix derives a closed-form expression for the theory-consistent aggregator T_T, characterizes its limiting behavior as the elasticity η^1 varies, and establishes formal comparisons with the simple-average and import-weighted aggregators.

A.1 Setup

Consider K products indexed by $k = 1, \ldots, K$, with tariff factors $\tau^k \geq 1$ (the corresponding percentage tariffs are $t^k = 100(\tau^k - 1)$), observed import values $X^k > 0$, observed import shares $s^k \equiv X^k / \sum_j X^j$, and product-level demand elasticities $\eta^k > 0$. In the notation of the main text, η^k corresponds to the absolute value of the (negative) tariff elasticity, i.e. $\eta^k = -\hat{\eta}^k_\tau$, and $\bar{\eta}$ below corresponds to $-\hat{\eta}^s_{ij,\tau}$. The three aggregators are

$$T_S \equiv \tfrac{1}{K} \sum\nolimits_k \tau^k \qquad \text{(simple average)}, \tag{15}$$

$$T_W \equiv \sum\nolimits_k s^k \tau^k \qquad \text{(import-weighted average)}, \tag{16}$$

$$T_T \equiv \left(\sum\nolimits_k \tilde{s}^k (\tau^k)^{-\eta^k} \right)^{-1/\bar{\eta}} \qquad \text{(theory-consistent, eq. 17)}, \tag{17}$$

where $\tilde{s}^k \equiv X^k (\tau^k)^{\eta^k} / \sum_j X^j (\tau^j)^{\eta^j}$ are the "free-trade" import shares and $\bar{\eta} \equiv \sum_k \tilde{s}^k \eta^k$ is the corresponding weighted elasticity. We work throughout in tariff-factor form; percentages are recovered by $100(T - 1)$.

A.2 Closed-Form Expression for T_T

Substituting the definition of $\tilde{s}^k$ into (17), the $(\tau^k)^{\eta^k}$ factors in the weights cancel against the inner $(\tau^k)^{-\eta^k}$ terms *in the numerator only*, leaving total imports over a tariff-weighted sum:

$$\begin{aligned} T_T &= \left(\sum\nolimits_k \tilde{s}^k (\tau^k)^{-\eta^k} \right)^{-1/\bar{\eta}} = \left(\frac{\sum_k X^k}{\sum_k X^k (\tau^k)^{\eta^k}} \right)^{-1/\bar{\eta}} = \left(\frac{\sum_k X^k (\tau^k)^{\eta^k}}{\sum_k X^k} \right)^{1/\bar{\eta}} \\ &= \left(\sum\nolimits_k s^k (\tau^k)^{\eta^k} \right)^{1/\bar{\eta}}. \end{aligned} \tag{18}$$

The second equality substitutes $\tilde{s}^k$ and cancels $(\tau^k)^{\eta^k} (\tau^k)^{-\eta^k} = 1$ in the numerator; the third uses the negative exponent $-1/\bar{\eta}$ to invert the ratio; the fourth divides numerator and denominator by $\sum_k X^k$ to express the result in observed import shares s^k. Thus the theory-consistent aggregator is a CES generalized mean of the tariff factors using *observed* import shares s^k as weights, with the elasticity exponent $\bar{\eta}$ itself a CES-tilted average of the product-level elasticities.

A.3 The Common-Elasticity Benchmark

When $\eta^k = \eta$ for all k, we have $\bar{\eta} = \eta$ and (18) reduces to the power mean

$$T_T \;=\; M_\eta(\tau; s) \;\equiv\; \left(\sum\nolimits_k s^k (\tau^k)^\eta \right)^{1/\eta}. \tag{19}$$

Lemma A.1 (Power-mean inequality, Hardy-Littlewood-Pólya)**.** *For fixed weights $s^k > 0$ summing to one and values $\tau^k > 0$, $M_\eta(\tau; s)$ is non-decreasing in $\eta \in \mathbb{R}$, strictly so unless all τ^k are equal, and*

$$\lim_{\eta\to 0} M_\eta(\tau; s) = \prod\nolimits_k (\tau^k)^{s^k}, \qquad \lim_{\eta\to+\infty} M_\eta(\tau; s) = \max_k \tau^k.$$

At $\eta = 1$, $M_1(\tau; s) = \sum_k s^k \tau^k = T_W$.

Proof. Write $M_\eta \equiv M_\eta(\tau; s) = \big(\sum_k s^k (\tau^k)^\eta\big)^{1/\eta}$ for $\eta \neq 0$, and define $P(\eta) \equiv \sum_k s^k (\tau^k)^\eta$, so that $\ln M_\eta = \eta^{-1} \ln P(\eta)$.

Step 1: Monotonicity. Differentiate $\ln M_\eta$ with respect to η. Using $P'(\eta) = \sum_k s^k (\tau^k)^\eta \ln \tau^k$,

$$\frac{d}{d\eta} \ln M_\eta = -\frac{1}{\eta^2} \ln P(\eta) + \frac{1}{\eta} \frac{P'(\eta)}{P(\eta)} = \frac{1}{\eta^2} \left[\frac{\eta\, P'(\eta)}{P(\eta)} - \ln P(\eta) \right]. \tag{20}$$

Introduce the probability weights

$$\pi^k(\eta) \equiv \frac{s^k (\tau^k)^\eta}{P(\eta)}, \qquad \sum_k \pi^k(\eta) = 1, \quad \pi^k(\eta) > 0,$$

so that $P'(\eta)/P(\eta) = \sum_k \pi^k(\eta) \ln \tau^k \equiv \mathbb{E}_\pi[\ln \tau]$. The bracketed term in (20) becomes

$$\eta\, \mathbb{E}_\pi[\ln \tau] - \ln P(\eta) = \sum_k \pi^k \big(\ln(\tau^k)^\eta \big) - \ln P(\eta) = \sum_k \pi^k \ln \frac{(\tau^k)^\eta}{P(\eta)} = \sum_k \pi^k \ln \frac{\pi^k}{s^k},$$

where the last equality uses $(\tau^k)^\eta / P(\eta) = \pi^k / s^k$ from the definition of π^k. This final sum is the Kullback-Leibler divergence $D_{\mathrm{KL}}(\pi \,\|\, s) = \sum_k \pi^k \ln(\pi^k / s^k) \geq 0$, with equality if and only if $\pi^k = s^k$ for all k, i.e. if and only if all τ^k are equal. Since $1/\eta^2 > 0$, equation (20) gives $\frac{d}{d\eta} \ln M_\eta \geq 0$, strictly unless all τ^k coincide. Hence M_η is non-decreasing in η on $\eta \neq 0$, strictly so in the non-degenerate case; continuity at $\eta = 0$ (Step 2) extends monotonicity to all of $\mathbb{R}$.

Step 2: Limit as $\eta \to 0$. A Taylor expansion gives $(\tau^k)^\eta = e^{\eta \ln \tau^k} = 1 + \eta \ln \tau^k + O(\eta^2)$, so

$$P(\eta) = \sum_k s^k \big(1 + \eta \ln \tau^k + O(\eta^2)\big) = 1 + \eta \sum_k s^k \ln \tau^k + O(\eta^2).$$

Using $\ln(1 + x) = x + O(x^2)$,

$$\ln M_\eta = \frac{\ln P(\eta)}{\eta} = \frac{\eta \sum_k s^k \ln \tau^k + O(\eta^2)}{\eta} \xrightarrow[\eta\to 0]{} \sum_k s^k \ln \tau^k.$$

Exponentiating, $M_\eta \to \exp\big(\sum_k s^k \ln \tau^k\big) = \prod_k (\tau^k)^{s^k}$, the weighted geometric mean.

Step 3: Limit as $\eta \to +\infty$. Let $\tau_{\max} \equiv \max_k \tau^k$ and let $\mathcal{K}^* \equiv \{k : \tau^k = \tau_{\max}\}$ with total weight $s^* \equiv \sum_{k \in \mathcal{K}^*} s^k > 0$. Factor out the dominant term:

$$P(\eta) = (\tau_{\max})^\eta \sum_k s^k \left(\frac{\tau^k}{\tau_{\max}} \right)^\eta.$$

Each ratio satisfies $\tau^k / \tau_{\max} \leq 1$, equal to 1 for $k \in \mathcal{K}^*$ and strictly less than 1 otherwise; hence

$(\tau^k/\tau_{\max})^\eta \to \mathbf{1}\{k \in \mathcal{K}^*\}$ as $\eta \to \infty$, and the sum converges to s^*. Therefore

$$\ln M_\eta = \frac{1}{\eta}\ln P(\eta) = \ln \tau_{\max} + \frac{1}{\eta}\ln\Big(\underbrace{\sum_k s^k(\tau^k/\tau_{\max})^\eta}_{\to s^* \in (0,1]}\Big) \xrightarrow[\eta\to\infty]{} \ln \tau_{\max},$$

since the second term is $\eta^{-1}\ln(s^*) + o(\eta^{-1}) \to 0$. Exponentiating gives $M_\eta \to \tau_{\max} = \max_k \tau^k$.

Step 4: Value at $\eta = 1$. Direct substitution: $M_1 = \big(\sum_k s^k(\tau^k)^1\big)^{1/1} = \sum_k s^k\tau^k = T_W$. □

Proposition A.1 (Ordering with common elasticity)**.** *When $\eta^k = \eta$ for all k:*

(i) $T_T \gtreqless T_W$ if and only if $\eta \gtreqless 1$, with equality only if all τ^k are equal.

(ii) $T_T \to \max_k \tau^k$ as $\eta \to \infty$ and $T_T \to \prod_k (\tau^k)^{s^k}$ (the geometric mean) as $\eta \to 0$.

(iii) $T_S - T_W = -K\,\mathrm{Cov}_{\mathrm{u}}(s,\tau)$, where $\mathrm{Cov}_{\mathrm{u}}$ denotes covariance under uniform weights. Hence $T_S < T_W$ when imports are positively correlated with tariffs, and $T_S > T_W$ when they are negatively correlated.

Proof. (i)-(ii) follow from Lemma A.1. For (iii): $T_S - T_W = \sum_k (1/K - s^k)\tau^k = -\sum_k (s^k - 1/K)(\tau^k - \bar\tau) = -K\,\mathrm{Cov}_{\mathrm{u}}(s,\tau)$ where $\bar\tau = T_S$ and the second equality uses $\sum_k (s^k - 1/K) = 0$. □

Part (iii) explains the wedge between the simple and import-weighted curves in Panel A: as τ^1 rises, observed imports of product 1 collapse, generating a strong *negative* correlation between s and τ. Hence $T_W < T_S$ at high τ^1, with the wedge widening monotonically.

A.4 Sensitivity to η^1 (Heterogeneous Case)

We now hold trade flows, tariffs, and η^k for $k \neq 1$ fixed at their data values and treat T_T as a function of η^1 alone. Let $A(\eta^1) \equiv \sum_k s^k(\tau^k)^{\eta^k}$ and $C \equiv \sum_{k\neq 1} s^k(\tau^k)^{\eta^k}$, so that $A = s^1(\tau^1)^{\eta^1} + C$.

Theorem A.1 (Saturation as $\eta^1 \to \infty$)**.** *For any $\tau^1 \geq 1$ with $s^1 > 0$,*

$$\lim_{\eta^1\to\infty} T_T \;=\; \tau^1.$$

Proof. Take logs in (18): $\ln T_T = (\ln A)/\bar\eta$.

Case 1: $\tau^1 > 1$. Then $(\tau^1)^{\eta^1} \to \infty$, so $A = s^1(\tau^1)^{\eta^1}\big(1 + C/[s^1(\tau^1)^{\eta^1}]\big)$ and

$$\ln A = \ln s^1 + \eta^1 \ln \tau^1 + \ln\Big(1 + \tfrac{C}{s^1(\tau^1)^{\eta^1}}\Big) = \ln s^1 + \eta^1 \ln \tau^1 + o(1).$$

The free-trade share satisfies $\tilde s^1 = s^1(\tau^1)^{\eta^1}/A \to 1$ and $\tilde s^k \to 0$ for $k \neq 1$, so

$$\bar\eta = \tilde s^1\eta^1 + \sum_{k\neq 1}\tilde s^k\eta^k = \eta^1\big(1 + o(1)\big).$$

Therefore $\ln T_T = \big(\ln s^1 + \eta^1 \ln \tau^1 + o(1)\big)/\big(\eta^1(1+o(1))\big) \to \ln \tau^1$, i.e. $T_T \to \tau^1$.

Case 2: $\tau^1 = 1$. Then $(\tau^1)^{\eta^1} = 1$ for all η^1, so $A = s^1 + C$ is constant in η^1, and $\tilde s^1 = s^1/(s^1 + C)$ is a positive constant. Thus $\bar\eta = \tilde s^1\,\eta^1 + \sum_{k\neq 1}\tilde s^k\eta^k \to \infty$ linearly in η^1, and $\ln T_T = (\ln A)/\bar\eta \to 0$,

so $T_T \to 1 = \tau^1$. □

Remark on $\max_k \tau^k$. The classical result for the power mean with *common* elasticity gives $T_T \to \max_k \tau^k$ as $\eta \to \infty$ (Lemma A.1). Theorem A.1 sharpens this for the heterogeneous case: when only η^1 rises, the limit is τ^1 specifically. The two coincide whenever $\tau^1 = \max_k \tau^k$, which is the case in Panel B for both displayed pairs ($\tau^1 = 150\%$ and $\tau^1 = 300\%$, both exceeding $\tau^2 = 40\%$). For low-τ^1 pairs in Panel A (those with $\tau^1 < \tau^2$), increasing η^1 instead pushes T_T toward τ^1 from above, eventually *decreasing* the aggregate, an asymmetry not visible in the standard CES intuition.

Proposition A.2 (Limit as $\eta^1 \to 0$)**.** $\lim_{\eta^1 \to 0} T_T = \left(s^1 + \sum_{k \neq 1} s^k (\tau^k)^{\eta^k}\right)^{1/\bar{\eta}^0}$, *where* $\bar{\eta}^0 = \sum_{k \neq 1} \tilde{s}_0^k \, \eta^k$ *with* $\tilde{s}_0^k = s^k (\tau^k)^{\eta^k} / [s^1 + \sum_{j \neq 1} s^j (\tau^j)^{\eta^j}]$.

Proof. Set $\eta^1 = 0$ in (18): $(\tau^1)^0 = 1$, so $A \to s^1 + \sum_{k \neq 1} s^k (\tau^k)^{\eta^k}$; the contribution of η^1 to $\bar{\eta}$ vanishes, leaving the elasticity-weighted average over the remaining products. □

At $\eta^1 = 0$, product 1 enters T_T only through its share s^1, contributing additively as if it were tariff-free; the aggregator effectively averages products $2, \ldots, K$ under their own CES weights. Combined with Theorem A.1, T_T traces out a curve in η^1 that begins at a positive constant (Proposition A.2) and saturates at τ^1 (Theorem A.1). When $\tau^1 > \bar{\eta}^0$-mean of the remaining tariffs, this curve is monotonically increasing, as seen in Panel B for both pairs.

A.5 Why T_T Lies Below T_W in This Application

In the common-elasticity benchmark, Proposition A.1(i) implies $T_T > T_W$ whenever $\eta > 1$. In our calibration, however, $\eta^k = (2, 6, 4)$ is heterogeneous, and at the baseline $\eta^1 = 2$ Panel A shows $T_T < T_W$ throughout. The heterogeneity matters: applying Jensen's inequality to the convex function $x \mapsto x^{\bar{\eta}}$ with weights s^k gives $T_W^{\bar{\eta}} = (\sum_k s^k \tau^k)^{\bar{\eta}} \leq \sum_k s^k (\tau^k)^{\bar{\eta}}$, but the relevant comparison is between $T_W^{\bar{\eta}}$ and $\sum_k s^k (\tau^k)^{\eta^k}$, which need not satisfy any fixed-sign inequality. Specifically,

$$\sum\nolimits_k s^k (\tau^k)^{\eta^k} \; - \; \sum\nolimits_k s^k (\tau^k)^{\bar{\eta}} \; = \; \sum\nolimits_k s^k \Big[(\tau^k)^{\eta^k} - (\tau^k)^{\bar{\eta}} \Big],$$

which is negative when products with the largest tariff factors τ^k also have the smallest elasticities η^k relative to $\bar{\eta}$. In our data, product 1 has the highest τ^k at high τ^1 but the lowest elasticity ($\eta^1 = 2 < \bar{\eta} \approx 5$), pulling T_T below the level a common-elasticity aggregator would deliver, and in particular below T_W. This is a substantive consequence of estimating product-specific elasticities rather than imposing a uniform value.

B Additional Tables and Results

Table 6: Summary Statistics of the TCT Database: Common Sample

Variable	Obs	Mean	Std. dev.	Min	Max
industry_id	25,050,077	88.58557	39.09339	1	153
exporter_iso3	string variable; not summarized				
importer_iso3	string variable; not summarized				
year	25,050,077	2011.321	8.553439	1988	2024
tariff_theory	25,050,077	8.140803	20.58782	0	3000
tariff_weighted	25,050,077	8.57774	23.34435	0	3000
tariff_simple	25,050,077	8.669426	20.83256	0	2314.286

Notes: This table reports the same summary statistics as Table 3, but for the common sample of 25,050,077 bilateral-industry-year observations for which all three aggregated tariffs – the theory-consistent (`tariff_theory`), the import-weighted (`tariff_weighted`), and the simple-average (`tariff_simple`) – are simultaneously non-missing. This is the sample used for the descriptive comparison in Section 4.1. By construction, all three tariff measures are now computed over an identical set of cells, so their means are directly comparable, which is not the case in Table 3. `exporter_iso3` and `importer_iso3` are string variables and are not numerically summarized.

Table 7: Average Tariffs by ITPD-E Industry

Industry ID	Theory Tariff	N	Weighted Tariff	N	Simple Tariff	N
1	7	234884	7.38	40545	6.73	264684
2	10.82	244334	9.47	18074	10.82	244334
3	9.1	250797	9.3	49834	8.54	273173
4	8.68	455240	8.39	62694	8.19	540759
5	6.35	408773	4.57	29301	6.84	529207
6	12.05	41681	13.92	11049	12.05	41681
7	9.08	678748	6.47	150148	8.14	730438
8	5.4	284789	3.69	47779	5.68	339343
9	8.49	98383	7.39	2959	8.49	98383
10	22.52	126791	20.05	38469	22.52	126791
11	12.01	551578	7.83	105950	11.58	603647
12	15.5	659341	11.3	172322	16.66	682943
13	16.06	764873	12.32	142722	17.16	804945
14	13.9	445059	9.86	89712	15.14	480518
15	38.1	15171	40.62	2436	38.1	15171
16	12.01	419700	8.49	92704	13.03	456197
17	6.14	221413	4.74	17748	6.69	298941
18	3.86	87176	3.74	9787	7.36	156315
19	15.62	334800	14.5	34357	15.62	334800
20	7.04	713013	4.81	133941	6.7	772224
21	5.1	72532	2.19	14836	5.1	72532
22	11.09	565425	8.82	155095	13.37	593542
23	3.07	454465	2.44	63514	3.57	512964
24	18.51	352930	21.27	57066	19.98	403390
25	12.28	706222	9.07	170733	12.45	741792
26	7.76	944120	6.01	249329	7.63	999140
27	5.23	753632	3.44	125426	6.74	823944
28	11.39	737406	7.7	117211	12.52	821550
29	3	236373	1.78	33732	3.37	282891
30	2.18	73010	1.4	6927	3.06	129707
31	3.16	375432	1.85	41446	4.27	475086
32	1.51	49278	.93	12537	1.63	56949

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Industry ID	Theory Tariff	N	Weighted Tariff	N	Simple Tariff	N
33	5.04	953289	3.42	238242	5.22	1005259
35	6.82	39236	6.07	1143	6.82	39236
36	13.4	834426	13.18	167866	15.9	892274
37	12.44	993563	10.37	220724	13.78	1051833
38	16.88	832540	14.77	249781	17.62	860714
39	11.25	857092	9.28	201278	10.58	914335
40	16.23	641606	16.35	167136	17.86	665483
41	13.26	827387	11.96	187161	14.01	888946
42	12.32	554357	11.75	130827	12.79	597652
43	9	290589	7.7	108462	10.57	299425
44	17.89	450469	14.7	158786	18.18	458384
45	17.03	673629	16.29	108746	16.75	749115
46	17.37	580037	15.28	202974	16.21	601024
47	17.95	485469	14.81	115842	18.63	508959
48	14.1	771775	13.4	277992	14.95	794154
49	39.42	552689	35.46	158107	40.2	586718
50	35.62	370857	36.64	112126	43.81	398256
51	25.79	343899	21	95410	16.71	365661
52	18.51	561767	14.49	163551	18.83	586247
53	32.97	618359	32.77	120172	33.92	673539
54	10.42	895241	9.38	257804	10.66	952985
55	14.71	897365	13.4	304355	16.9	926541
56	17.41	563045	13.91	178272	18.28	585811
57	10.33	650157	8.96	167907	11.74	697975
58	10.31	732326	8.88	234082	11.15	760904
59	16.38	605312	14.38	278167	15.66	618058
60	17.32	939278	15.52	388431	18.57	954056
61	12.28	346896	8.07	81940	13.33	385465
62	6.23	521344	5.02	115121	7.19	561972
63	14.63	595670	12.76	253838	15.71	612050
64	15.7	720425	13.87	265858	16.6	737829
65	7.09	634985	4.28	151921	7.17	669151
66	9.45	669719	7.54	152814	10.73	713225
67	12.41	412986	9.07	120867	13.3	427071
68	10.02	330395	7.09	114239	10.61	348404
69	12.22	643110	9.29	223892	12.04	657703
70	6.36	700144	5.58	220425	6.57	727618
71	10.91	545427	8.97	202968	11.33	562292
72	11.62	702763	9.5	259715	11.76	725709
73	1.78	523761	1.48	236726	2.22	536401
74	1.81	253615	1.2	85836	1.75	260798
75	10.31	400767	7.99	147582	11.5	465052
76	10.09	682113	8.74	233286	10.8	704126
77	11.79	591416	9.74	239337	13.52	608875
78	3.55	196791	2.9	60248	3.55	196791
79	3.69	156654	2.39	22951	4.13	182797
80	5.98	644497	5.2	208765	5.23	672662
81	3.13	148804	2.22	42453	3.66	176565
82	5.28	933271	4.29	292885	5.37	1008183
83	2.8	671151	2.75	149667	3.48	753039
84	5.01	574769	4.72	220424	5.27	591187
85	6.06	408507	5.54	150990	5.93	428744
86	8.87	539111	8.18	208609	9.16	555155
87	3.7	703403	3.26	296865	3.83	720146
88	14.39	660783	11.24	282100	13.69	675671
89	7.58	854179	6.45	328400	8.33	873861
90	5.93	494262	5.27	132806	6.39	547522
91	11.97	535977	10.26	195370	11.26	554192
92	9.06	606201	8.4	279526	9.7	623420
93	11.15	722627	9.8	362417	11.57	736326
94	9.86	717832	9.62	279352	10.65	737929
95	11.62	534481	11.76	218869	13.02	548682
96	7.42	455981	5.99	115649	8.37	498969
97	13.55	599982	11.34	132388	13.51	632981
98	8.76	727812	6.74	101618	8.27	814171
99	11.33	607920	8.36	132402	12.31	655289

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Industry ID	Theory Tariff	N	Weighted Tariff	N	Simple Tariff	N
100	12.12	569012	9.12	129838	13.26	607939
101	8.18	690549	7	211370	9.04	721920
102	6.97	918212	6.12	277180	6.99	949087
103	5.96	904338	5.25	249521	6.35	946787
104	9.79	568636	8.77	198009	10.51	589211
105	8.52	527546	7.31	140527	9.77	550391
106	5.04	423701	4.44	96610	5.3	488908
107	8.14	734512	7.67	301018	9.23	752754
108	10.16	889780	9.42	379274	11.02	905907
109	5.11	605581	4.38	149646	5.2	646299
110	6.23	650547	5.61	294075	6.23	665677
111	6.74	337390	5.99	199893	6.9	347132
112	4.6	412713	3.69	135968	4.89	432988
113	5.03	744524	4.26	225195	5.4	772166
114	7.28	651174	6.37	316954	7.19	664712
115	4.23	594207	3.55	179934	4.23	622626
116	4.65	825108	3.96	254163	4.82	850691
117	3.75	344440	3.26	82083	3.94	389753
118	4.28	894943	3.6	247959	4.62	943966
119	4.48	703072	3.63	191656	4.52	748590
120	4.87	642428	4.18	190486	4.8	674090
121	14.37	543704	10.05	97178	15.47	665253
122	4.22	605860	3.69	259526	4.47	624185
123	11.83	697399	10.92	265605	13.03	720389
124	4.5	614852	3.53	291652	6.86	626696
125	5.58	762865	4.89	294130	6.08	779459
126	7.7	466653	7.07	264725	8.36	478016
127	9.67	549275	8.59	240063	10.1	567896
128	12.07	658937	9.77	210886	11.9	692522
129	11.75	497147	10.58	235799	12.11	510065
130	7.62	592225	6.53	267006	7.75	606618
131	5.33	535060	3.73	233819	5.91	548771
132	6.04	561760	4.7	245588	6.53	578916
133	11.29	705895	9.41	282622	13.07	720453
134	3.81	506557	3.27	246528	3.88	523071
135	4.92	803305	4.04	325899	5.31	820402
136	8.15	808907	6.46	235624	9.04	847738
137	11.21	595959	9.18	182188	12.29	620474
138	14.68	810174	13.1	243157	13.5	831180
139	7.9	606937	6.69	163455	10.34	637079
140	8.65	342479	8.04	225228	9.79	351170
141	4.77	695578	3.92	99943	4.99	852522
142	11.74	478351	8.07	86823	12.99	547044
143	4.31	416772	3.53	86197	4.72	494867
144	3.61	796675	2.56	172628	4.49	844192
145	13.11	365623	10.9	127377	14.46	381859
146	8.07	281024	7.86	129876	7.58	292490
147	11.05	279435	8.58	97096	11.05	279435
148	15.66	563782	13.14	271380	16.22	574563
149	13.62	695029	8.21	165169	13.21	723894
150	9.38	575806	6.91	146152	9.95	614578
151	9.89	419302	8.26	188930	10.64	432690
152	11.68	472045	9.8	198690	12.95	488128
153	11.83	869614	10.42	323849	13.64	889176

Table 8: ITPD-E Industry-Level Tariff Elasticity Estimates

ID	Industry Description	Broad Sector	TCT Elasticities Estim.	TCT Elasticities Std.Err.	SAT Elasticities Estim.	SAT Elasticities Std.Err.	IWT Elasticities Estim.	IWT Elasticities Std.Err.
1	Wheat	Agriculture	-3.988	(.938)	-3.92	(.955)	-3.533	(1)
2	Rice (raw)	Agriculture	-3.061	(3.301)	-3.061	(3.301)	-3.061	(3.301)
3	Corn	Agriculture	.097	(.287)	.18	(.29)	.419	(.201)
4	Other cereals	Agriculture	-4.33	(.703)	-4.768	(.931)	-2.205	(.52)
5	Cereal products	Agriculture	-4.632	(1.522)	-5.074	(1.484)	-4.874	(1.446)
6	Soybeans	Agriculture	-.301	(.191)	-.301	(.191)	-.301	(.191)
7	Other oilseeds (excluding peanuts)	Agriculture	-.499	(.69)	-3.486	(1.549)	.43	(.309)
8	Animal feed ingredients and pet foods	Agriculture	-.25	(1.031)	-1.324	(1.451)	-.143	(.584)
9	Raw and refined sugar and sugar crops	Agriculture	-3.988	(.938)	-3.92	(.955)	-3.533	(1)
10	Other sweeteners	Agriculture	-2.979	(.687)	-2.979	(.687)	-2.979	(.687)
11	Pulses and legumes, dried, preserved	Agriculture	-1.158	(.852)	-3.274	(.899)	-.404	(.934)
12	Fresh fruit	Agriculture	-5.237	(.929)	-7.312	(.926)	-3.861	(.798)
13	Fresh vegetables	Agriculture	-3.266	(.633)	-4.058	(.826)	-2.339	(.557)
14	Prepared fruits and fruit juices	Agriculture	-6.218	(1.408)	-6.255	(1.348)	-5.472	(1.329)
16	Nuts	Agriculture	-2.429	(.731)	-.368	(1.007)	-2.145	(.657)
17	Live Cattle	Agriculture	1.247	(.783)	3.876	(1.019)	.859	(.607)
18	Live Swine	Agriculture	4.054	(1.516)	4.988	(2.25)	4.176	(1.113)
19	Eggs	Agriculture	-.123	(.571)	-.123	(.571)	-.123	(.571)
20	Other meats, livestock products, and live animals	Agriculture	.903	(.902)	-4.483	(1.704)	.997	(.698)
21	Cocoa and cocoa products	Agriculture	-4.781	(2.626)	-4.781	(2.626)	-4.781	(2.626)
22	Beverages, nec	Agriculture	-2.375	(.73)	-.041	(.432)	-2.223	(.661)
23	Cotton	Agriculture	1.936	(.826)	3.422	(2.14)	2.51	(.95)
24	Tobacco leaves and cigarettes	Agriculture	-.344	(.356)	-.418	(.297)	-.328	(.325)
25	Spices	Agriculture	-1.95	(.994)	-3.889	(1.073)	-1.861	(1.804)
26	Other agricultural products, nec	Agriculture	-.469	(.529)	-6.927	(1.553)	-.508	(.687)
27	Forestry	Agriculture	-9.965	(3.477)	-4.151	(4.825)	-14.156	(3.117)
28	Fishing	Agriculture	-3.354	(1.301)	-4.068	(1.935)	-4.482	(1.08)
29	Mining of hard coal	Mining & Energy	-3.156	(3.02)	-.037	(3.371)	.009	(2.313)
30	Mining of lignite	Mining & Energy	-45.494	(30.638)	-47.566	(30.218)	-45.5	(30.626)
31	Extraction crude petroleum and natural gas	Mining & Energy	-1.293	(4.399)	-.826	(5.701)	-3.033	(3.15)
32	Mining of iron ores	Mining & Energy	42.284	(13.261)	44.273	(14.174)	42.281	(13.141)
33	Other mining and quarrying	Mining & Energy	1.821	(2.784)	5.67	(3.613)	.54	(2.373)
35	Gas production and distribution	Mining & Energy	8.868	(6.764)	8.868	(6.764)	8.868	(6.764)
36	Processing/preserving of meat	Manufacturing	-4.272	(.526)	-3.864	(.708)	-1.452	(.351)
37	Processing/preserving of fish	Manufacturing	-2.355	(.93)	-.719	(1.007)	-1.104	(.922)
38	Processing/preserving of fruit and vegetables	Manufacturing	-3.649	(.514)	-4.378	(.548)	-3.494	(.366)
39	Vegetable and animal oils and fats	Manufacturing	-.278	(.541)	-.296	(.959)	-1.284	(.848)
40	Dairy products	Manufacturing	-4.172	(.365)	-3.392	(.354)	-2.305	(.261)
41	Grain mill products	Manufacturing	-3.231	(.755)	-7.497	(1.12)	-2.431	(.806)
42	Starches and starch products	Manufacturing	-2.119	(.6)	-3.748	(.731)	-1.66	(.415)
43	Prepared animal feeds	Manufacturing	-4.463	(.87)	-4.355	(.8)	-2.937	(.75)
44	Bakery products	Manufacturing	-4.686	(.559)	-4.923	(.578)	-4.57	(.546)
45	Sugar	Manufacturing	-2.818	(.543)	-3.096	(.563)	-2.595	(.435)
46	Cocoa chocolate and sugar confectionery	Manufacturing	-2.864	(.531)	-5.575	(.507)	-2.435	(.435)
47	Macaroni noodles and similar products	Manufacturing	-6.824	(.902)	-5.652	(.901)	-6.215	(.814)
48	Other food products n.e.c.	Manufacturing	-4.594	(.51)	-6.777	(.648)	-2.901	(.406)
49	Distilling rectifying and blending of spirits	Manufacturing	-2.049	(.371)	-3.086	(.682)	-1.834	(.367)
50	Wines	Manufacturing	-3.18	(.6)	-2.313	(.697)	-2.514	(.527)
51	Malt liquors and malt	Manufacturing	-1.351	(.637)	-2.053	(.85)	-1.62	(.899)
52	Soft drinks; mineral waters	Manufacturing	-7.935	(1.143)	-7.546	(.849)	-6.155	(1.074)
53	Tobacco products	Manufacturing	-1.113	(.478)	-.748	(.372)	-1.02	(.386)
54	Textile fibre preparation; textile weaving	Manufacturing	-5.285	(.699)	-7.017	(.732)	-2.517	(.574)
55	Made-up textile articles except apparel	Manufacturing	-5.577	(.644)	-6.275	(.609)	-4.377	(.561)
56	Carpets and rugs	Manufacturing	-7.996	(.785)	-8.088	(.814)	-7.055	(.759)
57	Cordage rope twine and netting	Manufacturing	-6.129	(1.285)	-5.629	(1.458)	-5.69	(1.051)
58	Other textiles n.e.c.	Manufacturing	-4.193	(.895)	-4.675	(.858)	-2.357	(.742)
59	Knitted and crocheted fabrics and articles	Manufacturing	-6.415	(.732)	-6.487	(.925)	-5.384	(.676)
60	Wearing apparel except fur apparel	Manufacturing	-4.74	(.707)	-5.224	(.665)	-3.793	(.67)
61	Dressing and dyeing of fur; processing of fur	Manufacturing	.744	(2.129)	-3.307	(2.256)	-2.485	(1.105)
62	Tanning and dressing of leather	Manufacturing	-9.473	(1.332)	-7.298	(1.581)	-7.257	(1.108)
63	Luggage handbags etc.; saddlery and harness	Manufacturing	-3.218	(1.456)	-4.179	(1.486)	-2.471	(1.279)
64	Footwear	Manufacturing	-2.691	(.827)	-3.153	(.773)	-1.675	(.731)
65	Sawmilling and planing of wood	Manufacturing	-8.757	(1.767)	-10.235	(1.94)	-9.904	(1.318)
66	Veneer sheets plywood particle board etc.	Manufacturing	-1.088	(1.254)	-4.452	(1.317)	-.524	(1.063)
67	Builders' carpentry and joinery	Manufacturing	-2.817	(1.836)	-4.246	(1.648)	-2.19	(1.598)
68	Wooden containers	Manufacturing	-5.722	(1.943)	-4.011	(1.743)	-6.418	(1.777)
69	Other wood products; articles of cork/straw	Manufacturing	-6.334	(1.181)	-3.474	(1.478)	-5.692	(1.093)
70	Pulp paper and paperboard	Manufacturing	-11.129	(1.448)	-10.546	(1.561)	-9.075	(1.216)
71	Corrugated paper and paperboard	Manufacturing	-8.053	(1.212)	-8.281	(1.202)	-7.563	(1.101)
72	Other articles of paper and paperboard	Manufacturing	-8.978	(1.091)	-11.063	(1.154)	-6.474	(.922)
73	Publishing of books and other publications	Manufacturing	-1.177	(2.69)	.286	(3.997)	-1.395	(2.239)
74	Publishing of newspapers journals etc.	Manufacturing	-2.842	(3.455)	-6.774	(3.298)	-1.209	(3.262)
75	Publishing of recorded media	Manufacturing	.324	(1.406)	-.235	(1.365)	.762	(1.374)
76	Other publishing	Manufacturing	-6.533	(2.359)	-4.032	(2.315)	-15.07	(1.604)
77	Printing	Manufacturing	-7.938	(1.247)	-6.859	(1.116)	-6.867	(1.11)
78	Service activities related to printing	Manufacturing	.774	(1.899)	.774	(1.899)	.774	(1.899)
79	Coke oven products	Manufacturing	-6.217	(3.966)	.776	(3.12)	-6.854	(3.716)
80	Refined petroleum products	Manufacturing	-3.796	(1.218)	-4.306	(1.735)	.179	(.939)
81	Processing of nuclear fuel	Manufacturing	5.512	(5.817)	18	(9.062)	5.107	(6.159)
82	Basic chemicals except fertilizers	Manufacturing	-.056	(1.367)	3.03	(1.569)	-1.912	(1.263)
83	Fertilizers and nitrogen compounds	Manufacturing	-8.813	(1.806)	-15.15	(1.878)	-5.26	(1.463)
84	Plastics in primary forms; synthetic rubber	Manufacturing	-9.662	(1.171)	-9.176	(1.233)	-7.96	(1.047)
85	Pesticides and other agro-chemical products	Manufacturing	-2.59	(1.036)	-2.53	(1.045)	-2.904	(.969)
86	Paints varnishes printing ink and mastics	Manufacturing	-8.283	(1.274)	-7.481	(1.262)	-5.729	(1.015)
87	Pharmaceuticals medicinal chemicals etc.	Manufacturing	-22.156	(2.636)	-22.235	(4.109)	-18.388	(2.228)
88	Soap cleaning and cosmetic preparations	Manufacturing	-11.781	(.943)	-12.553	(.989)	-10.166	(.876)

Continued on next page

89	Other chemical products n.e.c.	Manufacturing	-14.667	(1.938)	-15.121	(1.905)	-9.511	(1.646)
90	Man-made fibres	Manufacturing	-5.981	(1.197)	-6.709	(1.386)	-4.779	(1.026)
91	Rubber tyres and tubes	Manufacturing	-9.579	(1.002)	-11.998	(1.19)	-7.83	(.932)
92	Other rubber products	Manufacturing	-6.846	(1.334)	-8.738	(1.18)	-5.553	(1.065)
93	Plastic products	Manufacturing	-8.069	(1.083)	-6.899	(1.077)	-7.111	(.987)
94	Glass and glass products	Manufacturing	-4.341	(1.041)	-4.58	(1.059)	-3.605	(.863)
95	Pottery china and earthenware	Manufacturing	-6.649	(1.535)	-7.312	(1.319)	-5.376	(.856)
96	Refractory ceramic products	Manufacturing	-8.012	(1.013)	-7.842	(1.061)	-5.784	(.79)
97	Struct.non-refractory clay; ceramic products	Manufacturing	-2.754	(.61)	-3.95	(.731)	-1.844	(.589)
98	Cement lime and plaster	Manufacturing	.587	(.535)	-.626	(1.638)	.702	(.441)
99	Articles of concrete cement and plaster	Manufacturing	-8.519	(1.411)	-8.197	(1.385)	-6.553	(1.215)
100	Cutting shaping and finishing of stone	Manufacturing	-6.626	(1.604)	-6.225	(1.55)	-6.026	(1.427)
101	Other non-metallic mineral products n.e.c.	Manufacturing	-10.006	(1.728)	-10.574	(1.787)	-9.418	(1.447)
102	Basic iron and steel	Manufacturing	-7.625	(1.332)	-10.707	(1.083)	-6.148	(1.079)
103	Basic precious and non-ferrous metals	Manufacturing	-2.627	(3.239)	-15.944	(2.917)	-7.439	(3.53)
104	Structural metal products	Manufacturing	-4.421	(.841)	-3.012	(.895)	-4.32	(.716)
105	Tanks reservoirs and containers of metal	Manufacturing	-2.369	(.932)	-2.019	(.911)	-2.287	(.723)
106	Steam generators	Manufacturing	-6.139	(1.482)	-4.233	(1.485)	-4.792	(1.121)
107	Cutlery hand tools and general hardware	Manufacturing	-4.359	(1.178)	-5.927	(1.137)	-3.789	(.953)
108	Other fabricated metal products n.e.c.	Manufacturing	-6.192	(.93)	-5.696	(.923)	-5.24	(.796)
109	Engines and turbines (not for transport equipment)	Manufacturing	-18.693	(2.674)	-16.516	(2.318)	-16.114	(2.221)
110	Pumps compressors taps and valves	Manufacturing	-9.107	(2.148)	-10.531	(2.258)	-6.841	(1.835)
111	Bearings gears gearing and driving elements	Manufacturing	-8.569	(1.254)	-9.018	(1.24)	-6.96	(1.183)
112	Ovens furnaces and furnace burners	Manufacturing	-10.974	(2.214)	-8.978	(2.216)	-8.364	(1.646)
113	Lifting and handling equipment	Manufacturing	-10.865	(1.476)	-12.314	(1.448)	-8.68	(1.273)
114	Other general purpose machinery	Manufacturing	-7.064	(1.246)	-7.653	(1.422)	-5.902	(1.118)
115	Agricultural and forestry machinery	Manufacturing	-18.338	(2.143)	-20.815	(2.112)	-13.728	(2.014)
116	Machine tools	Manufacturing	-3.959	(1.734)	-3.081	(1.798)	-3.925	(1.503)
117	Machinery for metallurgy	Manufacturing	10.319	(2.012)	9.973	(2.059)	8.819	(1.678)
118	Machinery for mining and construction	Manufacturing	-13.23	(1.856)	-14.321	(1.812)	-11.427	(1.664)
119	Food/beverage/tobacco processing machinery	Manufacturing	-8.053	(1.294)	-8.031	(1.41)	-6.411	(1.086)
120	Machinery for textile apparel and leather	Manufacturing	1.981	(2.01)	.662	(3.1)	1.194	(1.5)
121	Weapons and ammunition	Manufacturing	.355	(1.136)	-2.627	(1.431)	-4.731	(.768)
122	Other special purpose machinery	Manufacturing	-10.049	(2.655)	-8.763	(2.211)	-11.189	(2.219)
123	Domestic appliances n.e.c.	Manufacturing	-8.443	(1.201)	-8.365	(1.153)	-6.54	(.992)
124	Office accounting and computing machinery	Manufacturing	-26.504	(4.705)	-13.057	(4.871)	-27.29	(4.482)
125	Electric motors generators and transformers	Manufacturing	-10.169	(1.322)	-7.897	(1.467)	-9.187	(1.156)
126	Electricity distribution and control apparatus	Manufacturing	-6.073	(1.053)	-5.404	(.98)	-4.549	(1.005)
127	Insulated wire and cable	Manufacturing	-13.218	(1.446)	-12.991	(1.421)	-9.561	(1.263)
128	Accumulators primary cells and batteries	Manufacturing	-7.69	(1.171)	-8.474	(1.336)	-7.667	(1.063)
129	Lighting equipment and electric lamps	Manufacturing	-4.556	(1.597)	-5.234	(1.708)	-4.311	(1.353)
130	Other electrical equipment n.e.c.	Manufacturing	-7.119	(1.695)	-7.081	(1.926)	-4.998	(1.448)
131	Electronic valves tubes etc.	Manufacturing	-3.664	(3.154)	-2.58	(3.948)	-3.952	(2.819)
132	TV/radio transmitters; line comm. apparatus	Manufacturing	-10.684	(2.475)	-17.679	(3.119)	-9.11	(2.137)
133	TV and radio receivers and associated goods	Manufacturing	-6.325	(1.041)	-1.66	(1.013)	-4.597	(.888)
134	Medical surgical and orthopaedic equipment	Manufacturing	-13.538	(3.097)	-15.484	(3.087)	-12.191	(2.738)
135	Measuring/testing/navigating appliances etc.	Manufacturing	-11.132	(2.042)	-10.713	(2.112)	-7.672	(1.75)
136	Optical instruments and photographic equipment	Manufacturing	-1.272	(2.345)	5.516	(2.418)	-4.148	(1.941)
137	Watches and clocks	Manufacturing	-8.562	(2.237)	-11.317	(1.761)	-7.346	(1.841)
138	Motor vehicles	Manufacturing	-10.764	(.839)	-13.318	(1.089)	-6.754	(.829)
139	Automobile bodies trailers and semi-trailers	Manufacturing	-9.862	(1.726)	-8.567	(1.626)	-4.931	(1.445)
140	Parts/accessories for automobiles	Manufacturing	-11.426	(1.677)	-10.123	(1.508)	-9.47	(1.5)
141	Building and repairing of ships	Manufacturing	-2.33	(1.589)	1.392	(2.146)	-3.152	(1.222)
142	Building/repairing of pleasure/sport. boats	Manufacturing	-3.397	(1.48)	-4.353	(1.445)	-8.844	(1.446)
143	Railway/tramway locomotives and rolling stock	Manufacturing	-9.847	(1.789)	-10.249	(1.87)	-7.42	(1.754)
144	Aircraft and spacecraft	Manufacturing	-8.8	(3.178)	-19.578	(4.652)	-8.002	(2.303)
145	Motorcycles	Manufacturing	-5.871	(1.026)	-4.819	(.861)	-4.936	(.962)
146	Bicycles and invalid carriages	Manufacturing	.108	(1.415)	-3.541	(1.896)	2.714	(.966)
147	Other transport equipment n.e.c.	Manufacturing	-6.816	(1.415)	-6.816	(1.415)	-6.816	(1.415)
148	Furniture	Manufacturing	-11.166	(1.028)	-10.642	(.99)	-10.119	(.939)
149	Jewellery and related articles	Manufacturing	-5.846	(1.602)	-1.582	(2.722)	-4.607	(1.317)
150	Musical instruments	Manufacturing	-2.643	(1.583)	-3.836	(1.74)	-2.3	(1.339)
151	Sports goods	Manufacturing	-1.653	(1.535)	-1.542	(1.707)	-1.859	(1.458)
152	Games and toys	Manufacturing	-8.122	(1.401)	-6.127	(2.004)	-8.497	(1.321)
153	Other manufacturing n.e.c.	Manufacturing	-5.165	(1.191)	-3.736	(1.152)	-3.848	(.927)

Notes: This table reports estimates of the tariff elasticities obtained from specification (13). The dependent variable is nominal industry-level bilateral trade in levels. The estimator is PPML, and all estimates are obtained with exporter-industry-time fixed effects, importer-industry-time fixed effects, and a rich set of time-varying and time-invariant gravity variables, whose estimates are omitted for brevity. The standard errors are clustered by country-pair. Columns (1)-(3) list the industry IDs, industry descriptions, and broad sector descriptions from the ITPD-E. Columns (4) and (5) report the estimated tariff elasticities and their corresponding standard errors when the key tariff covariate is the theory-consistent tariff variable. Columns (6) and (7) report corresponding estimates that are based on simple-average tariffs. Finally, the results in columns (8) and (9) are obtained with import-weighted tariffs. See text for further details.