The Effectiveness of Development-Oriented Non-Reciprocal Trade Preferences in Promoting Agricultural Trade*

William Ridley
University of Illinois
Urbana-Champaign

Farzana Shirin
University of Illinois
Urbana-Champaign

Abstract

Evidence on the efficacy of development-oriented non-reciprocal trade preferences (NRTPs) in promoting the exports of agricultural and food products from preference beneficiaries to preference donors has been mixed. We investigate the impacts of NRTPs on such trade in a structural gravity setting at a highly disaggregated product level. To this end, we compile a detailed dataset on bilateral trade and tariffs for 23 individual agricultural commodities prominent in developing countries' export baskets, which together accounted for roughly $519 billion of trade as of 2018. Based on estimates from our commodity-level structural gravity model, we utilize the structural foundation of the gravity framework to quantify the trade impacts of such preference schemes in a counterfactual simulation analysis. The results of this analysis show that NRTPs were responsible for around $1.4 billion in expanded exports from NRTP beneficiary countries to donor countries as of 2018, with significant heterogeneity in the countries and commodities that undergo the largest impacts.

Keywords: Non-reciprocal trade preferences; Generalized System of Preferences; Agricultural trade; Gravity
JEL Codes: F13; F14; O24; Q17

*This work was supported by the USDA National Institute for Food and Agriculture, Agricultural and Food Research Initiative Competitive Program, Agriculture Economics and Rural Communities grant #2022-67023-36382.

1. Introduction

Development-oriented non-reciprocal trade preferences (NRTPs) have grown considerably in prominence and scope in recent decades as a means to facilitate export-led growth for beneficiary countries. NRTPs are of heightened relevance in international agricultural trade. This is because, first, trade barriers have remained enduringly high in the agricultural sector (Anderson et al., 2013). As of 2022, average most-favored nation (MFN) tariffs across all WTO members stood at 21.2% for agricultural products compared to 12.9% for non-agricultural products, and even most advanced economies still maintain high tariffs on imports of agricultural products (WTO, 2022).[1] Consequently, preference schemes intended to facilitate market access for low- and middle-income economies are likely to have comparatively larger impacts on trade in agricultural products relative to non-agricultural products.

A second factor which underscores the elevated importance of development-oriented NRTPs relates to the relative importance of the agricultural sector in most developing economies. In 2021, the agricultural sector accounted for 9.1% of GDP on average for low- and middle-income countries and a striking 25.6% for low-income countries on their own (based on data from World Bank, 2021). While these shares have declined considerably in recent decades, they still stand in stark contrast with analogous statistics for advanced economies, for which agriculture accounted for just 1.3% of GDP on average. Even as the share of the agricultural sector in most countries' GDP has fallen in recent decades, agriculture still accounts for an outsize share of employment in most developing economies and LDCs (Anderson and Ponnusamy, 2022).

Most prominent among the assortment of NRTPs is the Generalized System of Preferences (GSP), a system of trade preferences wherein importing countries maintain low or zero tariff rates on imports from developing and least-developed countries (LDCs). For most of their history, GSP regimes have been maintained mostly by advanced economies such as the United States, the European Union, Japan, and others. However, an increasing number of less-advanced economies, for instance, China, India, Thailand, and others have recently enacted their own development-oriented NRTP schemes aimed towards improving market access for exporters in developing countries and LDCs. Initially proposed at the first United Nations Conference on Trade and Development (UNCTAD I) in 1964, the motivations for GSP were threefold: first, to enhance the export earnings of developing countries, second, to

[1] Trade in agricultural products is also increasingly beset by an extensive and growing number of non-tariff barriers (NTBs), such as phytosanitary and sanitary (SPS) measures and technical barriers to trade (TBTs), among others. See Santeramo and Lamonaca (2019) for a review of the literature on the impacts of NTBs in agricultural trade.

promote industrialization, and third, to accelerate the economic growth and development of beneficiary countries. The GSP was formalized under the 1979 Enabling Clause of the General Agreement on Tariffs and Trade (GATT), which permanently authorized the differential application of trade preferences to imports from developing countries.

Since their inception, 27 NRTP schemes have come into force (Ornelas and Ritel, 2020), most of which pertain to GSP schemes that extend special trade preferences to all developing countries. NRTPs also encompass regionally-defined special trade preferences, such as the US African Growth and Opportunity Act (AGOA) and the EU African, Caribbean, and Pacific (ACP) preference schemes, which offer non-reciprocal preferences to countries from specific regions. With the enduring impasse in the completion of the WTO Doha Round, the liberalization of trade at the multilateral level, and agricultural trade in particular, remains in limbo (Anderson and Martin, 2005; Anderson, 2022). NRTPs including GSP and other regionally-focused preference schemes therefore offer a channel by which agricultural producers in developing economies can attain easier access to the markets of advanced economies, markets which tend to remain characterized by a high degree of effective protection (Atkin and Khandelwal, 2020).

In this paper, we investigate the effects of NRTP regimes on agricultural trade at a detailed commodity level to shed light on the degree to which these trade preferences facilitate the agricultural exports of preference beneficiaries to preference donors. To this end, we undertake two interrelated empirical analyses. First, we assess the trade impacts of NRTPs by estimating a structural gravity model of trade for 23 widely traded primary and processed agricultural commodities. We select these commodities based on their prominence in global agri-food trade, as well as their comparative importance in the export baskets of developing countries. As of 2018, these commodities together account for roughly \$519 billion of global trade and \$307 billion worth of export sales from developing countries (based on data from CEPII's BACI dataset). Through this analysis we recover commodity-specific estimates of the tariff elasticity of bilateral trade, which allows us to quantify the degree to which beneficiary countries' exports are shaped by NRTP schemes.

Second, and using the parameter estimates obtained from the gravity estimation, we undertake a counterfactual simulation exercise to quantify the magnitude of the trade impacts of development-oriented NRTP schemes on global agricultural trade at the commodity level. For this purpose we implement the empirical methodology of Anderson et al. (2018), in which the counterfactual impacts of trade policy changes can be decomposed into direct (i.e., partial effects from nonreciprocal trade liberalization at the country-pair level) and indirect (i.e., multilateral effects on trade between other countries) effects. This allows us to assess the hypothetical reversion of tariff rates under NRTPs to non-discriminatory MFN tariff rates in order to measure the impacts of existing NRTPs on trade between preference beneficiaries and preference donors.

Even though the underlying motivation for NRTPs is to foster exports from developing economies through special tariff preferences, empirical findings on their impacts remain mixed. Evidence on positive trade impacts can be found in a number of studies. For example, Cirera et al. (2016) estimate a positive impact of NRTPs on beneficiary countries' exports to the European Union. Cipollina and Salvatici (2010) also show evidence for a positive impact of EU preferences on the agricultural exports of developing countries in terms of both the intensive and extensive margins of trade, though the magnitude of these impacts differs significantly across sectors. Using data on multiple preferential access schemes and countries over the period 1960–2008, Gil-Pareja et al. (2014) show that the various development-oriented NRTP schemes maintained by the European Union, the United States, Canada, and other advanced economies have had a positive effect on developing countries' exports to the markets of preference donors.

However, other studies present contrasting evidence depicting a limited overall impact from NRTPs. Francois et al. (2006) show that administrative barriers, particularly onerous rules-of-origin requirements, diminish the capacity of special preferences to bolster developing countries' exports. Uncertainty over the reliable continuation of GSP by certain providers has been shown to attenuate impacts on exports. For example, the US GSP program for developing countries and LDCs must be renewed periodically and has expired on several occasions.[2] As shown by Hakobyan (2015), the resulting uncertainty over future US trade policy significantly diminished the program's effectiveness. Similar concerns over the uncertainty generated by the European Union's GSP system motivated a 2014 reform to enhance the stability of the program by relaxing existing rules on countries' "graduation" from the EU GSP when their share of EU imports surpassed stipulated thresholds (Borchert and Di Ubaldo, 2020). Work by Herz and Wagner (2011) even finds that, on average over the period 1953–2006, participation in GSP actually reduces beneficiaries' exports. Specifically, their findings indicate that, while GSP participation tends to foster developing countries' exports in the short-run, the long-run trade impacts of countries' participation in such programs are negative. They attribute this counterintuitive result to the structural distortions in preference recipients' economies engendered by the receipt of NRTPs.

[2] The most recent expiration of the US GSP program occurred in December 2020, and the program has yet to be renewed by the US Congress.

Most closely related to our work are the recent studies of Sharma et al. (2019) and Sharma et al. (2021), which similarly focus on the impacts of special preferences under GSP on beneficiary countries' agricultural exports in a gravity setting. In contrast with much of the existing literature examining the impacts of GSP on merchandise trade more broadly, these works uncover significant and positive impacts of NRTPs on agricultural trade (but only limited impacts on non-agricultural trade). Importantly, the extent of these impacts hinge on relative preferential margins across commodities and preference schemes. We build on these and related studies in several ways. First, we conduct our analysis at a more detailed product level than existing analyses, a consideration of significant importance given that tariff preferences are typically set at the product level. Second, we undertake our econometric analysis in a fully theory-consistent structural gravity framework based on current best practices from the gravity literature. Third, we utilize the structural foundation of the gravity model to quantify the trade impacts of NRTPs in a theory-grounded general equilibrium setting, in contrast with the partial equilibrium analyses undertaken by many existing studies.

Our findings can be summarized as follows. In estimating a structural gravity model of trade for the 23 commodities in our analysis, we derive estimates of the tariff elasticity that are near-universally statistically significant and negative, oftentimes strongly so. These results suggest that bilateral trade in most agricultural products is highly sensitive to tariff barriers and that the degree of substitutability of products sourced from different countries is high. We uncover the largest estimates of this parameter for cocoa beans (an estimated tariff elasticity of –6.9), bananas (–5.9), and soybean oil (–5.0), suggesting that the homogeneous nature of most agricultural products gives rise to a high Armington elasticity of substitution.

Our simulation results on the counterfactual impacts of NRTPs show that these preference schemes give rise to trade impacts that vary widely across commodities and trading relationships. In short, our simulation analysis suggests that NRTPs are responsible for $1.4 billion annually in elevated exports from beneficiary countries to donor countries relative to a counterfactual scenario based on MFN tariff rates. The largest impacts materialize for rice ($371.0 million in increased exports), cashews ($331.2 million), and sugar ($282.6 million), commodities for which preference margins are typically high. The exporters estimated to undergo the largest impacts are Brazil ($152.8 million), Myanmar ($135.9 million), and Thailand ($132.1 million), countries which are intensively specialized in the products that typically face the highest preference margins.

Our work contributes to two broad strands of the literature. First, our work is in line with existing research examining the impacts of NRTPs and GSP regimes on trade in agricultural products (e.g., Cipollina and Salvatici, 2010; Sharma et al., 2019; Sharma et al., 2021). In contrast with the bulk of the existing literature in this area that examines trade in broadly aggregated product categories, we undertake our analysis at the product level by compiling detailed data on product-level bilateral tariff preferences. Moreover, ours is the first (to our knowledge) study to explore the trade impacts of NRTPs by implementing a completely theory-consistent structural gravity model based on current best practices from the gravity estimation literature. As we discuss in more detail below, our approach accounts for several crucial features of the gravity framework neglected by many existing studies—namely, fully accounting for the theoretical multilateral resistance terms (MRTs) famously described by Anderson and van Wincoop (2003), the incorporation of data on intra-national trade at the product level, and the use of a comprehensive array of high-dimensional fixed effects to capture features of bilateral trade costs and other determinants of trade.

Second, we build on the voluminous literature that empirically investigates the impacts of trade policies facing global trade in food and agricultural products. The most closely related work to ours in this area includes several recent studies that adapt the structural gravity model to explore the impacts of tariffs and tariff elimination in international markets for food and agricultural products. Noteworthy examples include Raimondi and Olper (2011), who estimate a structural gravity model to obtain estimates of trade substitution elasticities for 18 food sectors and analyze the impacts of the hypothetical elimination of tariffs on these products. Our work is also similar in spirit to a growing number of studies (e.g., Zongo and Larue, 2019; Dadakas and Tatsi, 2021; Ridley et al., 2022; Ridley and Devadoss, 2023) that utilize the structural gravity model and the simulation approach from Anderson et al. (2018) to quantify the counterfactual impacts of tariffs in global markets for specific agricultural products.

The remainder of the paper is organized is follows. In section 2, we describe the data and estimation approach used to recover econometric estimates of tariff elasticities at the commodity level. In section 3, we present the results of our econometric analysis. Section 4 undertakes a counterfactual simulation to quantify the counterfactual impacts of the global regime of NRTPs on the agricultural exports of beneficiary countries to donor countries. Finally, section 5 provides concluding discussion.

2. Estimation Approach and Data

In this section we describe our modeling framework estimation approach, which is based on the canonical CES-Armington structural gravity setting, as well as the data used to conduct our analysis. We empirically implement the gravity model to obtain commodity-level estimates of the tariff elasticity of bilateral trade, which we then utilize to undertake a simulation analysis investigating the counterfactual impacts of NRTPs on exports from beneficiary countries to preference donor countries.

Estimation Approach

Following the foundational work of Anderson and van Wincoop (2003), the structural gravity relationship characterizing exports from country i to country j of commodity k in period t is given by

$$(1) \qquad X_{ijkt} = \frac{Y_{ikt}E_{jkt}}{Y_{kt}} \left(\frac{\phi_{ijkt}}{\Pi_{ikt}P_{jkt}} \right)^{1-\sigma_k}.$$

X_{ijkt} is the unidirectional value of trade from i to j, $Y_{ikt} = \sum_j X_{ijkt}$ (which includes intra-national trade, i.e., X_{ijkt} for $i = j$) is the value of country i's total output, $E_{jkt} = \sum_i X_{ijkt}$ (which similarly includes consumption of domestically produced goods) is the value of importer j's total expenditures, and $Y_{kt} = \sum_i Y_{ikt} = \sum_j E_{jkt}$ is global output/expenditures. The terms in the second part of the right-hand side of equation (1) correspond to bilateral (ϕ_{ijkt}) and multilateral (Π_{ikt} and P_{jkt}) trade frictions. The former encompass elements that impede or encourage trade between any two trading partners. Such elements include tariffs and other discriminatory or preferential trade policies and other formal and informal determinants of trade, including economic, geographical, cultural, and other factors. The latter are the well known multilateral resistance terms (MRTs), defined as

$$(2) \qquad \Pi_{ikt}^{1-\sigma_k} = \sum_j \left(\frac{\phi_{ijkt}}{P_{jkt}} \right)^{1-\sigma_k} \frac{E_{jkt}}{Y_{kt}} \quad \text{and} \quad P_{jkt}^{1-\sigma_k} = \sum_i \left(\frac{\phi_{ijkt}}{\Pi_{ikt}} \right)^{1-\sigma_k} \frac{Y_{ikt}}{Y_{kt}}.$$

$\Pi_{ikt}^{1-\sigma_k}$ is the outward MRT for exporters and $P_{jkt}^{1-\sigma_k}$ is the inward MRT for importers. These terms respectively correspond to consumption- and production-weighted averages of the bilateral and multilateral trade costs faced by exporter i and importer j, i.e., the average barriers that countries face in exporting to, or importing from, the rest of the world. Finally, $\sigma_k > 1$ is the Armington elasticity of substitution between goods from different sources.

We parameterize the bilateral trade-cost variable ϕ_{ijkt} as a function of time-varying bilateral policies as well as time-invariant bilateral factors:

$$(3) \qquad \phi_{ijkt} = \exp \left\{ \log \left(1 + \tau_{ijkt} \right) + \alpha_{1k}\text{PTA}_{ijt} + \alpha_{2k}\text{WTO}_{ijt} + \lambda_{ijk} \right\}.$$

τ_{ijkt} is the ad valorem (or ad valorem equivalent) tariff applied by country j on imports of commodity k from country i. PTA_{ijt} and WTO_{ijt} (with associated parameters α_{1k} and α_{2k}) are indicator variables respectively equal to one when i and j share common membership in a preferential trade agreement (PTA) or are both members of the WTO, and zero otherwise. We include these two variables in order to account for trade policy factors that might correlate with both trade volumes and bilateral tariff rates, the omission of which could potentially confound our estimates on the relationship between trade and tariffs. λ_{ijk} is a term that captures all time-invariant factors that vary at the exporter-importer-commodity level.

Based on our parameterization of ϕ_{ijkt} in equation (3), our estimating equation is thus given by

$$X_{ijkt} = \exp\Big\{\beta_{0kt} + \beta_{1k}\log(1+\tau_{ijkt}) + \beta_{2k}\text{PTA}_{ijt} + \beta_{3k}\text{WTO}_{ijt} + \gamma_{ikt} + \delta_{jkt} + \eta_{ijk}\Big\} + \epsilon_{ijkt}, \tag{4}$$

where $\beta_{0kt} = -\log(Y_{kt})$, $\beta_{1k} = (1-\sigma_k)$, $\beta_{2k} = (1-\sigma_k)\,\alpha_{1k}$, and $\beta_{3k} = (1-\sigma_k)\,\alpha_{2k}$. The coefficient of main interest in equation (4) is β_{1k}, which measures the elasticity of trade with respect to bilateral tariff rates.[3]

Equation (4) includes the fixed effects $\gamma_{ikt} = \log(Y_{ikt}) + (1-\sigma_k)\,\Pi_{ikt}$, $\delta_{jkt} = \log(E_{jkt}) + (1-\sigma_k)\,P_{jkt}$, and $\eta_{ijk} = (1-\sigma_k)\,\lambda_{ijk}$, which respectively account for all factors that vary by exporter-commodity-year, importer-commodity-year, and country-pair-commodity. The terms γ_{ikt} and δ_{jkt} account for the exporter and importer size terms (Y_{ikt} and E_{jkt}) from the structural gravity equation, as well as the outward and inward MRTs (Π_{ikt} and P_{jkt}). As shown in Anderson and van Wincoop (2003), failing to control for these latter two terms is likely to give rise to significant bias in estimates of gravity. These fixed effects also control for all country-product-time-specific supply and demand factors, such as technology and productivity levels, consumer income levels, domestic policies, and all non-discriminatory trade and regulatory barriers. Such factors also include most non-tariff measures (NTMs) that affect trade, such as sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs), which are typically implemented in a non-discriminatory fashion.

The country-pair-commodity fixed effect η_{ijk} is an important inclusion. As shown by Agnosteva et al. (2014) and Egger and Nigai (2015), country-pair fixed effects better capture the role of time-invariant determinants of trade costs compared to traditional gravity covariates such as distance, common language, contiguity, and others. Moreover, and as detailed by Baier and Bergstrand (2007), the use of such fixed effects helps to mitigate endogeneity in

[3]Based on the CES-Armington framework, estimates of β_{1k} also yield direct estimates of the elasticity of substitution from the identity $\sigma_k = 1 - \beta_{1k}$.

trade policy variables originating from long-run factors such as historical trade relations. As shown in recent work by Fontagné et al. (2022), who estimate trade elasticities at the 6-digit Harmonized System (HS) product level, the inclusion of a country-pair fixed effect often yields sharply different estimates of this elasticity relative to specifications that do not include such a term. Finally, ϵ_{ijkt} is a mean-zero error term which we cluster by country-pair to flexibly account for correlation in the error term within trading relationships.

We estimate equation (4) separately for each of the different commodities in our analysis (which are described further below). Following Santos Silva and Tenreyro (2006, 2011) and what has become standard in the empirical trade literature, we estimate equation (4) using Poisson pseudo-maximum likelihood (PPML), which has the advantages relative to log-linearized gravity models of accommodating zero trade flows and being unbiased and consistent under heteroskedasticity. While many gravity estimations employ interval data to account for dynamics in trade policy impacts (see, e.g., Trefler, 2004; Olivero and Yotov, 2012; Anderson and Yotov, 2016), we follow the recent guidance of Egger et al. (2022), who advocate for the use of data pooled over consecutive years to increase the precision of the estimates.[4]

Data

Our sample consists of annual observations for 154 trading countries for the years 2000 to 2018, a period during which the number of countries offering development-oriented NRTPs proliferated.[5] The beginning and ending years of our sample are chosen due to limitations on the availability of tariff data for many countries in the pre-2000 period, and because of constraints on the availability of comprehensive tariff data and intra-national trade volumes post-2018. To focus our analysis on a tractable set of commodities, we analyze trade in 23 different agricultural products which encompass 16 primary commodities and 7 processed goods, and which together accounted for around \$519 billion of global trade as of 2018. We restrict our analysis to these 23 commodities for two reasons. First, they together account for a significant share of total world agricultural trade, or roughly 36% based on statistics from FAO (2022). Second, most of the products (e.g., bananas, coffee, palm oil, rubber, sugar, tea, and others) are overwhelmingly produced and exported by developing countries. Specifically, the combined \$306.5 billion of exports of these commodities undertaken by low- and middle-income countries accounted for around half of these countries' total agri-food exports in 2018 (based on statistics from CEPII's BACI dataset). Consequently, we focus

[4]To assess the robustness of our estimates, we also perform the estimation based on interval data; see Table A3 in the Appendix.

[5]Appendix Table A1 lists the countries included in our analysis.

on these specific products given their profound importance for many NRTP beneficiary countries.[6]

Table 1 lists the 23 commodities in our analysis along with information on the aggregate value of international exports in these commodities, with trade values delineated between the world total and the total for developing countries (defined here as low, lower-middle, and upper-middle income countries in the World Bank's country income classification for 2018). As the table shows, there is considerable variation across the 23 commodities in the share of world trade accounted for by developing country exporters, ranging from a low of 7.4% for pig meat to a high of 93.9% for rubber. However, the fact that developing countries account for a majority (59.1%) of total exports in these commodities illustrates their overall importance in the export baskets of low- and middle-income economies.

We also present the average NRTP preference margin, which we define as the average difference (in percentage points) between donor countries' MFN tariff rates and tariff rates under their respective NRTP regimes for each commodity. Evident from these figures is the considerable variation in average tariff preference margins. Exports of some commodities are subject to average preference margins that are only modest. Noteworthy examples of this include rubber and tea, which face average NRTP margins of 2.3 and 2.7 percentage points, respectively. In contrast, exports of other commodities are subject to massive preference margins. This is particularly the case for commodities such as bovine meat, sugar, and rice, which face average preference margins of 49.2, 48.0, and 32.5 percentage points respectively. These figures suggest that the extent of any positive trade impacts engendered by existing NRTP schemes is likely to differ considerably across commodities.

To complement the information on preference margins by commodity, we also present the average preference margins for each NRTP donor country across the 23 commodities, which are shown in Figure 1. The figure reveals significant heterogeneity in the magnitude of these preference margins, though some patterns do emerge. Noticeably, many countries with notoriously high levels of protectionism in agriculture, such as India and Japan, have sizable average preference margins (around 32% and 24%, respectively). Conversely, several countries which already maintain low barriers on imports of most agricultural products, such as the United States, Canada, Australia, and New Zealand, maintain comparatively small preference margins for these products.

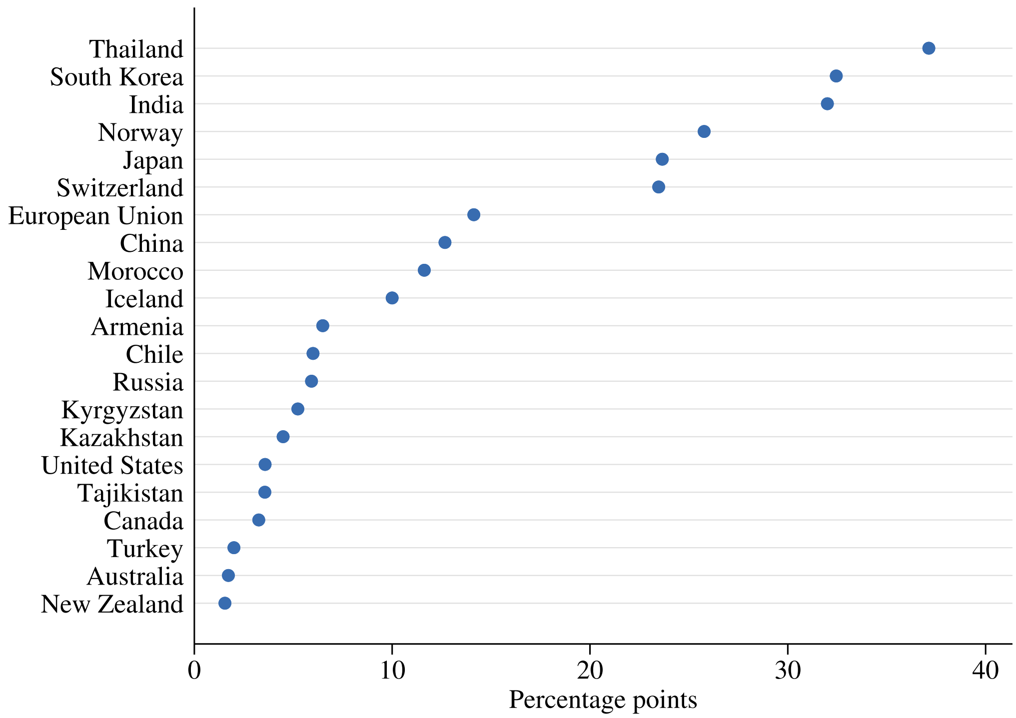
[6] A third and more practical reason for which we focus on the commodities that we do relates to the calculation of intra-national trade values. Specifically, the limited availability of the requisite data for computing this variable at the commodity level for highly processed goods such as food manufactures obliges us to focus on primary and minimally processed goods for which the necessary data is more widely available.

Table 1: Commodities in Analysis, Global Exports, and Average NRTP Preference Margin

Commodity	Intl. exports (billion USD) Total	Intl. exports (billion USD) Dev. countries	Dev. country share of total (%)	NRTP pref. margin (% points)
Avocados	5.8	3.9	67.2	4.0
Bananas	13.1	11.0	84.0	10.5
Cashews	10.3	9.3	90.3	5.8
Cocoa Beans	9.1	8.4	92.3	4.9
Coffee	30.4	18.1	59.5	4.3
Cotton	15.8	7.6	48.1	4.3
Grapes	10.5	4.8	45.7	4.6
Maize	36.1	16.9	46.8	6.8
Meat (Bovine)	49.1	15.4	31.4	49.2
Meat (Pig)	28.4	2.1	7.4	12.8
Meat (Poultry)	27.1	9.9	36.5	10.3
Palm Oil	32.6	29.9	91.7	8.4
Rice	26.8	22.3	83.2	32.5
Rubber	14.7	13.8	93.9	2.3
Soybean Meal	27.8	20.0	71.9	5.3
Soybean Oil	9.1	6.4	70.3	5.9
Soybeans	60.4	38.6	63.9	5.4
Sugar	25.0	18.4	73.6	48.0
Sunflower Oil	11.1	8.1	73.0	7.4
Tea	7.7	6.0	77.9	2.7
Tobacco	10.5	7.7	73.3	14.5
Tomatoes	9.4	4.7	50.0	17.1
Wheat	47.9	23.3	48.6	16.4
Total	*518.8*	*306.5*	*59.1*	*12.4*

Notes: Authors' construction based on data from CEPII (2022) and UNCTAD (2022). Developing countries are defined as those classified as low, low-middle, or upper-middle income in the World Bank's country income group classification for the year 2018. Preference margins measure the average difference between MFN tariff rates and preferential rates under NRTP schemes.

Figure 1: Average preference margins of NRTP donor countries



Notes: Figure depicts the average difference (in percentage points) between MFN tariff rates and tariff rates under NRTPs across the 23 commodities in the analysis. Authors' construction based on data from UNCTAD (2022) TRAINS.

Table 2: Sample Summary Statistics

Variable	**Mean**	**Std. dev.**	**Min**	**Max**
International trade flows (X_{ijt} for $i \neq j$)	0.6	24.5	0.0	27,224.3
Intra-national trade flows (X_{ijt} for $i = j$)	395.0	3,264.7	0.0	178,251.1
Tariff rates (τ_{ijt})	13.8	47.5	0.0	3,000.0
Preferential trade agreement (PTA_{ijt})	0.2	0.4	0.0	1.0
Shared WTO membership (WTO_{ijt})	0.7	0.4	0.0	1.0

Notes: Trade flows are measured in million USD. Tariffs are measured in percentage. PTA_{ijt} and WTO_{ijt} are dichotomous variables indicating shared membership between countries in preferential trade agreements and the World Trade Organization, respectively.

Our data are compiled from several sources. Information on bilateral international trade flows are taken from the commonly used BACI database from CEPII (Gaulier and Zignago, 2010), which records bilateral trade in current dollar values at the 6-digit HS commodity level. To incorporate intra-national trade values (X_{ijkt} for $i = j$) by commodity, we impute domestic sales using countries' quantities of production and exports by commodity based on data from FAO (2022), the difference of which is then multiplied by country-specific farm-gate prices for each commodity.[7]

Tariff rates by commodity and country pair are taken from the UNCTAD (2022) TRAINS database, which reports ad valorem (or ad valorem equivalent, when relevant) import tariff rates. These rates include both preferential tariff rates, which encompass tariffs enacted under NRTPs and other preferential relationships (such as free trade agreements), as well as non-discriminatory MFN tariff rates applied to trade between countries without preferential trading relationships with one another. Finally, information on countries' shared membership in PTAs and WTO membership statuses are taken from the USITC's gravity dataset (Gurevich and Herman, 2018).

Table 2 presents summary statistics on our dataset pooled across the 23 commodities.[8] Unsurprisingly, intra-national trade volumes tend to be larger on average than international trade values. Tariff rates in our sample, which average around 14%, exhibit substantial variation.[9] Around 20% of the observations in our sample reflect countries sharing PTA membership, and the majority of the observations in our sample (around 70%) correspond to

[7]Because of differences in FAO's reporting of production and export data, the calculation occasionally yields negative values of intra-national trade, though such occurrences are infrequent. There are also many instances in which country-level prices are not reported for certain commodities, in which case we use information on regional average prices, or in instances of missing regional average prices, global average prices.

[8]We present the summary statistics by commodity in Appendix Table A2.

[9]Tariffs on tobacco imports tend to be the highest of the commodities in our analysis, with duties routinely exceeding 500% ad valorem.

trade between mutual WTO members.

3. Econometric Results

We next present our econometric estimates obtained from commodity-specific estimations of gravity equation (4), paying particular attention to the estimates on the tariff elasticity (β_{1k}). Table 3 presents the complete estimates of the gravity model for each of the 23 commodities. Each row of the table corresponds to a commodity-level regression of equation (4).[10] To aid interpretation, Figure 2 also graphically depicts the point estimates and associated 95% confidence intervals for the estimated tariff coefficient for each of the commodities in the analysis.

Consistent with expectations, the preponderance of estimates are negative in sign (20 of 23), and of these, most (17 of 20) are significantly different from zero at standard critical levels. The values of the negative and statistically significant estimates range from cocoa beans and bananas with elasticities of –6.972 and –5.941, respectively (with the identity $\sigma_k = 1 - \beta_{1k}$ implying elasticities of substitution of 7.972 and 6.941), to wheat and tobacco with respective elasticities of –0.799 and –0.927 (implying elasticities of substitution of 1.799 and 1.927). Because of the small number of positive estimates that run counter to theory (which occur for cashews, rice, and sunflower oil), in the counterfactual simulation for these commodities that we perform in the following section, we instead use the elasticity estimates for the relevant 4-digit HS commodities from Fontagné et al. (2022).[11]

Our estimates on the trade elasticity are largely comparable to existing estimates from the literature. For the commodities in our analysis which overlap with the commodities analyzed by Raimondi and Olper (2011), who also estimate trade elasticities for agri-food products in a gravity setting, our findings on this parameter are typically in line with theirs. For example, they obtain estimates of the elasticities of substitution for meat products of 2.083 (compared to our estimates of 3.075, 2.738, and 2.692 for bovine, pig, and poultry meat), 8.695 for fruit products (compared to our estimate of 6.941 for bananas), and 3.313 for sugar (compared to our estimate of 2.820). Our results are also in broad alignment with the recent estimates of this parameter from Fontagné et al. (2022), who estimate comparable trade elasticities at the 6-digit HS level.dd

[10]The differences in observations across the different estimations originates from the exclusion of singleton observations (observations for which one or more of the fixed effects perfectly predicts the outcome variable) in the estimation routine; see Correia (2015).

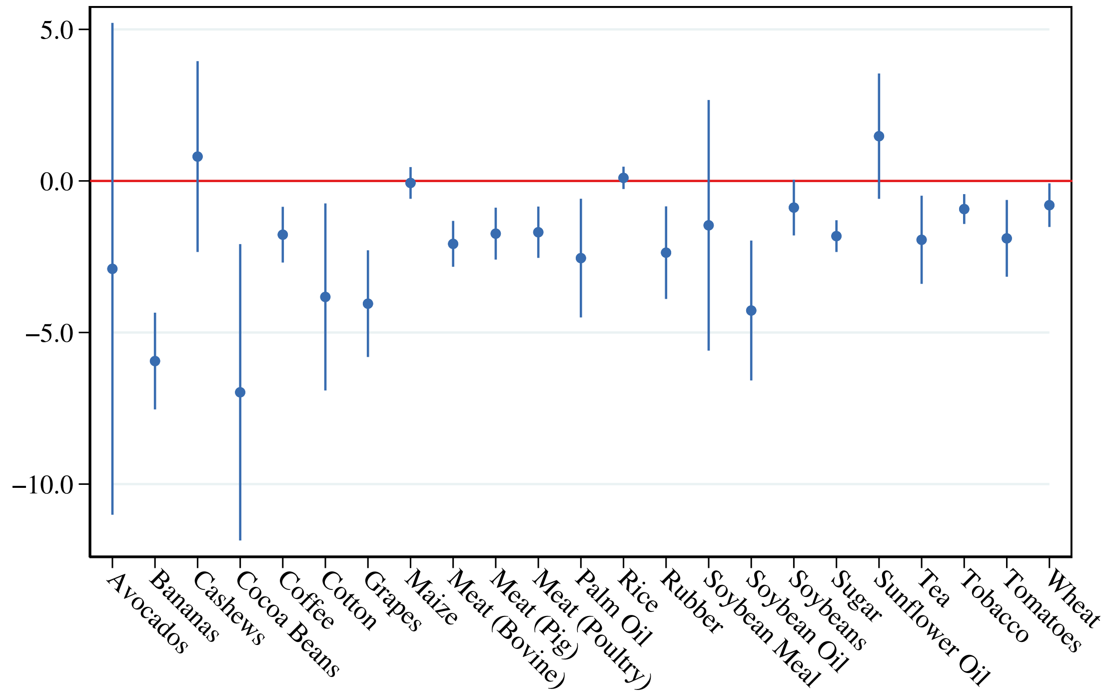
[11]The values of the relevant elasticities are equal to –7.377 for cashews, –6.538 for rice, and –11.584 for sunflower oil. Fontagné et al. (2022) similarly estimate a small number of positive tariff elasticities in their analysis.

Table 3: Full Estimates of Gravity Equation, by Commodity

	Trade Policy Variables							
	$\ln(1+\tau)$		PTA		WTO			Pseudo
Commodity	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.	Obs.	R^2
Avocados	–2.899	(4.139)	–1.329[a]	(0.254)	–0.336	(0.795)	63,616	0.992
Bananas	–5.941[a]	(0.814)	0.064	(0.092)	0.026	(0.532)	97,674	0.994
Cashews	0.804	(1.606)	–0.142	(0.110)	1.850[a]	(0.386)	128,028	0.982
Cocoa Beans	–6.972[a]	(2.494)	0.007	(0.093)	1.325	(0.877)	59,309	0.977
Coffee	–1.773[a]	(0.469)	–0.022	(0.056)	–0.123	(0.137)	201,359	0.983
Cotton	–3.826[b]	(1.574)	–0.160	(0.189)	0.415	(0.466)	101,853	0.989
Grapes	–4.048[a]	(0.898)	0.262[b]	(0.127)	0.663[b]	(0.276)	128,215	0.998
Maize	–0.066	(0.267)	0.080	(0.171)	1.700[a]	(0.307)	115,278	0.996
Meat (Bovine)	–2.075[a]	(0.386)	–0.413[b]	(0.168)	–0.342	(0.731)	119,064	0.997
Meat (Pig)	–1.738[a]	(0.437)	0.198	(0.124)	0.436	(0.380)	90,890	0.998
Meat (Poultry)	–1.692[a]	(0.432)	0.550[b]	(0.235)	–0.081	(0.345)	124,256	0.997
Palm Oil	–2.545[b]	(0.999)	0.830[a]	(0.262)	0.042	(0.443)	96,440	0.983
Rice	0.102	(0.188)	0.003	(0.191)	0.745[b]	(0.297)	158,705	0.998
Rubber	–2.366[a]	(0.779)	–0.245[c]	(0.143)	–0.001	(0.219)	113,903	0.987
Soybean Meal	–1.463	(2.109)	0.294	(0.273)	0.565	(0.530)	59,815	0.987
Soybean Oil	–4.274[a]	(1.177)	0.172	(0.228)	–1.409[a]	(0.418)	88,591	0.988
Soybeans	–0.879[c]	(0.469)	–0.127	(0.291)	1.476[a]	(0.548)	79,743	0.993
Sugar	–1.820[a]	(0.267)	0.265[c]	(0.144)	–0.135	(0.298)	172,735	0.980
Sunflower Oil	1.477	(1.055)	0.619[a]	(0.139)	0.068	(0.235)	110,001	0.971
Tea	–1.941[a]	(0.742)	0.240[a]	(0.088)	0.125	(0.218)	187,737	0.992
Tobacco	–0.927[a]	(0.251)	–0.087	(0.089)	0.706[a]	(0.184)	129,863	0.976
Tomatoes	–1.894[a]	(0.646)	1.160[b]	(0.464)	–1.472[a]	(0.558)	93,401	0.999
Wheat	–0.799[b]	(0.367)	0.024	(0.096)	0.002	(0.288)	100,765	0.989

Notes: Dependent variable in each regression is the value of unidirectional exports by commodity. Estimates from each row are obtained from the same regression. Estimation includes exporter-year, importer-year, and country-pair fixed effects. Robust standard errors clustered by country pair are reported in parentheses. Intercept is included in estimation but not reported. a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.1$.

Figure 2: Estimates of tariff elasticities (β_{1k}), by commodity



Notes: Estimates are obtained from individual commodity-level estimations of equation (4). Error bands depict the 95% confidence interval. Standard errors are clustered by bilateral country pair.

While our findings on the trade elasticity parameter are roughly comparable to previous estimates from the literature obtained by similar means, it is important to note the ways in which our approach departs from those used to obtain earlier estimates. Notably, almost none of the related literature applying the gravity model to agricultural trade makes use of country-pair fixed effects in estimation. This element not only controls for a host of unobserved determinants of trade costs and mitigates endogeneity in trade cost variables, but tends to yield sharply different estimates of this parameter (see, e.g., Boehm et al., 2020). Of equal importance is our (theory-consistent) incorporation of intra-national trade volumes in the gravity estimation, the inclusion of which has increasingly been recognized as critical for obtaining accurate estimates on the impacts of trade policy variables (Yotov, 2022).

The estimates on the other two trade policy variables present a less consistent pattern. Perhaps surprisingly, only a minority (seven) of the estimates on the PTA variable are positive and significant across specifications. Also surprising are the two estimates for which the effect of shared trade agreement membership is estimated to be negative and significant.

While the modest estimated impacts of PTA membership for many of the commodities eludes a ready explanation, two observations help rationalize this finding. First, having already controlled for preferential tariffs in the regression specification, any residual impacts of PTA membership on trade volumes are likely to be limited. Such residual impacts might arise, for instance, from bilaterally applied NTMs or other regulatory measures whose impacts are likely to be smaller than those relating to the implementation of preferential tariffs under PTAs. Second, tariff rates in general are often higher on processed goods versus the primary commodities used to make those goods (e.g., escalating tariffs on raw cotton versus textiles versus finished apparel products). The differential magnitudes of the declines in such tariffs under PTAs could therefore encourage trade in processed goods while diminishing trade in primary goods such as the ones we analyze.

Estimates on the bilateral WTO variable are even more scattered. Only five specifications give positive and significant estimates on this variable, with two of the estimates coming through as negative and significant. These findings suggest that countries' mutual WTO membership played only a negligible role in influencing trade volumes in the specified commodities over period of analysis. However, because many of the impacts of WTO membership are non-discriminatory, and because our specification accounts for unilateral time-varying factors specific to exporters and importers, it is not overly surprising that we fail to find any consistent pattern from the impact of joint WTO membership between trading partners.

4. Simulating the Trade Impacts of NRTPs

To measure the trade impacts of existing NRTP regimes on exports from preference beneficiaries to preference donors, we utilize our econometric estimates from above to undertake a counterfactual simulation analysis based on the methodology of Anderson et al. (2018). This approach utilizes the structural foundation of the gravity modeling framework to calculate predicted differences in bilateral trade volumes under a baseline (denoted by superscript B) versus counterfactual (denoted by superscript C) trade policy vector.[12] Importantly, the methodology captures both the direct (i.e., partial impacts arising from changes in tariffs within a given trading relationship) and indirect (i.e., multilateral effects mediated by adjustments in the outward and inward MRTs) trade impacts arising from changes in trade policy.

[12]This methodology has been widely employed to estimate the impacts of various trade policies affecting trade in food and agriculture. For example, Zongo and Larue (2019) use the approach to quantify the effects of animal disease on global beef trade. Recent works by Ridley et al. (2022) and Ridley and Devadoss (2023) implements this approach to measure the trade impacts of tariff retaliation in the international wine and cotton markets, respectively. Finally, Cheptea et al. (2021) adapt the methodology to assess the impacts of Brexit on European agricultural exports.

Specifically, the estimates of the exporter and importer fixed effects can be used to recover estimates of the outward and inward MRTs, changes in which reflect changes in exporters' and importers' multilateral market access. The effects of NRTPs on each bilateral trading relationship can thus be recovered not only for the directly impacted trading relationships, but for the entire global trading system.

In our analysis, we consider the baseline scenario as reflecting trade volumes between NRTP donor importers and beneficiary exporters under observed applied tariff rates, and in particular, observed applied tariff rates under trading relationships with active NRTP schemes. In contrast, we consider the counterfactual scenario as one in which all actively applied tariff rates under existing NRTP were reverted to non-discriminatory MFN tariff rates. In essence, the comparison of trade values the baseline versus counterfactual scenarios allows us to assess trade volumes under observed preferential GSP tariffs against the hypothetical trade volumes that would take place in the absence of such preferences, all else equal.[13] To conduct this analysis, we fix the year of analysis to 2018, the latest year in our sample and the closest approximation of the current trade situation. Our results are therefore interpreted as simulated trade values for the year 2018 under the baseline versus the counterfactual scenario. Consequently, for notational simplicity we drop the time indices from the exposition that follows.

Simulation Methodology

The simulation approach proceeds according to the following steps. Having obtained the parameter estimates $\widehat{\beta}_1$, $\widehat{\beta}_2$, $\widehat{\beta}_3$, and $\widehat{\eta}_{ij}$ from the panel estimation of (4), we generate in turn baseline (based on observed tariff rates) versus counterfactual (based on assumed alternative tariff rates) trade volumes for the year of analysis.

[13] It is important to note two observations here. First, there are several instances where only a comparatively low share of beneficiary countries' exports enter the importing market under NRTP rates, suggesting that tariff rates under specific preference schemes might not reflect the tariff rate applied to all trade within each trading relationship (see, e.g., Bureau et al., 2007). For example, less than one percent of Kenya's preference-eligible exports to the European Union in 2020 entered under the EU GSP scheme, with most of the country's eligible exports instead entering under the EU's non-reciprocal Market Access Regulation for African countries (see `https://gsphub.eu/country-info/Kenya`). However, while utilization of GSP tariff rates is sometimes low, under-utilization is most prevalent for trade in goods with onerous rules-of-origin requirements (Grossman and Sykes, 2005). Such regulations are much less salient for trade in primary agricultural products. Second and relatedly, in the hypothetical removal of all existing NRTP regimes as considered in our analysis, not all applied tariff rates would revert to MFN rates. This is because countries sometimes maintain multiple preferential tariff schemes that apply to the same beneficiary, only some of which fall under GSP or other NRTPs. In light of these two observations, we interpret our estimates as upper bounds on the trade impacts of the hypothetical reversion of GSP and NRTP tariff rates to MFN tariff levels.

First, to calculate baseline trade values, we use the commodity-specific parameter estimates obtained from estimation of equation (4) to estimate[14]

$$(5)\qquad X_{ijk} = \exp\left\{\widehat{\beta}_{1k}\log\left(1+\tau^{\mathrm{B}}_{ijk}\right) + \widehat{\beta}_{2k}\mathrm{PTA}_{ij} + \widehat{\beta}_{3k}\mathrm{WTO}_{ij} + \gamma_{ik} + \delta_{jk} + \widehat{\eta}_{ijk}\right\} + \epsilon_{ijk}$$

using the observed 2018 values for each variable, where "$\widehat{\ }$" indicates parameter estimates. τ^{B}_{ijk} reflects bilateral applied tariff rates in the baseline scenario, which reflects the tariff rates applied under NRTP schemes as well as other (reciprocal) preferential or non-discriminatory tariff rates which do not change between the baseline and counterfactual scenarios. As with the estimation of equation (4), we perform the estimation of equation (5) separately for each commodity. From the estimation of equation (5), we obtain estimates of $\widehat{\gamma}^{\mathrm{B}}_{ik}$ and $\widehat{\delta}^{\mathrm{B}}_{jk}$, which are interpreted as the estimates of the exporter and importer fixed effects (and implicitly, the OMR and IMR terms from Anderson and van Wincoop, 2003) which, as shown by Fally (2015), are consistent with countries' observed output and expenditures in the data under the baseline trade policy vector (i.e., under τ^{B}_{ijk}). The imputed baseline values of bilateral trade, which we denote as X^{B}_{ijk}, are thus given by

$$(6)\qquad X^{\mathrm{B}}_{ijk} = \exp\left\{\widehat{\beta}_{1k}\log\left(1+\tau^{\mathrm{B}}_{ijk}\right) + \widehat{\beta}_{2k}\mathrm{PTA}_{ij} + \widehat{\beta}_{3k}\mathrm{WTO}_{ij} + \widehat{\gamma}^{\mathrm{B}}_{ik} + \widehat{\delta}^{\mathrm{B}}_{jk} + \widehat{\eta}_{ijk}\right\}.$$

Intuitively, changes in tariff rates will give rise to direct bilateral trade impacts embodied via the term $\widehat{\beta}_{1k}\log\left(1+\tau^{\mathrm{B}}_{ijk}\right)$. In addition and importantly, the indirect impacts of changes in trade policy (i.e., third-country multilateral impacts mediated by adjustments in the structural OMR and IMR terms) will be directly captured by the exporter and importer fixed effects γ_{ik} and δ_{jk}.

Obtaining the values of bilateral trade values (X^{C}_{ijk}) under the counterfactual scenario follows a largely identical process. First, to obtain estimates of the exporter and importer fixed effects under the counterfactual, $\widehat{\gamma}^{\mathrm{C}}_{ik}$ and $\widehat{\delta}^{\mathrm{C}}_{jk}$ (which capture the OMR and IMR terms under the counterfactual scenario), we re-estimate a version of equation (4) given by

$$(7)\qquad X_{ijk} = \exp\left\{\widehat{\beta}_{1k}\log\left(1+\tau^{\mathrm{C}}_{ijk}\right) + \widehat{\beta}_{2k}\mathrm{PTA}_{ij} + \widehat{\beta}_{3k}\mathrm{WTO}_{ij} + \gamma_{ik} + \delta_{jk} + \widehat{\eta}_{ijk}\right\} + \epsilon_{ij}.$$

Here, τ^{C}_{ijk} represents the assumed counterfactual tariff rates (i.e., MFN tariff rates in place of rates under NRTPs), and the values of all parameters besides γ_i and δ_{jk} are again constrained to equal their values obtained from the estimation of equation (4). Estimation of equation (7) yields values for $\widehat{\gamma}^{\mathrm{C}}_{ik}$ and $\widehat{\delta}^{\mathrm{C}}_{jk}$, which are interpreted as the exporter and importer fixed effects

[14] The intercept β_0 from equation (4) is dropped from the estimation by subsuming it with the fixed effects.

(and implicitly, the OMR and IMR terms) which are consistent with countries' observed output and expenditures but under the counterfactual tariff vector τ^{C}_{ijk}. Counterfactual trade values are therefore given by

$$X^{\text{C}}_{ijk} = \exp\left\{\widehat{\beta}_{1k}\log\left(1+\tau^{\text{C}}_{ijk}\right) + \widehat{\beta}_{2k}\text{PTA}_{ij} + \widehat{\beta}_{3k}\text{WTO}_{ij} + \widehat{\gamma}^{\text{C}}_{ik} + \widehat{\delta}^{\text{C}}_{jk} + \widehat{\eta}_{ijk}\right\}. \quad (8)$$

As with the values of X^{B}_{ijk} under the baseline scenario, the counterfactual trade values X^{C}_{ijk} embody both bilateral tariff impacts, reflected by the $\widehat{\beta}_{1k}\log\left(1+\tau^{\text{C}}_{ijk}\right)$ term, as well as multilateral impacts via the OMR and IMR terms embodied by the terms $\widehat{\gamma}^{\text{C}}_{ik}$ and $\widehat{\delta}^{\text{C}}_{jk}$.

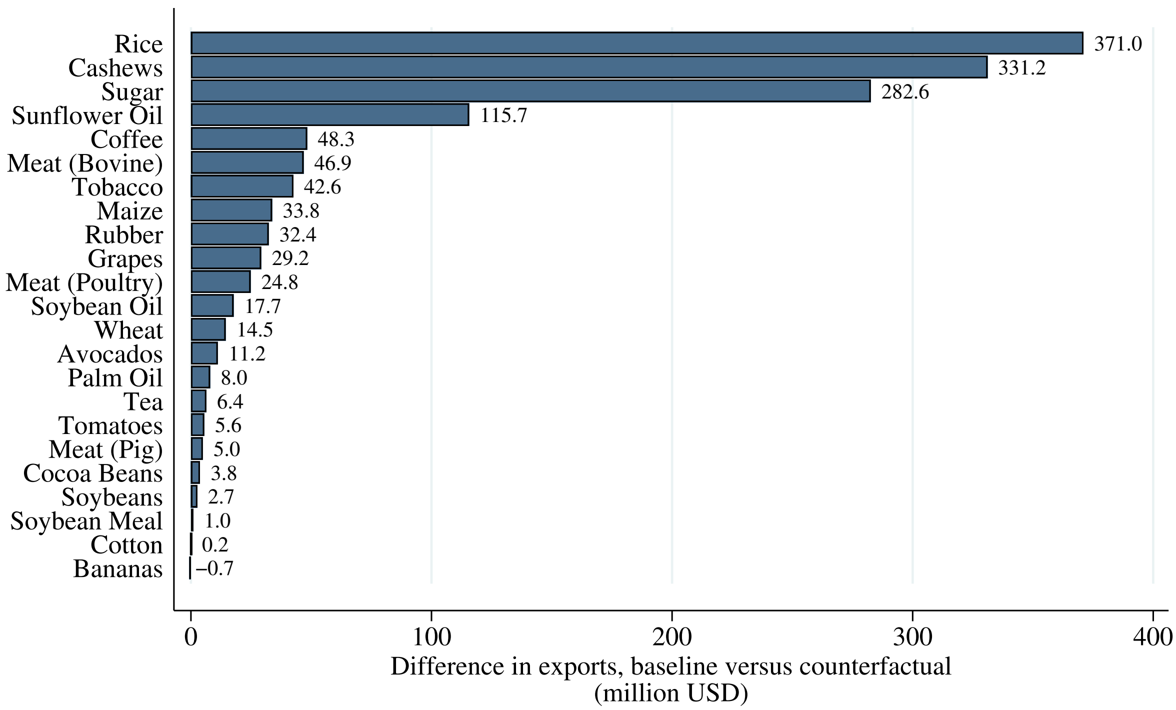
Simulation Results

The simulation results for trade impacts broken down by commodity are presented in Figure 3. The figure depicts the difference in the value of total exports by commodity (in million USD) from NRTP beneficiary countries to NRTP donor countries under the baseline versus counterfactual scenarios. Immediately apparent is that the largest trade impacts are manifested from only a handful of commodities: in order, rice ($371.0 million in increased exports), cashews ($331.2 million), and sugar ($282.6 million). Other commodities that undergo significant trade impacts include sunflower oil ($115.7 million), coffee ($48.3 million), bovine meat ($46.9 million), tobacco ($42.6 million), and a few others, though the trade impacts for these commodities are modest in comparison to those for the leading commodities. Strikingly, the estimated trade impacts for many extensively traded commodities, including wheat ($14.5 million), palm oil ($8.0 million), soybeans ($2.7 million), and soybean meal ($1.0 million) are only minor in spite of the tens of billions of dollars of global trade for which these commodities account. For bananas, we even find a negative counterfactual impact on total trade (–$0.7 million), though this result is only trivially different from zero.[15]

The results in Figure 3 can be explained by an assortment of factors. First, and as was seen in Table 1, preference margins under NRTPs vary substantially across commodities. Commodities such as rice and sugar are typically subject to much more onerous tariff barriers (with preference margins of 32.5 and 48.0 percentage points, respectively) compared to products such as wheat, palm oil, and soybeans, for which preference margins are typically much lower (16.4, 8.4, and 5.4 percentage points, respectively). However, average preference margins alone do not fully explain the results, in that several commodities for which preference

[15]This finding mostly results from the pronounced diversion in the counterfactual of many Central American countries' banana exports away from the EU market (for which preference margins on bananas are high) to the US market (where preference margins on bananas are negligible), such that the decreases in trade in the former are outweighed by the increases in trade in the latter.

Figure 3: Counterfactual impacts on exports from beneficiary countries to donor countries, by commodity



Note: Changes in aggregate exports are calculated as $\Delta X_{ik} = \sum_{j \neq i} \left(X^{\mathrm{B}}_{ijk} - X^{\mathrm{C}}_{ijk} \right)$. Values are in million USD.

margins are on-average low (e.g., coffee and sunflower oil) experience non-negligible impacts on counterfactual trade volumes.

Second, even for widely traded products for which preference margins are high, such as wheat and bovine meat, such commodities do not always play prominent roles in beneficiary countries' export baskets. Intuitively, the commodities with the very largest impacts tend to be those for which low- and middle-income countries account for the majority of global exports. In contrast, the commodities with smaller impacts tend to be those for which developing countries play a comparatively less important role in international markets.

Third, the magnitudes of the estimated trade impacts shown in Figure 3 naturally rely on the value of the estimates of the tariff elasticity (presented in Figure 2 above), in that larger tariff elasticities will yield larger counterfactual trade impacts, all else equal. It is worth noting, however, that some commodities with low values for the estimated tariff elasticity, including sugar, coffee, and bovine meat, undergo significant counterfactual trade impacts. Conversely, some commodities with large estimated elasticities, such as cocoa beans and soybean oil, experience only negligible impacts.

A fourth important explanation for the trade impacts revealed in Figure 3 relates to the distribution of trade impacts across NRTP beneficiaries and donors, impacts which are depicted in Figure 4. Subfigure 4a presents the simulated counterfactual impacts on NRTP beneficiary countries' exports to donor countries cumulated across commodities, while subfigure 4b depicts the corresponding impacts on NRTP donor countries' imports from beneficiary countries. For the sake of brevity, the figure presents only the countries with the 15 largest impacts in each subfigure.[16] To help unpack the results across commodities and trade linkages, in Table 4 we also present the results on the bilateral trade linkages and associated commodities that undergo the largest trade impacts.

We focus first on the simulated impacts on beneficiary countries' exports presented in subfigure 4a. A diverse assortment of countries experience large impacts on exports in the baseline versus counterfactual scenarios. Brazil, one of the world's largest exporters of agricultural products, experiences a sizable $152.8 million increase in exports to NRTP donor countries. The large majority of this increase in trade arises from expanded sugar exports ($102.4 million), but also from maize ($17.0 million) and poultry ($9.9 million). Perhaps surprisingly, the beneficiary country that undergoes the second largest impacts is Myanmar, which is estimated to experience a $135.9 million increase in exports, most of which is driven by expanded exports of rice ($102.7 million) and rubber ($23.5 million). Other countries that undergo significant export impacts include Thailand with $132.1 million in increased exports (of which $90.6 million comes from expanded rice exports), Tanzania with $113.9 million (with $105.7 million of this from cashew exports), Cambodia with $106.4 million (with $91.2 million from rice exports), and Ukraine with $108.1 million (with $77.2 million from sunflower oil exports). In total, we estimate that the existing global regime of NRTPs as of 2018 was responsible for nearly $1.4 billion in increased trade between beneficiary country exporters and donor country importers.[17]

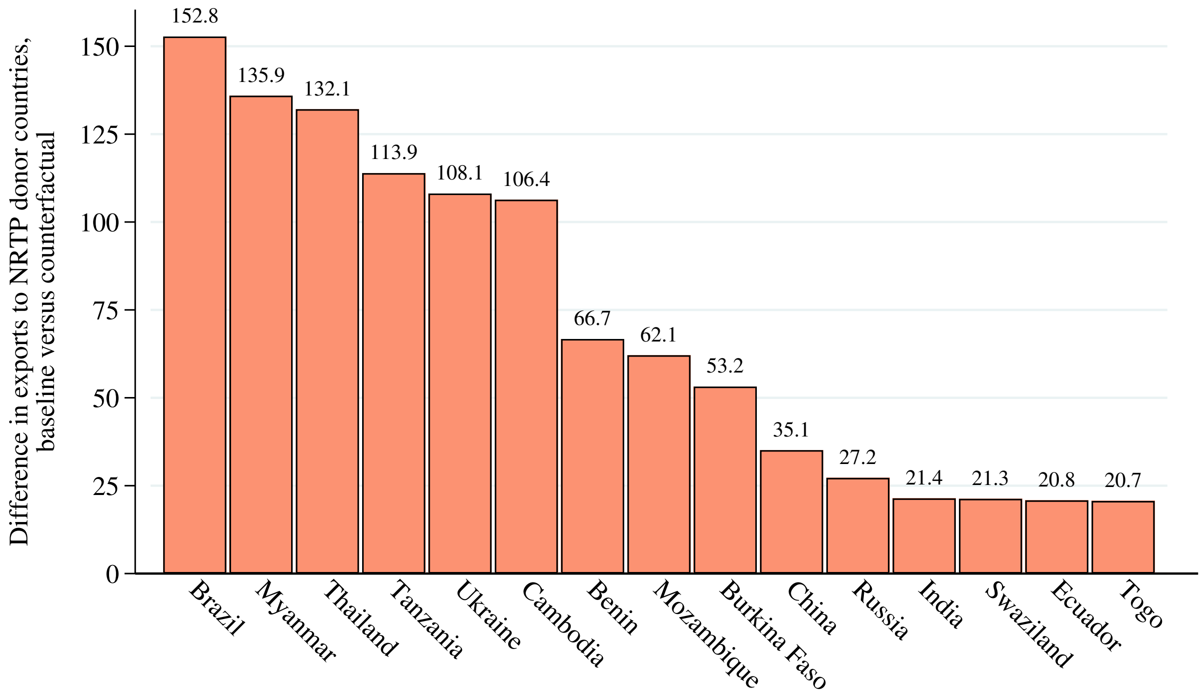
The estimated impacts on donor countries' imports shown in subfigure 4b portray a more concentrated distribution of trade impacts. Remarkably, the country that experiences the largest simulated impacts (by a significant margin) is India, which we estimate to undergo a $381.1 million increase in imports from NRTP beneficiary countries in the baseline versus counterfactual scenarios. The primary source of these impacts is the country's extensive

[16] See Appendix Tables A4 and A5 for the complete estimated impacts on NRTP beneficiary and donor countries' trade.

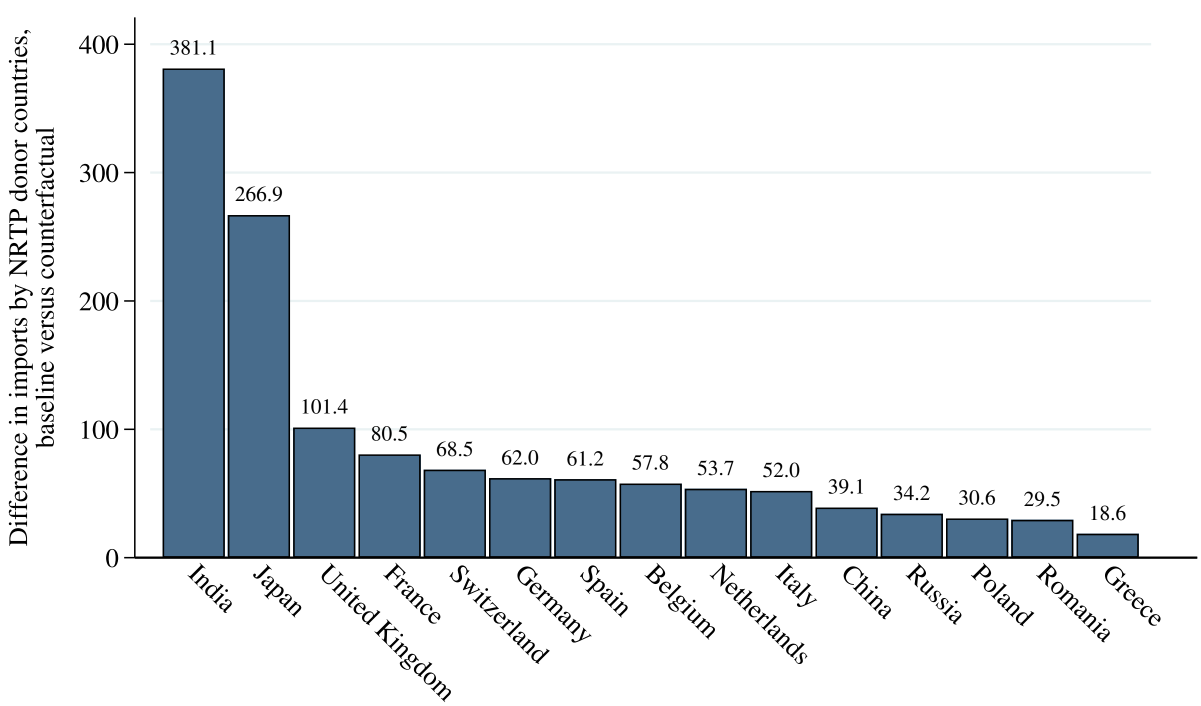
[17] While this figure is not insignificant, it should be noted that it amounts to only around 0.3% of the cumulative value of total exports by developing countries for these commodities ($306.5 billion). However, the increases in exports for many individual commodities (in particular, rice, sugar, rubber, and several others) correspond to significantly larger relative increases in trade.

Figure 4: Counterfactual impacts on beneficiary country exports and donor country imports, by commodity

(a) Impacts on beneficiary country exports to donor countries



(b) Impacts on donor country imports from beneficiary countries



Note: Difference in exports is calculated as $\Delta X_i = \sum_k \sum_{j \neq i}(X^{\text{B}}_{ijk} - X^{\text{C}}_{ijk})$ and difference in imports is calculated as $\Delta X_j = \sum_k \sum_{i \neq j}(X^{\text{B}}_{ijk} - X^{\text{C}}_{ijk})$. Values are in million USD.

Table 4: Bilateral Trade Linkages with the 30 Largest Estimated Trade Impacts

Exporter	**Importer**	**Commodity**	$\boldsymbol{\Delta X_{ijk}}$
Thailand	Japan	Rice	175.0
Tanzania	India	Cashews	107.8
Benin	India	Cashews	69.2
Colombia	United States	Bananas	63.3
Burkina Faso	India	Cashews	55.1
Mozambique	India	Cashews	38.4
Ukraine	Switzerland	Sunflower Oil	35.3
Cambodia	France	Rice	32.3
Myanmar	China	Rubber	27.0
Myanmar	Belgium	Rice	25.4
China	Japan	Rice	22.9
Brazil	United States	Sugar	21.5
Togo	India	Cashews	19.2
Uganda	India	Coffee	17.4
Brazil	Japan	Maize	17.2
Brazil	Romania	Sugar	17.2
Mozambique	Switzerland	Sunflower Oil	15.8
Guinea	India	Cashews	15.6
Cambodia	Germany	Rice	15.5
Brazil	United Kingdom	Sugar	15.0
Cambodia	Netherlands	Rice	12.6
Brazil	Spain	Sugar	11.5
Ukraine	Russia	Sunflower Oil	11.3
Vietnam	Japan	Rice	11.2
Senegal	India	Cashews	11.2
Botswana	United Kingdom	Meat (Bovine)	10.7
Ecuador	Belgium	Bananas	10.5
Niger	India	Rice	10.0
Ecuador	Germany	Bananas	9.9
Thailand	South Korea	Sugar	9.6

Notes: $\Delta X_{ijk} = X_{ijk}^{\mathrm{B}} - X_{ijk}^{\mathrm{C}}$ gives the difference in bilateral exports between the baseline and counterfactual scenarios (in million USD).

cashew imports, which in 2018 were valued at over $1.7 billion. The existence of its regime of NRTPs for developing countries and associated 37 percentage point preference margin is responsible for around $327 million of expanded cashew imports, most of which come from African exporters. The trade impacts for India are not confined to cashews, however, as its imports of coffee ($18.9 million) and rice ($15.9 million) also expand. Japan experiences the second largest impacts on its imports ($267.2 million), with the largest part of these impacts accruing from expanded imports of rice ($213.6 million) and maize ($31.7 million).

Many European countries also experience sizable increases in imports, including Switzerland ($68.5 million) and current and former EU members the United Kingdom ($101.4 million), France ($80.5 million), Germany ($62.0 million), and others.[18] All told, we estimate that the combined impacts on EU member countries' imports from beneficiary countries amounts to a sizable $619.9 million. These impacts are diverse in terms of commodities and partners and are too extensive to describe in detail. However, the largest impacts on NRTP-conferring countries' imports arise in the United Kingdom's sugar imports ($55.2 million in expanded imports), Switzerland's sunflower oil imports ($54.5 million), France's rice imports ($40.9 million), and Spain's sugar imports ($31.9 million). Other non-European countries, including China and South Korea, also experience higher imports from beneficiary countries ($39.1 million and $18.6 million, respectively), though these impacts are comparatively modest.

Noticeably absent from the list of countries that undergo the largest predicted impacts on imports is the United States, particularly given its status as a major importer of agricultural products and its extensive system of regionally oriented NRTPs and long-standing GSP regime. Surprisingly, and perhaps counterintuitively, we estimate total US imports from beneficiary countries to actually be *smaller* under the baseline scenario versus the counterfactual scenario, reflecting a difference in aggregate imports of $34.2 million. This lower value of US imports from NRTP beneficiary countries under the baseline scenario is driven almost entirely by impacts on US rice imports (though for almost all of the other commodities, US imports are higher under the baseline than the counterfactual scenario). This result is readily explained by two factors, which together highlight the importance of accounting for multilateral trade impacts in our analysis.

First, US preference margins on rice imports are very low (around two percentage points), and the counterfactual removal of these preferences on its own causes only a minimal reduction in US imports. Second, and more importantly, the simultaneous removal of other donor countries' NRTP schemes in the counterfactual scenario causes considerable re-allocations of other donor and beneficiary countries' trade. In this case, with the counterfactual removal of Japan's tariff preferences on rice imports and reversion to a 286% MFN tariff (and associated preference margin on Japanese rice imports of over 200 percentage points), Japan's rice imports from beneficiary countries decline markedly. With this decline, and the sizable differential change in the tariff margins on US versus Japanese rice imports, US rice imports from beneficiary countries in the counterfactual actually rise as a consequence of the reduction in Japanese import demand.

To summarize, we find that the counterfactual impacts of tariffs implemented under NRTPs on

[18] While the United Kingdom left the European Union in January 2020 (and thereafter no longer operated under the European Union's NRTPs and GSP), the country enacted its own GSP scheme upon its departure.

exports from beneficiary countries to donor countries depends strongly on a wide assortment of factors, none of which is sufficient on its own to fully explain the impacts. As described above, these factors broadly encompass (a) the magnitude of average preference margins across commodities and preference schemes, (b) the characteristics of commodities in terms of their importance in developing countries' export baskets, (c) the degree of substitutability between commodities from different sources as reflected by the estimated trade elasticity. The total trade impacts that we estimate ($1.4 billion in expanded trade between beneficiary and donor countries) are not overly large in comparison to the total volume of trade for these commodities. However, they are nonetheless significant for certain commodities and trading relationships, with some importer-exporter relationships estimated to undergo tens or hundreds of millions of dollars in elevated trade.

5. Concluding Discussion

Development-oriented NRTPs have grown in prevalence and scope since their introduction over five decades ago, with a rapidly growing number of donor countries enacting such special preferences to provide preferential market access to exporters from low- and middle-income countries. Though such preference schemes are implemented with the objective of facilitating export-driven growth for emerging economies, questions on their effectiveness have left researchers with an unclear picture of their overall impact.

In this study, we investigate the impact of NRTPs on exports from beneficiary countries to donor countries in a structural gravity framework for 23 major agricultural commodities. Based on estimates of the tariff elasticity of trade obtained from our econometric results, we undertake a counterfactual simulation analysis to quantify the anticipated differences in bilateral and aggregate trade volumes across countries and commodities under the hypothetical reversion of tariff rates under the current global regime of NRTPs to MFN levels. In doing so, we estimate the counterfactual impact of these special preferences to be around $1.4 billion in expanded exports from beneficiary countries to donor countries. However, these impacts exhibit substantial heterogeneity, and most of the increases in trade are concentrated in only a handful of commodities. Not surprisingly, these gains tend to arise in commodities for which preference margins and tariff elasticities are highest.

In short, our findings suggest that the effectiveness of development-oriented NRTPs in promoting agricultural trade seems to be significant for some countries, but quite limited for others. For countries whose special preference regimes offer only minimal gains in market access for beneficiary countries and negligible preference margins (among them, the United

States, Canada, Australia, New Zealand, and a handful of others) for the commodities that we analyze, NRTPs are estimated to have only modest impacts on the agricultural exports of developing countries. In contrast, the preference schemes of countries which otherwise maintain high levels of protectionism in agriculture (e.g., India, Japan) seem to be responsible for significant increases in the exports of beneficiary countries.

More broadly, our findings highlight the nuanced and evolving role of trade policy as a means to facilitate export-led development. In light of the secular declines in the levels of most advanced economies' tariff protectionism in agriculture over recent decades, the resulting erosion of preference margins has arguably diminished the relative effectiveness of NRTPs and GSP schemes in facilitating the exports of beneficiary countries. The proliferation of NTMs in the global trade environment, which in many cases serve as implicit forms of protectionism, has further altered the effective barriers to trade faced by exporters. In light of these observations, advanced economies and global institutions such as the WTO would be well served by considering how other margins of trade policy can be used to encourage the export-driven growth of developing countries.

References

Agnosteva, D., J. Anderson, and Y. Yotov (2014). Intra-National Trade Costs: Measurement and Aggregation. NBER Working Paper No. 19872.

Anderson, J., M. Larch, and Y. Yotov (2018). GEPPML: General Equilibrium Analysis with PPML. *The World Economy 41*(10), 2750–2782.

Anderson, J. and E. van Wincoop (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review 93*(1), 170–192.

Anderson, J. and Y. Yotov (2016). Terms of Trade and Global Efficiency of Free Trade Agreements, 1990–2002. *Journal of International Economics 99*, 279–298.

Anderson, K. (2022). Agriculture in a More Uncertain Global Trade Environment. *Agricultural Economics 53*(4), 563–579.

Anderson, K. and W. Martin (2005). Agricultural Trade Reform and the Doha Development Agenda. *The World Economy 28*(9), 1301–1327.

Anderson, K. and S. Ponnusamy (2022). Structural Transformation Away from Agriculture in Growing Open Economics. Forthcoming in *Agricultural Economics*.

Anderson, K., G. Rausser, and J. Swinnen (2013). Political Economy of Public Policies: Insights from Distortions to Agricultural and Food Markets. *Journal of Economic Literature 51*(2), 423–477.

Atkin, D. and A. Khandelwal (2020). How Distortions Alter the Impacts of International Trade in Developing Countries. *Annual Reviews of Economics 12*, 213–238.

Baier, S. and J. Bergstrand (2007). Do Free Trade Agreements Actually Increase Members' International Trade? *Journal of International Economics 71*(1), 72–95.

Boehm, C., A. Levchenko, and N. Pandalai-Nayar (2020). The Long and Short (Run) of Trade Elasticities. NBER Working Paper No. 27064.

Borchert, I. and M. Di Ubaldo (2020). Go Ahead and Trade: The Effect of Uncertainty Removal in the EU's GSP Scheme. ESRI Working Paper No. 691.

Bureau, J.-C., R. Chakir, and J. Gallezot (2007). The Utilisation of Trade Preferences for Developing Countries in the Agri-food Sector. *Journal of Agricultural Economics 58*(2), 175–198.

CEPII (2022). BACI Database. *Centre d'Etudes Prospectives et d'Informations* (CEPII). Available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=37.

Cheptea, A., M. Huchet, and L. Henry (2021). How Will Brexit Affect the Patterns of European Agricultural and Food Exports? *European Review of Agricultural Economics 48*(5), 1031–1073.

Cipollina, M. and L. Salvatici (2010). The Trade Impact of European Union Agricultural Preferences. *Journal of Economic Policy Reform 13*(1), 87–106.

Cirera, X., F. Foliano, and M. Gasiorek (2016). The Impact of Preferences on Developing Countries' Exports to the European Union: Bilateral Gravity Modeling at the Product Level. *Empirical Economics 50*(1), 59–102.

Correia, S. (2015). Singletons, Cluster-Robust Standard Errors, and Fixed Effects: A Bad Mix. Technical Note, Duke University.

Dadakas, D. and S. Tatsi (2021). Global Agricultural Trade Impact of the 2011 Triple Disaster in Japan: A Gravity Approach. *Australian Journal of Agricultural and Resource Economics 65*(4), 937–972.

Egger, P., M. Larch, and Y. Yotov (2022). Gravity Estimations with Interval Data: Revisiting the Impact of Free Trade Agreements. *Economica 89*(353), 44–61.

Egger, P. and S. Nigai (2015). Structural Gravity with Dummies Only: Constrained ANOVA-Type Estimation of Gravity Models. *Journal of International Economics 97*(1), 86–99.

Fally, T. (2015). Structural Gravity and Fixed Effects. *Journal of International Economics 97*(1), 76–85.

FAO (2022). FAOSTAT Statistical Database. Food and Agriculture Organization of the United Nations. Available at http://www.fao.org/faostat/en/#data. Accessed January 14th, 2022.

Fontagné, L., H. Guimbard, and G. Orefice (2022). Tariff-Based Product-Level Trade Elasticities. *Journal of International Economics 137*, 103593.

Francois, J., B. Hoekman, and M. Manchin (2006). Preference Erosion and Multilateral Trade Liberalization. *The World Bank Economic Review 20*(2), 197–216.

Gaulier, G. and S. Zignago (2010). BACI: International Trade Database at the Product-Level. Munich Personal RePEc Archive Paper No. 31398.

Gil-Pareja, S., R. Llorca-Vivero, and J. A. Martínez-Serrano (2014). Do Nonreciprocal Preferential Trade Agreements Increase Beneficiaries' Exports? *Journal of Development Economics 107*, 291–304.

Grossman, G. and A. Sykes (2005). A Preference for Development: The Law and Economics of GSP. *World Trade Review 4*(1), 41–67.

Gurevich, T. and P. Herman (2018). The Dynamic Gravity Dataset: 1984–2016. USITC Working Paper No. 2018-02-A.

Hakobyan, S. (2015). Accounting for Underutilization of Trade Preference Programs: The Us Generalized System of Preferences. *Canadian Journal of Economics 48*(2), 408–436.

Herz, B. and M. Wagner (2011). The Dark Side of the Generalized System of Preferences. *Review of International Economics 19*(4), 763–775.

Olivero, M. and Y. Yotov (2012). Dynamic Gravity: Endogenous Country Size and Asset Accumulation. *Canadian Journal of Economics 45*(1), 64–92.

Ornelas, E. and M. Ritel (2020). The Not-so-Generalised Effects of the Generalized System of Preferences. *The World Economy 43*(7), 1809–1840.

Raimondi, V. and A. Olper (2011). Trade Elasticity, Gravity and Trade Liberalisation: Evidence from the Food Industry. *Journal of Agricultural Economics 62*(3), 525–550.

Ridley, W. and S. Devadoss (2023). Competition and Trade Policy in the World Cotton Market: Implications for US Cotton Exports. Forthcoming in *American Journal of Agricultural Economics*.

Ridley, W., J. Luckstead, and S. Devadoss (2022). Wine: The Punching Bag in Trade Retaliation. *Food Policy 109*, 102250.

Santeramo, F. G. and E. Lamonaca (2019). The Effects of Non-Tariff Measures on Agri-Food Trade: A Review and Meta-Analysis of Empirical Evidence. *Journal of Agricultural Economics 70*(3), 595–617.

Santos Silva, J. and S. Tenreyro (2006). The Log of Gravity. *Review of Economics and Statistics 88*(4), 641–658.

Santos Silva, J. and S. Tenreyro (2011). Further Simulation Evidence on the Performance of the Poisson Pseudo-Maximum Likelihood Estimator. *Economics Letters 112*(2), 220–222.

Sharma, A., K. Boys, and J. Grant (2019). The Bright Side of the Generalized System of (Trade) Preferences: Lessons from Agricultural Trade. *Journal of Agricultural and Resource Economics 44*(1), 32–61.

Sharma, A., J. Grant, and K. Boys (2021). Truly Preferential Treatment? Reconsidering the Generalised System of (Trade) Preferences with Competing Suppliers. *Journal of Agricultural Economics 72*(2), 500–524.

Trefler, D. (2004). The Long and Short of the Canada-US Free Trade Agreement. *American Economic Review 94*(4), 870–895.

UNCTAD (2022). Trade Analysis Information System Database (TRAINS). UN Council on Trade and Development. Available at https://wits.worldbank.org/. Accessed January 14th, 2022.

World Bank (2021). National Accounts Data. Available at https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS.

WTO (2022). World Tariff Profiles. World Trade Organization. Available at https://www.wto.org/english/res_e/publications_e/world_tariff_profiles22_e.htm.

Yotov, Y. (2022). On the Role of Domestic Trade Flows for Estimating the Gravity Model of Trade. *Contemporary Economic Policy 40*(3), 526–540.

Zongo, W. J.-B. and B. Larue (2019). A Counterfactual Experiment about the Eradication of Cattle Diseases on Beef Trade. *Canadian Journal of Agricultural Economics 67*(4), 379–396.

Appendix

Table A1: Countries in Empirical Analysis

Afghanistan*	Dominican Republic*	Lesotho*	Rwanda*
Albania*	Ecuador*	Liberia*	Saudi Arabia*
Algeria*	Egypt*	**Lithuania***	Senegal*
Angola*	El Salvador*	**Luxembourg**	Sierra Leone*
Argentina*	**Estonia***	Macau*	Singapore*
Armenia*	Ethiopia*	Macedonia*	**Slovakia***
Australia	Fiji*	Madagascar*	**Slovenia***
Austria	**Finland**	Malawi*	South Africa*
Azerbaijan*	**France**	Malaysia*	**South Korea***
Bahamas*	French Polynesia*	Mali*	**Spain**
Bahrain*	Gabon*	**Malta**	Sri Lanka*
Bangladesh*	Gambia*	Mauritius*	Sudan*
Barbados*	Georgia*	Mexico*	Suriname*
Belarus*	**Germany**	Moldova*	Swaziland*
Belgium	Ghana*	Mongolia*	**Sweden**
Benin*	**Greece**	**Morocco***	**Switzerland**
Bolivia*	Guatemala*	Mozambique*	Syria*
Bosnia and Herzegovina*	Guinea*	Myanmar*	**Tajikistan***
Botswana*	Haiti*	Namibia*	Tanzania*
Brazil*	Honduras*	Nepal*	**Thailand***
Brunei*	Hong Kong*	**Netherlands**	Togo*
Bulgaria*	**Hungary***	**New Zealand**	Trinidad and Tobago*
Burkina Faso*	**Iceland**	Nicaragua*	Tunisia*
Cambodia*	**India***	Niger*	**Turkey***
Cameroon*	Indonesia*	Nigeria*	Turkmenistan*
Canada	Iran*	**Norway**	Uganda*
Chile*	**Ireland**	Oman*	Ukraine*
China*	Israel*	Pakistan*	United Arab Emirates*
Colombia*	**Italy**	Palestine*	**United Kingdom**
Congo*	Jamaica*	Panama*	**United States**
Costa Rica*	**Japan**	Papua New Guinea*	Uruguay*
Côte d'Ivoire*	Jordan*	Paraguay*	Uzbekistan*
Croatia*	**Kazakhstan***	Peru*	Venezuela*
Cuba*	Kenya*	Philippines*	Vietnam*
Cyprus*	Kuwait*	**Poland***	Yemen*
Czech Republic*	**Kyrgyzstan***	**Portugal**	Zambia*
Dem. Rep. of the Congo*	Laos*	Qatar*	Zimbabwe*
Denmark	**Latvia***	**Romania***	
Djibouti*	Lebanon*	**Russia***	

Notes: Bold entries indicate NRTP/GSP donor countries. * indicates NRTP/GSP beneficiary countries.

Alternative Gravity Equation Estimates

Estimates of Equation (4) based on Interval Data

Our baseline gravity estimates presented in Table 3 and Figure 2 are obtained using our full panel of data for 2000–2018 pooled across consecutive years. However, many researchers (see, e.g., Trefler, 2004; Baier and Bergstrand, 2007; Olivero and Yotov, 2012) have advocated for the use of interval to account for non-instantaneous adjustments of trade volumes to changes in trade policy. To assess the robustness of our baseline results, we estimate equation (4) by instead using data at three-year intervals for the 2000–2018 period.

The results for this estimation are presented in Table A3. Encouragingly, the alternative specification yields estimates that are broadly similar to our baseline estimates.

Table A2: Sample Summary Statistics by Commodity

	International trade (X_{ijt} for $i \neq j$)				Intra-national trade (X_{ijt} for $i = j$)				Tariffs (τ_{ijt})			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Avocados	0.1	6.3	0.0	2,157.3	16.8	75.1	0.0	1171.9	13.9	20.4	0.0	607.5
Bananas	0.4	8.7	0.0	929.5	171.4	779.1	0.0	13,140.5	19.8	95.3	0.0	3,000.0
Cashews	0.2	5.5	0.0	1,189.6	12.9	99.9	0.0	2,165.7	11.5	13.8	0.0	178.3
Cocoa Beans	0.3	8.0	0.0	1,150.4	20.7	214.7	0.0	9,801.7	6.1	8.4	0.0	45.0
Coffee	0.8	13.7	0.0	1,868.9	25.6	177.8	0.0	4,650.5	12.4	14.3	0.0	100.0
Cotton	0.5	16.1	0.0	3,427.8	156.1	1,220.7	0.0	38,773.5	3.8	6.8	0.0	90.0
Grapes	0.3	6.0	0.0	773.7	380.3	1,464.6	0.0	17,182.6	14.3	17.6	0.0	182.5
Maize	0.9	25.0	0.0	4,394.0	966.1	6,116.9	0.0	114,471.8	8.9	30.9	0.0	395.3
Meat (Bovine)	1.2	24.5	0.0	2,412.6	1,221.6	4,460.8	0.0	61,154.6	25.2	37.8	0.0	302.7
Meat (Pig)	0.9	18.4	0.0	1,979.1	1,226.8	9,485.6	0.0	178,251.1	22.7	37.5	0.0	418.4
Meat (Poultry)	0.7	13.9	0.0	1,413.7	968.8	3,427.5	0.0	53,652.9	21.9	32.6	0.0	398.1
Palm Oil	0.9	30.6	0.0	5,047.2	74.7	578.3	0.0	15,793.1	9.0	13.4	0.0	182.5
Rice	0.7	12.3	0.0	2,217.6	1,411.0	7,253.4	0.0	119,153.1	15.0	26.7	0.0	513.0
Rubber	0.6	21.3	0.0	4,854.6	50.6	346.9	0.0	6,230.6	3.7	6.3	0.0	77.0
Soybean Meal	0.8	16.8	0.0	2,280.8	248.2	1,716.5	0.0	32,851.8	4.8	8.3	0.0	80.5
Soybean Oil	0.3	10.1	0.0	1,960.9	152.0	949.1	0.0	13,451.5	10.8	17.6	0.0	194.0
Soybeans	1.4	95.4	0.0	27,224.3	348.1	2,015.0	0.0	24,958.2	7.9	39.4	0.0	508.6
Sugar	0.9	15.2	0.0	1,850.4	287.8	988.6	0.0	16,767.5	20.9	25.4	0.0	146.3
Sunflower Oil	0.3	7.2	0.0	1,773.8	35.4	159.5	0.0	2,570.8	10.4	12.4	0.0	104.7
Tea	0.2	3.7	0.0	581.7	51.5	473.1	0.0	10,738.4	12.6	26.0	0.0	288.2
Tobacco	0.4	5.0	0.0	480.2	80.7	695.6	0.0	14,303.5	40.3	178.7	0.0	2,399.3
Tomatoes	0.3	11.0	0.0	2,174.9	456.6	2,149.6	0.0	33,636.3	18.6	25.5	0.0	300.4
Wheat	1.4	23.2	0.0	3,720.0	722.1	3,167.6	0.0	51,305.3	8.2	17.6	0.0	168.2

Notes: Trade flows are measured in million USD. Tariffs are measured in percentage.

Table A3: Full Estimates of Gravity Equation, by Commodity (Three-Year Interval Data)

	Trade Policy Variables							
	$\ln(1+\tau)$		PTA		WTO			Pseudo
Commodity	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.	Obs.	R^2
Avocados	–3.093	(4.907)	–1.943[a]	(0.305)	–0.261	(0.684)	18,364	0.991
Bananas	–6.888[a]	(1.054)	0.148	(0.113)	–0.289	(1.063)	27,850	0.994
Cashews	0.473	(1.712)	–0.182	(0.124)	2.034[a]	(0.397)	36,427	0.982
Cocoa Beans	–5.286[a]	(2.040)	–0.009	(0.114)	–1.052	(0.989)	16,800	0.979
Coffee	–2.036[a]	(0.628)	–0.008	(0.063)	0.035	(0.162)	61,541	0.982
Cotton	–2.263	(1.724)	0.011	(0.189)	–0.051	(0.550)	28,725	0.989
Grapes	–5.232[a]	(0.998)	0.152	(0.115)	0.864[a]	(0.271)	37,696	0.998
Maize	–0.171	(0.275)	0.179	(0.176)	1.290[a]	(0.396)	32,681	0.996
Meat (Bovine)	–2.150[a]	(0.481)	–0.473[b]	(0.211)	0.284	(0.612)	33,872	0.997
Meat (Pig)	–2.896[a]	(0.604)	0.166	(0.151)	–0.203	(0.485)	26,176	0.998
Meat (Poultry)	–1.934[a]	(0.451)	0.789[a]	(0.243)	–0.471	(0.414)	35,583	0.997
Palm Oil	–2.033[c]	(1.092)	0.834[a]	(0.270)	0.191	(0.673)	26,730	0.984
Rice	0.141	(0.197)	0.062	(0.207)	0.332	(0.399)	45,972	0.998
Rubber	–1.604[b]	(0.798)	–0.325[b]	(0.162)	0.040	(0.306)	32,841	0.988
Soybean Meal	–4.126[c]	(2.357)	0.368	(0.317)	–0.041	(0.928)	16,909	0.988
Soybean Oil	–4.074[a]	(1.378)	0.121	(0.234)	–1.162[b]	(0.573)	24,709	0.989
Soybeans	0.177	(0.950)	–0.137	(0.462)	1.794[a]	(0.564)	22,050	0.992
Sugar	–2.472[a]	(0.338)	0.273[c]	(0.143)	–0.378	(0.307)	50,435	0.982
Sunflower Oil	1.921[c]	(1.099)	0.660[a]	(0.164)	0.149	(0.262)	31,804	0.970
Tea	–2.288[a]	(0.784)	0.284[a]	(0.092)	–0.064	(0.244)	55,206	0.992
Tobacco	–1.259[a]	(0.318)	–0.136	(0.100)	0.758[a]	(0.282)	38,004	0.977
Tomatoes	–2.650[a]	(0.765)	0.885[b]	(0.348)	–1.136[b]	(0.530)	25,982	0.999
Wheat	–1.106[b]	(0.538)	0.044	(0.117)	0.220	(0.289)	27,828	0.990

Notes: Dependent variable in each regression is the value of unidirectional exports by commodity. Estimates from each row are obtained from the same regression. Estimation includes exporter-year, importer-year, and country-pair fixed effects. Robust standard errors clustered by country pair are reported in parentheses. Intercept is included in estimation but not reported. a: $p < 0.01$, b: $p < 0.05$, c: $p < 0.1$.

Full Results on NRTP Beneficiary Exports and Donor Imports

Tables A4 and A5 present the full results for the counterfactual analysis of NRTP benefiaries' exports to donor countries and NRTP donors' imports from beneficiary countries, respectively, cumulative across the 23 commodities in the analysis.

Table A4: Complete Results for Counterfactual Impacts on NRTP Beneficiary Country Exports to Donor Countries

Country	ΔX_i	**Country**	ΔX_i	**Country**	ΔX_i
Brazil	152.8	Kazakhstan	4.7	Turkmenistan	0.1
Myanmar	135.9	Dominican Republic	4.0	Djibouti	0.1
Thailand	132.1	Panama	4.0	Angola	0.1
Tanzania	113.9	Paraguay	4.0	Venezuela	0.1
Ukraine	108.1	Kenya	3.7	Romania	0.1
Cambodia	106.4	Malaysia	3.6	Georgia	0.1
Benin	66.7	Singapore	3.5	Haiti	-
Mozambique	62.1	Fiji	3.5	Lithuania	-
Burkina Faso	53.2	Morocco	3.3	Tajikistan	-
China	35.1	Madagascar	3.1	Albania	-
Russia	27.2	Nicaragua	2.9	Croatia	-
India	21.4	Afghanistan	2.7	Jordan	-
Swaziland	21.3	Papua New Guinea	2.7	Bulgaria	-
Ecuador	20.8	Uruguay	2.7	Syria	-
Togo	20.7	El Salvador	2.5	Gabon	-
Botswana	17.2	Egypt	2.5	Hungary	-
Guinea	16.4	South Korea	2.4	Azerbaijan	-
Guatemala	15.9	Mali	2.3	Bahrain	-
Laos	15.1	Uzbekistan	2.2	Mongolia	-
Argentina	13.2	Jamaica	2.1	Armenia	-
Peru	12.7	Indonesia	2.0	Oman	-
Malawi	12.0	Tunisia	1.9	Estonia	-
Vietnam	11.6	Sudan	1.9	Bahamas	-
Senegal	11.4	Belarus	1.5	Kuwait	-
Costa Rica	11.4	Iran	1.3	Trinidad and Tobago	-
South Africa	11.3	Nepal	1.3	Latvia	-
Cuba	10.8	Cameroon	1.1	Slovenia	-
Niger	10.7	Pakistan	1.1	Slovakia	-
Algeria	10.5	Sri Lanka	1.0	Poland	-
Namibia	9.8	Bolivia	0.8	Macau	-
Turkey	9.3	Honduras	0.8	Czech Republic	-
Chile	9.1	Bosnia and Herzegovina	0.7	Palestine	-
Mauritius	8.6	Barbados	0.7	Cyprus	-
Uganda	8.4	Liberia	0.7	French Polynesia	-
Moldova	7.9	Macedonia	0.6	Malta	-
Zimbabwe	7.6	Congo	0.5	Brunei	-
Côte d'Ivoire	7.1	Saudi Arabia	0.4	Lesotho	-
Gambia	6.9	Israel	0.3	Qatar	-
Philippines	6.3	Sierra Leone	0.3	Nigeria	–0.6
Bangladesh	6.3	Lebanon	0.2	Ghana	–2.6
Ethiopia	5.9	Rwanda	0.2	Colombia	–4.3
United Arab Emirates	5.0	Kyrgyzstan	0.2	Mexico	–7.4
Suriname	4.8	Yemen	0.2	*Total*	*1,433.6*
Zambia	4.7	Hong Kong	0.2		

Notes: Entries depict the estimated impact on NRTP beneficiary countries' exports to donor countries (in million USD) cumulative across the 23 commodities in the analysis. "-" indicates estimates of less than $100 thousand in value.

Table A5: Complete Results for Counterfactual Impacts on NRTP Donor Country Imports from Beneficiary Countries

Country	$\boldsymbol{\Delta X_i}$	**Country**	$\boldsymbol{\Delta X_i}$
India	381.1	Thailand	5.9
Japan	266.9	Austria	4.9
United Kingdom	101.4	Hungary	3.4
France	80.5	Morocco	2.8
Switzerland	68.5	Slovenia	2.6
Germany	62.0	Armenia	2.0
Spain	61.2	Estonia	2.0
Belgium	57.8	Malta	1.6
Netherlands	53.7	Latvia	1.5
Italy	52.0	Cyprus	1.5
China	39.1	Kyrgyzstan	1.3
Russia	34.2	Ireland	0.9
Poland	30.6	Australia	0.8
Romania	29.5	Luxembourg	0.7
Greece	18.6	Slovakia	0.5
South Korea	18.6	Tajikistan	0.1
Bulgaria	17.0	Chile	-
Portugal	15.6	Iceland	-
Croatia	10.7	Turkey	-
Finland	9.4	New Zealand	–0.3
Czech Republic	9.4	Canada	–4.3
Sweden	8.2	Norway	–5.3
Kazakhstan	7.1	United States	–34.2
Denmark	6.3	*Total*	*1,433.6*
Lithuania	6.2		

Notes: Entries depict the estimated impact on NRTP beneficiary countries' exports to donor countries (in million USD) cumulative across the 23 commodities in the analysis. "-" indicates estimates of less than $100 thousand in value.