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The Bright Side of the Generalized System of (Trade) Preferences: Lessons from Agricultural Trade

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Empirical evidence on the Generalized System of Preferences (GSP) for low-income countries generally portrays a rather stark prediction: the program has produced virtually no impact on intended low-income beneficiaries' exports to high-income countries. This result, based on total merchandise trade, is misleading because it masks three underlying heterogeneities in the program: i) preference structure across countries, ii) pre-existing distortions across sectors, and iii) rules of origin. Using a theoretically consistent gravity equation for sector- and product-level trade over 1962–2010, we illustrate that the GSP has delivered significant positive effects for low-income countries' agricultural exports (but not necessarily for their nonagricultural exports) to developed countries.

Key words: gravity, heterogeneity, Poisson pseudo-maximum likelihood

Introduction

The global economic downturn in the post-war period of the 1960s exacerbated the already significant economic divide between high- and low-income countries. The Generalized System of Preferences (GSP) was introduced in 1971 under the aegis of the United Nations Conference on Trade and Development (UNCTAD) to address this economic divide by encouraging developed countries to offer nonreciprocal tariff reductions or duty-free status to certain products imported from designated developing and least-developed countries (LDC).[1] The nonreciprocal nature of the GSP program ensures that when countries offer GSP tariff reductions, they do not ask for reciprocal preferential treatment from the beneficiaries. This important design feature preserves the idea that low-income countries are never obliged to repay the benefits they receive as the GSP is revised and renewed through time. While the idea of nonreciprocity of preferences contradicts the charter of the Most Favored Nation (MFN) principle,[2] it is compatible with the World Trade Organization's (WTO) Enabling Clause, which allows developed countries to treat developing countries more favorably than other WTO members. Notably, the WTO considers the GSP program an important approach for fostering economic growth and development in less-developed countries through trade. As a result, perhaps, the GSP program has expanded considerably over time.

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[1] It is no longer solely high-income countries that administer GSP programs; some economically developing nations—such as India, China, Kazakhstan, the Kyrgyz Republic, Russia, and Thailand—now also extend this form of preferential treatment to their less-developed counterparts. Following previous literature, we use the terms "developed," "donor countries," or "donors" to refer to high-income countries and "GSP recipients" or "recipients" to refer to low-income or less-developed countries receiving GSP preferences.

[2] MFN treatment refers to the World Trade Organization (WTO) principle that countries cannot discriminate between trade partners; that is, if a country extends favorable treatment—such as tariff reductions on a product—to one partner, then it has to extend the same reduced tariff to all WTO members.

From a modest start in 1971, when Japan, Norway, and the European Community were the only donors, 43 countries now provide GSP tariff preferences to more than 200 states and territories (World Trade Organization, 2017a). In 2016, about €62.7 billion in imports into the European Union received GSP preferences (European Commission, 2018). Similarly, the Congressional Budget Office (CBO) estimates that the U.S. GSP program will result in $665 million in foregone tariff revenue in 2017 (Congressional Budget Office, 2015). In light of this transfer—of potential GSP tariff revenue—from importers to exporters in low-income countries, it is often assumed that the GSP is a promising trade liberalization effort toward growth and development in less-developed countries. However, empirical research assessing the GSP impact on bilateral trade has produced contradictory results. For example, in one of the most comprehensive recent studies of the program, Herz and Wagner (2011) place the value of the GSP program squarely in doubt. Their model incorporates recent advances in specification and estimation, pools across all GSP programs, and uses total merchandise trade flows to evaluate GSP outcomes. The authors find that while exports of GSP beneficiaries are improved in the short run, in the long run their exports to high-income countries are hampered.

This paper reconciles the apparent inconsistency between the program's ambitions and Herz and Wagner's (2011) conclusion regarding the program's trade flow effects. Our approach is grounded in examining three underlying heterogeneities in the GSP program and its design: i) differences in preference structure across countries, ii) differences in pre-existing distortions in agriculture compared to nonagricultural sector, and iii) rules of origin (RoO). For more than 2 decades after its conception, GSP preferences were limited to manufacturing and semi-manufacturing products. This pro-industry stance on GSP intervention is rooted in the Prebisch–Singer hypothesis on relative prices of primary agricultural products. Accordingly, export earnings from nonprimary and manufacturing products were expected to improve the terms of trade in favor of less-developed countries (see Ray, 1987; Williamson, 2002; Santos, Farias, and Cunha, 2005). However, developing countries' comparative advantages have historically been in the production of agricultural products (Panagariya, 2003; Grossman and Sykes, 2005). Therefore, as suggested by earlier studies examining GSP impacts (e.g., Yamazaki, 1996; Panagariya, 2003; Bureau, Jean, and Matthews, 2006), excluding the agricultural sector from the program did not produce the desired outcomes. In addition, recipient countries were not always able to comply with the RoO requirements.[3] This was particularly relevant for the less-privileged recipient countries (Cadot et al., 2006; Dowlah, 2008; Grinols and Silva, 2011; Hakobyan, 2015). The Uruguay Round Agreement on Agriculture (URAA) streamlined these issues by formally recognizing LDC among less-developed countries and by integrating the agricultural sector into the GSP program. Subsequently, LDC received larger reductions in tariff rates and often had expanded product coverage, including many agricultural products, compared to developing countries.

GSP trade liberalization reforms have the potential to benefit the preference recipients through different channels, for example, by inducing mark-up responses at the production unit level, which aggregates up to market share reallocations at a global level (Viner, 1950; Lipsey, 1957; Kemp, 1964; Vanek, 1965; Ohyama, 1972; Kemp and Wan, 1976; Bhagwati, Greenaway, and Panagariya, 1998; Panagariya, 2000; Melitz, 2003; Helpman, Melitz, and Rubinstein, 2008). The potential GSP trade benefits, however, are likely related to the following three heterogeneities: First, differences in preference structures between LDC and developing countries suggest that the GSP impact on exports originating from these two sets of countries can be different. Second, whereas the products in the nonagricultural sector face an average MFN rate as low as 5%, tariff peaks of rates above 100% are common in agriculture and food products (see Hoekman, Ng, and Olarreaga, 2002; Guimbard et al., 2012). Thus, given the relative predominance of agricultural products in their exports, GSP tariff preferences may generate significant positive trade impacts for LDC and developing countries'

[3] RoO include criteria concerning product origin, consignment conditions, and documentary evidence requirements. For example, the origin criteria requires an eligible product to originate or undergo a minimum amount of processing in a recipient country.

exports of agricultural products compared with nonagricultural products. Third, relative to primary agricultural products, the RoO might have a more pronounced impact on processed agricultural products because they are more likely to require advanced processing technology, and several intermediate inputs in their production process. The idea that these heterogeneities may impact trade is not entirely new; however, to best of our knowledge, the GSP program has not been evaluated in a unified context of these three asymmetries. We fill this void.

We keep our analytical framework purposefully simple and focused on the three heterogeneities. To that end, the preference margin, utilization rate, and product-based graduation policies, while important, are not the focus of this paper (see Devault, 1996; Hoekman and Michel, 2001; Inama, 2003; Manchin, 2006; Limão, 2007; Cuyvers and Soeng, 2013; Sharma, Grant, and Boys, 2015, for details).[4] For our empirical purpose, we adopt a holistic approach and consider the universe of GSP donor and recipient countries over an extended sampling period (1962–2010). This approach is particularly appealing because most studies in this literature take a case-study approach and generally use a shorter time frame. Herz and Wagner (2011) is the only known exception. Further, the use of sector-level trade data and consideration of export-product composition (within sectors) across different types of recipients has permitted us a robust identification of the three heterogeneities. Using a theoretically founded gravity model of international trade, we find that the GSP program has significantly increased agricultural exports from developing countries to high-income countries but does not necessarily increase their exports of nonagricultural goods. In addition, the GSP effect is large, positive, and statistically significant even for the LDC recipients of primary agricultural products, which they export more intensively. For a given year, their exports turn out to be about 43% higher compared to nonrecipients' exports of primary agricultural products. In our sample of 185 countries, the overall share of agriculture in gross domestic product (GDP) is small compared to that from the nonagricultural sector. However, this difference is notable when considering that total primary agricultural exports constitute about US$4.7 billion in 2010 alone. In short, although our analysis does not examine the economy-wide welfare implications of the GSP program for low-income countries, our findings indicate that this program's performance is generally consistent with its design.

Heterogeneities in the Pattern of GSP Recipient Trade

The three heterogeneities introduced in the previous section are easy to understand, but are they exhibited in patterns of trade? Below, we present graphical and descriptive analyses of these heterogeneities to illustrate some initial clues.

Heterogeneity across Sectors

Figure 1 illustrates the differences in average applied tariff rates for agricultural and nonagricultural products exported from GSP recipients and nonrecipients between 2000 and 2008. We use Harmonized System (HS) 6-digit trade data from the United Nation's Comtrade database and matching HS-6-digit tariff data from the World Integrated Trade Solutions (WITS) database to construct these average tariffs.[5] First, we average HS-6-digit tariffs over all the exported products

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[4] That said, we do include relevant panel dummies in our estimating equations to account for these country or country-pair and product-specific characteristics.

[5] The agricultural (nonagricultural) dataset contains 613 (3,906) HS-6-digit products and matching MFN, GSP, and other preferential tariff rates. In the agricultural (nonagricultural) sample, 24.5% (17%) of the observations are GSP recipients. Of these recipients in agricultural (nonagricultural) data, 36.5% (17.5%) are LDC recipients and the remaining are developing country recipients. HS-6-digit tariff data are not complete for many recipients for the initial years of the GSP program. Thus, we are constrained to using this shorter panel (2000–2008) for exploring the sources of heterogeneity. However, the majority of our empirical analysis does not require tariff information, and we are thus able to use a longer sampling frame (1962–2010). The HS-6-digit agricultural dataset is also used in sensitivity tests. In all cases, we use the 185 countries listed in Appendix A.

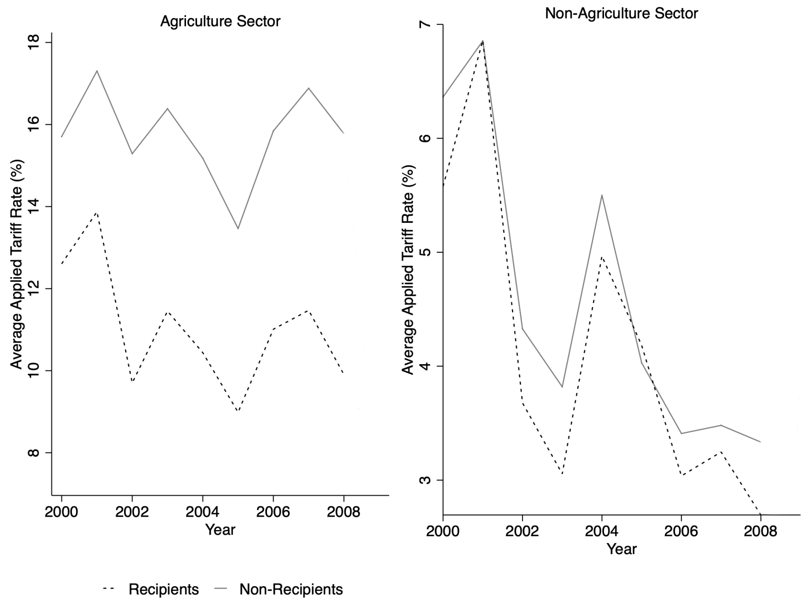

Figure 1. Differences in Applied Tariff Rates for Aggregated Agricultural and Nonagricultural Sectors

in a given sector for each country.[6] We then average these country-level tariffs over recipients and nonrecipients for each sector. Hence, the differences illustrated in this figure reflect changes in tariff rates across recipients and nonrecipients over time and are not driven by changes in the volume of their exports. If the GSP program has generated a significant tariff reduction, we could expect to see differences in the applied tariff rates between GSP recipients and nonrecipients in each sector. As illustrated in Figure 1, tariff rates in agriculture for GSP recipients are noticeably lower compared with those of nonrecipients. In most years, this pattern is also generally true for the nonagricultural sector. However, there are important differences between the two sectors. For example, in 2008, nonrecipients faced a tariff rate of about 17% in the agricultural sector but barely 3.5% in the nonagricultural sector. Because the agricultural sector faces a higher tariff rate on average and the difference in tariff rates between recipients and nonrecipients is also higher for the agricultural sector, we expect that the GSP has a greater impact on trade in this sector.

Heterogeneity across Recipients

Figure 2 shows the difference in applied tariff rates for developing and LDC recipients in the agricultural sector. The figure categorizes the percentage of goods exported in a given tariff range into one of five continuous bins. By way of example, to interpret this figure, an average applied tariff rate of 5 denotes export products with an applied tariff rate of between $>0\%$ and $\leq 5\%$. Again, we use the matching HS-6-digit agricultural tariff data from WITS and trade data from UNCTAD to compute these export shares. First, we compute export shares for each tariff bin separately for each country.[7] Then, we average these export shares over respective groups of recipients by each tariff bin.

The share of goods exported duty-free is significantly higher for LDC recipients. In 2000, LDC recipients exported 50% of their goods duty-free compared to only about 30% of developing country

[6] Note that the tariffs are averaged over only the exported products; therefore, these averages, like other averages that do not use counterfactuals, do not account for prohibitive tariffs that result in zero trade flows between country pairs.

[7] For a given country, this share is the ratio of a number of actually traded tariff lines in a given bin to the total number of traded tariff lines in the agricultural sector.

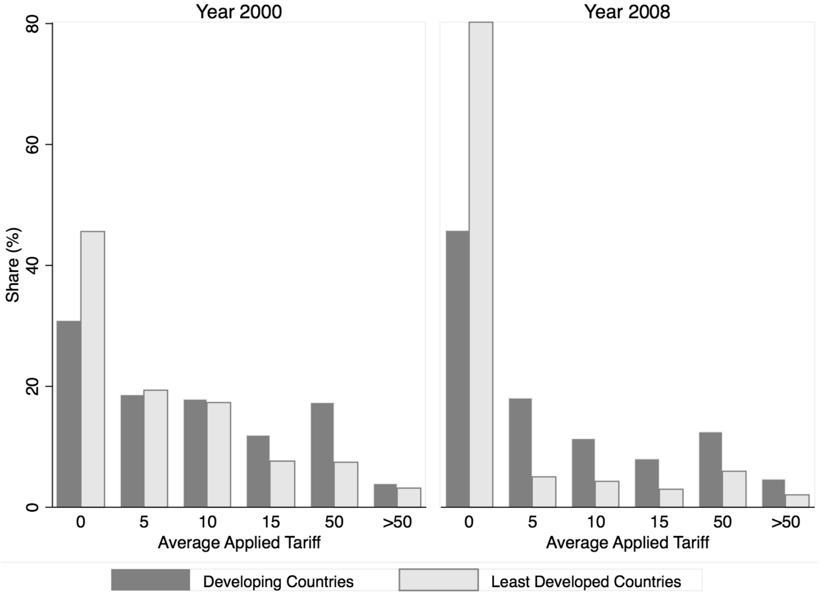

Figure 2. Differences in Liberalization across GSP Recipients in the Agricultural Sector

recipients' exports. In addition, the relative benefits offered to these groups of recipient countries have increased over time. By the end of 2008, LDC recipients exported 80% and developing country recipients exported 45% of agricultural goods duty-free. While it is plausible that some eligible GSP exports at the HS-6-digit level might not have utilized GSP preferences, Figure 2 still suggests that the GSP program offers meaningful benefits to its recipients in the agricultural sector.

Heterogeneity in Export Competition

As noted before, LDC recipients generally trade primary agricultural products more intensively. Further, developing countries, with their often higher technical capacities or better ability to meet RoO and other trading requirements, trade both primary and processed agricultural products. It is thus possible that the difference in average applied tariff rates observed in Figure 2 was partly driven by the difference in the composition of recipients' export bundles to high-income countries. Therefore, Figure 3 presents the difference in the value of GSP exports of primary and processed agricultural goods for developing and LDC recipients. LDC recipients increased their exports of primary products to developed countries from about US$0.4 billion in 1971 to about US$3.8 billion in 2010, while their exports of processed products to developed countries increased relatively little (US$0.25–US$0.5 billion) over the same period. In contrast, developing countries' GSP exports of processed products increased from about US$2.5 billion to about US$70 billion over the same period. Notably, there is a reversal in the pattern of exports for developing country recipients. Before 1995, the majority of developing country recipients' agricultural exports were primary products. After 1995, there was both a decrease in primary product exports and an increase in processed product exports, which, by 2000, dominated developing country recipients' exports. Recall that one of the GSP goals was to foster industrialization and thereby accelerate the economic growth of lower-income countries. While the GSP may have contributed to the doubling of the processed agricultural exports of LDC countries, this impact is dwarfed by the 28-fold increase in developing countries' processed-good exports.

These stylized facts provide evidence of three important heterogeneities in the GSP program and form the basis of this study. Is there a "bright side" to the GSP program once these heterogeneities

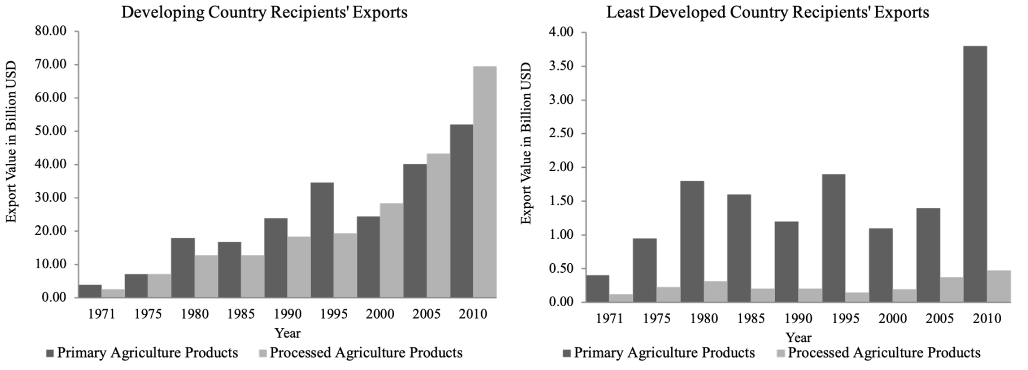

Figure 3. Differences in Primary and Processed Agricultural Product Exports across GSP Recipients

are taken into account? In the next section, we present a model of bilateral trade flows to answer this question.

Model

We use a gravity model to assess the impact of GSP on bilateral trade flows. Following Dixit and Stiglitz (1977), Anderson and Wincoop (2003), and Baldwin and Taglioni (2006), we describe a product-level gravity equation:

$$(1) \qquad X_{ijk} = \alpha_{ijk}^{\gamma_{jk}} \tau_{ijk}^{1-\sigma_{ik}} \left(\frac{Y_{ik} E_{jk}}{\Omega_{ik} Q_{jk}^{1-\sigma_{ik}}} \right),$$

where X_{ijk} is country j's expenditure on product k imported from country i, α_{ijk} is a product-specific preference parameter for j's imports from i, τ_{ijk} is the product-specific composite price of tariff and nontariff costs faced by consumers in j for imports from i, Y_{ik} reflects i's total exports of k, E_{jk} denotes j's total expenditure on k, Q_{jk} is a composite price index for j regardless of where product k originates, and Ω_{ik} is an outward multilateral resistance term and provides an indication of the real market potential for i's exports of product k. The elasticity of substitution between products sourced from different countries is denoted by σ_{ik}.

As it is not observable, E_{jk} is assumed to be a function of total income $(GDP_j^{\beta_1})$ in country j; similarly, $GDP_j^{\beta_2}$ can be used as a proxy for Y_{ik}. The product-specific parameter is qualified with an intensity parameter, γ_{jk}, and stems from differences in average incomes across countries. That is, in this product-level gravity model, we expect countries with higher average income to have higher preferences for processed products and therefore to consume a larger proportion of these goods than others. Replacing X_{ijk} with the value of exports from i to j and accounting for variance across time t, equation (1) can be expressed in log-linear form as[8]

$$(2) \quad \ln X_{ijtk} = \ln \alpha_{ijtk} + (1 - \sigma_{ik}) \ln \tau_{ijtk} + \beta_1 \ln GDP_{jt} + \beta_2 \ln GDP_{it} + (\sigma_{ik} - 1) \ln Q_{jtk} - \ln \Omega_{itk}$$

[8] In this paper, the product-level empirics are pertinent to the agricultural sector, and we therefore do not reserve a separate notation to denote sectors. However, we do estimate sector-level gravity models to explore the heterogeneities across agricultural and nonagricultural sectors (e.g., Table 1). In this case, the agricultural sector is an aggregate of all agricultural products, and the nonagricultural sector is an aggregate of all remaining products. Because the formal derivation of the gravity equation can be found in many previous studies (e.g., Anderson and Wincoop, 2003; Baldwin and Taglioni, 2006), we do not reproduce the derivation.

and

$$(3) \qquad (1-\sigma_{ik})\ln\tau_{ijtk} = \sum_{l}\gamma_l \boldsymbol{D_{ijt}} - \nu_{ijtk},$$

where $\boldsymbol{D_{ijt}}$ is a vector of observable trade cost or facilitation variables and is stochastic due to unmeasured trade frictions $(\nu_{ijtk}, N(0,\sigma_\nu^2))$ between the country pairs for a given time period. The vector includes dummy variables representing whether trading partners i and j share a contiguous boarder $(Contiguity_{ij})$, have a common official language $(Lang_{ij})$, have had a colonial relationship after 1945 $(Colony\_1945_{ij})$, are currently in a colonial relationship $(Curcol_{ijt})$, or had a common colonizer $(Comcol_{ijt})$. This vector also contains separate measures of the size of the trading partners reflected by the logarithm of their land area $(Area_{i(j)})$ and per capita GDP $(GDPPC_{i(j)t})$ and indicator variables of whether a member of the trading pair is a landlocked $(Landlocked_{i(j)})$ or an island nation $(Island_{i(j)})$. This vector also includes the log-transformed value of the distance between the trading partners $(Dist_{ij})$.

The vector also includes several policy variables. The primary variables of interest are related to the GSP program, but membership in regional trade agreements and the WTO can also lead to increased trade. As a result, omitting these variables might bias the GSP coefficient in an unknown direction. As trade policies can have asymmetric effects on trading partners (Bagwell and Staiger, 2002, 2005; Subramanian and Wei, 2007; Melitz and Ottaviano, 2008), we use separate variables to reflect whether both trading partners are members of the WTO (WTO_Both_{ijt}), if the exporter (WTO_Exp_{ijt}) or importer (WTO_Imp_{ijt}) is a WTO member, or if they are members of the same (RTA_{ijt}) or a different regional trade agreement (RTA) $(RTA\_Different_{ijt})$.

In the baseline analysis, the impact of GSP programs is pooled for all GSP donors and GSP recipients using the dummy variables $GSPDon_{ijt}$ (is unitary if an importer offers GSP preferences to the exporting partner, and 0 otherwise) and $GSPRec_{ijt}$ (is unitary if an exporter receives GSP preferences from the importing partner, and 0 otherwise). We construct additional categorical variables to reflect the heterogeneity of program recipients: GSP offered to developing countries (GSP_DVING), GSP offered to least-developed countries (GSP_LDC), and GSP offered to other territories and states (GSP_OTH). These variables can be further decomposed to separately reflect exports by recipients and donors (e.g., GSP_OTH_Rec, GSP_OTH_Don). Note that these GSP variables are defined for bilateral trade pairs for each year and hence all take subscripts (ijt) at the sample unit level.

In an alternative specification, we use various combinations of these variables to separately evaluate the impact of the GSP program on donors and different classes of recipients. For example, to examine potentially different GSP effects due to heterogeneity in recipients' export-product composition, in alternative model specifications we include an indicator variable to reflect whether the traded good is a primary $(Primary_{ijkt} = 1)$ or a processed product. We use interaction terms between this variable and trading partner types (e.g., $Primary_{ijkt} \times GSP\_DVING\_Rec_{ijt}$) to evaluate the extent to which the GSP program has facilitated trade of particular types of agricultural products.

Finally, the price indices, Q_{jtk} and Ω_{itk} are not directly observable. Not accounting for these indices would subsume these variables into the error term (Anderson and Wincoop, 2003; Feenstra, 2015; Baldwin and Taglioni, 2006). Depending upon the dataset, slice of sample, and estimation technique, we use country-pair fixed (μ_{ij}), product (ϕ_k), and time effects (ϕ_t) to separately account for the unobservable price indices. As the dependent variable reflects the unidirectional flow of trade, we use asymmetric bilateral fixed effects of the form $\mu_{ij} \neq \mu_{ji}$ in our specifications. Preference and preference-intensity parameters are discussed further below.

Estimation Approach

Estimating equation (2) in log-linear form is straightforward if the dependent variable has strictly positive values. However, our datasets also include a number of observations with zero trade flows (discussed in detail in the Data section). Santos Silva and Tenreyro (2006), and Helpman, Melitz, and Rubinstein (2008) provide evidence that ignoring zero flows leads to biased estimates because logarithmic transformation of the dependent variable ignores zero flows and thus results in sample-selection bias. Further, the logarithmic transformed constant elasticity model is inconsistent in the presence of heteroskedasticity.[9] Extensive theoretical and empirical evidence shows that Poisson pseudo-maximum likelihood (PPML) estimators are superior to other estimators in the presence of heteroskedasticity and zero trade flows (Gong and Samaniego, 1981; Gourieroux, Monfort, and Trognon, 1984; Santos Silva and Tenreyro, 2006, 2011; Westerlund and Wilhelmsson, 2011). Therefore, we use the PPML estimator unless otherwise stated.

The possibility that the GSP variable might not be purely exogenous also requires consideration. A country may, for example, lobby its actual or potential developed country trading partners for GSP preferences. In such instances, countries may select into the GSP program endogenously based on their lobbying abilities. Country selection into the program may also be correlated with levels of bilateral trade. While an instrumental variable approach would have been appropriate to address this endogeneity, identifying an instrument that is correlated with the *GSP* variable but not with trade is difficult, particularly given the panel context. Given that the institutional framework requires GSP to be nondiscriminatory,[10] country–time effects would partly address this potential endogeneity. Therefore, in addition to country-pair fixed effects, we also use country–time effects in at least one specification.[11]

An important consideration that alludes to the limited use of country–time effects in our specification is related to the possibility that certain groups of GSP–eligible countries (e.g., LDCs) are more likely to export primary products. Therefore, we include $GDP_{i(j)t}$ and $GDPPC_{i(j)t}$ in our specifications to ensure that the results do not suffer from omitted-variable bias. However, in a fixed effect PPML estimation, the variables $GDP_{i(j)t}$ and $GDPPC_{i(j)t}$ are collinear with country–time effects. Therefore, we do not include country–time binary variables and GDP variables together in the same specification. Likewise, the inclusion of other time-invarying standard gravity equation variables depends upon the use of fixed effects in the estimation.

Ideally, we would use country-pair–product–time and country–product–time dummy variables to account for preference and preference intensity parameters. However, using the binary variables of these dimensions would quickly exhaust the degrees of freedom in an empirical model. For example, when using country-pair–product–time effects, the number of dummy variables (that need to be included) would almost perfectly identify the number of observations in our sample. Therefore, we include country–product–time dummies and country-pair–product dummies (which are also related to multilateral prices) in some of our specifications in sensitivity tests.

Data

The analysis makes use of unidirectional trade flows on a nominal basis to control for false deflation of trade values (Baldwin and Taglioni, 2006). We use the Standard International Trade Classification (SITC) 4-digit revision 1 database for international import and export flows, obtained from UNCTAD. We then aggregate these 4-digit SITC data into four datasets, which differ in their product aggregation. We follow UN's concordance on SITC classification to aggregate products into an agricultural dataset, nonagricultural dataset, and agricultural product-level dataset with two types of products: primary and processed (UN Statistics Division, 2015). The fourth dataset aggregates the SITC-4 digit data to obtain total merchandise trade flows. Each dataset contains import and

[9] This heteroskedasticity stems from the well-known Jensen's inequality, which implies that $\ln E(\varepsilon_{ij}|\boldsymbol{x_{ij}}) \neq E(\ln(\varepsilon_{ij})|\boldsymbol{x_{ij}})$, where ε_{ij} is the stochastic error term and $\boldsymbol{x_{ij}}$ is a vector of independent variables. Note that in equation (3), $v_{ijkt} = \ln \varepsilon_{ijkt}$.

[10] Although the WTO Enabling Clause allows a country to treat less-developed countries more favorably than other WTO members, it does not allow the country to offer such favorable tariff reductions to only a few of its favored trade partners.

[11] Alternatively, one could use the generalized method of moments with lagged variables serving as instruments for current differences. However, this method is sensitive to the number of lags used.

export flows for 185 countries over 1962–2010. AppendiX A lists these countries and their 3-digit International Organization for Standardization (ISO) codes.

Unidirectional trade flow data are liable to false zeros because the flow is reported as zero if a country pair is in a trading relationship but does not report a trade value for a particular product in a particular year. To address this problem, we use mirrored trade flows from the partner country to fill in missing information, as in Feenstra (2015). Further, to avoid selection bias, each dataset is first zero-inflated to construct a balanced panel. Then, if a country pair trades a given product for at least 5 years in the total sample, the zero flow is retained for the year; if not, the zero flows are omitted from the data. After adopting this approach, approximately 43% of the observations in the product-level agricultural dataset, 38.6% in the aggregated agricultural and nonagricultural datasets, and 35.9% in the total merchandise trade dataset report zero flows.

Other control variables are derived from standard data sources. GDP, population, and exchange rate data are obtained from the World Bank's Development Indicators database (World Bank, 2015). WTO and RTA data are retrieved from the WTO's database on WTO members and observers (World Trade Organization, 2017c) and the RTA information system (World Trade Organization, 2017b), respectively. Geographic distance, area, borders, language, and colonial relationships are accessed from the Centre d'Etudes Prospective et d'informations Internationales (CEPII) GeoDist database (Mayer and Zignago, 2011).

GSP program information is accessed through the WTO's database on preferential trade agreements, handbooks on the Generalized System of Preferences of each donor country, and UNCTAD newsletters. Appendix B provides a detailed description of the sources and construction of the GSP database. In our datasets, 13.9%– 14.78% of observations receive GSP preferences. Of these recipients, about 26%–28.9% are GSP_LDC recipients and 5.2%–5.6% are GSP_OTH recipients. Note that our datasets are unbalanced panels; hence we observe these discrepancies in number of recipients across the datasets. Using 2010 as the base period, only about 2.7% of recipients were either graduated, suspended, or removed from the program for at least 1 year in the sampling period in our product-level agricultural dataset.[12] Although the churning rate is low, the number of recipients increased by about 0.6 times from 1971 to 2010. Clearly, the sample variation in GSP status is achieved mainly due to the formation of new GSP schemes over time.

Results and Discussion

As a starting point and in a benchmark model, we compare our results to findings in Herz and Wagner (2011). Then we evaluate the GSP program in light of the previously introduced three sources of heterogeneity using the gravity model. Finally, we assess the sensitivity of our findings to the model selection. We also move beyond the state-of-the-art gravity equation and PPML estimation technique to consider regression discontinuity design (RDD) to ensure that our results are not driven by the choice of estimation technique.

GSP Effect considering Heterogeneity across Sectors

To permit comparison with Herz and Wagner (2011) analysis, we first apply our model to total merchandise trade and then separately to agricultural and nonagricultural trade. Table 1 presents these results. Columns 1–3 report the estimates from total merchandise trade, while columns 4–6 and columns 7–9 report results from nonagricultural and agricultural sectors, respectively. In each case, the first column presents estimates that do not include fixed effects; the second column presents estimates with country-pair and time effects; the third column presents estimates with country–time and country-pair fixed effects.

[12] If countries were suspended but retroactively activated and compensated, they are not counted as switching from recipients to nonrecipients.

Table 1. GSP Effect across Sectors

	Total Merchandise Trade Dep. Var.: X_{ijt}			Nonagricultural Sector Dep. Var.: X_{ijst}			Agricultural Sector Dep. Var.: X_{ijst}		
Variables	1	2	3	4	5	6	7	8	9
$\ln GDP_{jt}$	0.96***	0.21***		1.01***	0.24***		0.46***	0.63***	
	(0.010)	(0.067)		(0.011)	(0.085)		(0.007)	(0.066)	
$\ln GDP_{it}$	0.85***	0.14**		0.86***	0.11*		0.77***	0.11***	
	(0.008)	(0.068)		(0.009)	(0.061)		(0.007)	(0.034)	
$\ln GDPPC_{jt}$	0.12***	0.55***		0.11***	0.60***		−0.35***	0.32***	
	(0.011)	(0.070)		(0.012)	(0.068)		(0.009)	(0.052)	
$\ln GDPPC_{it}$	−0.23***	0.42***		−0.26***	0.39***		0.14***	−0.07	
	(0.015)	(0.073)		(0.017)	(0.090)		(0.008)	(0.088)	
WTO_Both_{ijt}	0.45***	0.57***	0.15**	0.44***	−0.14	0.14***	0.45***	0.27***	1.19**
	(0.066)	(0.053)	(0.075)	(0.072)	(0.158)	(0.007)	(0.055)	(0.028)	(0.122)
WTO_Imp_{ijt}	−0.43***	0.01		−0.39***	−0.27***		−0.59***	0.23	
	(0.061)	(0.115)		(0.067)	(0.058)		(0.053)	(0.170)	
WTO_Exp_{ijt}	−0.18***	0.23***		0.48***	0.73***		0.58***	−0.16	
	(0.052)	(0.082)		(0.141)	(0.113)		(0.048)	(0.154)	
WTO_Onein_{ijt}			−0.02			−0.15			0.34**
			(0.070)			(0.090)			(0.138)
RTA_{ijt}	0.26***	0.16***	0.31***	0.26***	0.14***	0.01	0.48***	0.46***	1.58***
	(0.026)	(0.040)	(0.037)	(0.028)	(0.042)	(0.041)	(0.020)	(0.049)	(0.059)
$RTA\_Different_{ijt}$	−0.27***	−0.04***	−0.01**	−0.31***	−0.05***	−0.02***	0.08***	0.05**	0.29***
	(0.024)	(0.013)	(0.006)	(0.026)	(0.013)	(0.006)	(0.025)	(0.021)	(0.02)
$GSPRec_{ijt}$	−0.05	0.03	−0.22	−0.11***	−0.19*	−0.16**	0.60***	0.40*	0.15*
	(0.035)	(0.089)	(0.56)	(0.038)	(0.107)	(0.068)	(0.023)	(0.216)	(0.084)
$GSPDon_{ijt}$	−0.11***	−0.11	−0.09*	−0.10***	−0.10	−0.00	−0.57***	−0.13	0.81***
	(0.022)	(0.065)	(0.050)	(0.023)	(0.067)	(0.052)	(0.030)	(0.095)	(0.107)
$Curcol_{ijt}$	0.21***			0.26***			0.16***		
	(0.028)			(0.030)			(0.036)		
$Comcol_{ijt}$	0.10*			0.11*			0.18***		
	(0.057)			(0.060)			(0.042)		
$Colony\_1945_{ijt}$	0.35***			0.36***			0.18***		
	(0.038)			(0.040)			(0.046)		

Table 1. GSP Effect across Sectors

	Total Merchandise Trade Dep. Var.: X_{ijt}			Nonagricultural Sector Dep. Var.: X_{ijst}			Agricultural Sector Dep. Var.: X_{ijst}		
Variables	1	2	3	4	5	6	7	8	9
$Lang_{ijt}$	0.56***			0.59***			0.39***		
	(0.025)			(0.027)			(0.020)		
$Contiguity_{ij}$	0.77***			0.76***			0.71***		
	(0.033)			(0.035)			(0.026)		
$Dist_{ij}$	−0.48***			−0.48***			−0.54***		
	(0.012)			(0.013)			(0.009)		
$Area_j$	−0.10***			−0.10***			−0.18***		
	(0.009)			(0.010)			(0.005)		
$Area_i$	−0.15***			−0.19***			−0.19***		
	(0.008)			(0.009)			(0.006)		
$Landlocked_j$	−0.40***			−0.38***			−0.63***		
	(0.025)			(0.027)			(0.020)		
$Landlocked_i$	−0.31***			−0.27***			−0.77***		
	(0.024)			(0.026)			(0.025)		
$Island_j$	0.02			−0.01			0.42***		
	(0.028)			(0.029)			(0.033)		
$Island_i$	0.28***			0.29***			0.15***		
	(0.028)			(0.029)			(0.027)		
No. of obs.	856,394	858,112	1,076,442	843,426	653,394	1,065,076	677,649	669,599	848,270
R^2	0.70	0.74	0.99	0.68	0.73	0.91	0.56	0.69	0.91
Log-pseudolikelihood	$-6.992e+13$	$-1.058e+13$	$-6.540e+12$	$-6.669e+13$	$-6.669e+13$	$-5.889e+12$	$-9.390e+12$	$-3.323e+12$	$9.30e-01$
Time effects	No	Yes	No	No	Yes	No	No	Yes	No
Importer-time effects	No	No	Yes	No	No	Yes	No	No	Yes
Exporter-time effects	No	No	Yes	No	No	Yes	No	No	Yes
Country-pair effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses. While there is no full correlation between country–time effects and WTO_Imp_{ijt} or WTO_Exp_{ijt}, as a precautionary step, we include WTO_Onein_{ijt}, which takes a value 1 if either of the trade partner is a WTO member and 0 otherwise, in columns 3, 6, and 9 instead.

The results show that the standard gravity equation explanatory variables—such as GDP, distance, contiguity, colonial relationship, and common language—take the expected signs and are statistically significant. For example, the coefficients on $GDP_{i(j)t}$, although not unitary, are positive and closer to 1 than to 0 in most specifications. In most cases, an increase in per capita GDP $(GDPPC_{i(j)t})$ increases trade. As expected, trade flows decrease with the distance $(Dist_{ij})$ and the size of exporter $(Area_i)$. Also as expected, sharing a border $(Contiguity_{ij})$, being members of the same RTA (RTA_{ijt}), both countries having WTO membership (WTO_Both_{ijt}) or only the exporter being in WTO (WTO_Exp_{ijt}), having a common official language $(Lang_{ij})$, and having colonial ties $(Colony\_1945_{ij}, Curcol_{ij}, Comcol_{ij})$ increase trade between partners. While being in different RTAs $(RTA\_Different_{ijt})$ lowers aggregate and nonagricultural trade, agricultural trade is generally stimulated, but coefficients are smaller than when trade partners belong to the same RTA. Further, land-locked countries $(Landlocked_{i(j)})$ trade less and island countries $(Island_{i(j)})$ trade more.

The key variable of interest in this study is GSP recipient exports; a casual glance at $GSPRec_{ijt}$ in columns 1–9 suggests that the GSP program has not stimulated recipients' exports evenly. For example, in the case of total merchandise trade, the coefficient $GSPRec_{ijt}$ is statistically insignificant. This is true for all specifications, irrespective of the inclusion of various panel fixed effects (columns 1–3). That is, in aggregate, there is no evidence that the GSP program promotes exports from low-income countries to high-income countries. Yet, proceeding with sector-level trade, we are able to uncover a number of salient sector-level differences in GSP outcomes. First, our data mimic Herz and Wagner's (2011) "dark" side GSP effect in the case of nonagricultural trade. In all three specifications, where we progressively control for country-pair and country–time characteristics (columns 4–6), we find the GSP coefficient to be negative and statistically significant, indicating that nonagricultural exports are hampered by the program. Where we depart from Herz and Wagner is in agricultural sector trade: There we find that recipient's agricultural exports to a donor are, on average and depending upon the specification, 16%–82.2% higher in a given year compared with those of a nonrecipient.[13] Many donor countries have progressively prioritized GSP preferences to agricultural products over nonagricultural products following the Uruguay Round. Further, as already discussed, tariff differences across recipients and nonrecipients are also greater for agricultural products. In light of these facts, the above results are not surprising. Further, this is one of the first pieces of evidence that the GSP impact is economically and statistically significant for agricultural trade. These results are robust to alternatively decomposing recipients into different classes or considering different product aggregations and to the estimation technique.

GSP Effect considering Heterogeneity across GSP Recipients

GSP donors tailor the list of products covered and the extent of tariff preferences that they offer to their beneficiaries. Therefore, we also explore the effect of GSP programs by considering the heterogeneity in preferences across recipients. We limit our discussion to the GSP policy variables. Table 2 presents the regression results and the results of related statistical tests (columns 1–4). Each variable is numbered for ease of reference to the statistical tests.

Column 1 of Table 2 reports the estimates from nonagricultural trade. The coefficient estimates indicate that GSP_DVING recipients' $(GSP\_DVING\_Rec_{ijt})$ exports of nonagricultural products are not significantly impacted by GSP provisions. By comparison, exports of nonagricultural goods are reduced for GSP_LDC recipients $(GSP\_LDC\_Rec_{ijt})$ by 45.6% relative to those who are not GSP recipients. This unfortunate outcome extends to GSP_OTH recipients $(GSP\_OTH\_Rec_{ijt})$, which export substantially less (60.5%) nonagricultural product than nonrecipients. These findings of heterogeneous GSP impacts across recipients (variables 10–12) are further supported by tests of joint and pair-wise equality of GSP exports among these recipient types that are easily rejected (column 1, H1–H4).

[13] Calculated as $((exp(0.15) - 1) \times 100)$ and $((exp(0.60) - 1) \times 100)$.

Table 2. EGSP Effect across Recipients by Export Products

			Dep. Var. : X_{ijt}	Dep. Var. : X_{ijkt}					
			Nonag. Sector	Ag. Sector					
			Full Sample	Full Sample	Pre–URAA	Post–URAA	Full Sample	Pre–URAA	Post–URAA
	Variables		1	2	3	4	5	6	7
1	$\ln GDP_{jt}$		0.98***	−0.06	−0.08***	−0.10	−0.06	−0.08***	−0.11
			(0.012)	(0.037)	(0.023)	(0.140)	(0.037)	(0.024)	(0.140)
2	$\ln GDP_{it}$		0.82***	0.22**	0.02	0.61***	0.22**	0.02	0.61***
			(0.009)	(0.087)	(0.020)	(0.080)	(0.087)	(0.020)	(0.080)
3	$\ln GDPPC_{jt}$		−0.13***	0.21***	0.34***	−0.05	0.22***	0.34***	−0.05
			(0.015)	(0.082)	(0.040)	(0.082)	(0.082)	(0.040)	(0.082)
4	$\ln GDPPC_{it}$		−0.23***	0.36***	0.47***	0.37***	0.36***	0.47***	0.38***
			(0.020)	(0.050)	(0.041)	(0.142)	(0.050)	(0.041)	(0.142)
5	$URAA_{ijt}$			0.36***			0.36***		
				(0.055)			(0.055)		
6	WTO_Both_{ijt}		0.56***	−0.11	−0.31	0.08	−0.11	−0.31	0.08
			(0.086)	(0.129)	(0.189)	(0.103)	(0.129)	(0.189)	(0.103)
7	WTO_Imp_{ijt}		−0.21***	0.50***	0.53***	0.14	0.50***	0.53***	0.14
			(0.080)	(0.122)	(0.181)	(0.094)	(0.122)	(0.181)	(0.094)
8	WTO_Exp_{ijt}		−0.21***	0.24*	0.33*	0.05	0.25*	0.32*	0.05
			(0.074)	(0.140)	(0.189)	(0.090)	(0.140)	(0.189)	(0.090)
9	RTA_{ijt}		0.24***	0.07***	0.01	0.02**	0.08***	−0.00	0.03***
			(0.024)	(0.016)	(0.026)	(0.012)	(0.017)	(0.034)	(0.012)
10	$GSP\_DVING\_Rec_{ijt}$		0.02	0.09***	−0.21***	0.15**	−0.43***	−0.40***	−0.17**
			(0.041)	(0.014)	(0.071)	(0.072)	(0.105)	(0.099)	(0.073)
11	$GSP\_LDC\_Rec_{ijt}$		−0.61***	−0.37***	−0.28***	−0.01	−1.99***	−1.78***	−1.66***
			(0.164)	(0.109)	(0.093)	(0.113)	(0.144)	(0.135)	(0.172)
12	$GSP\_OTH\_Rec_{ijt}$		−0.93***	−0.29***	−0.24**	−0.13**	−1.01***	−1.20***	−0.90***
			(0.049)	(0.077)	(0.111)	(0.056)	(0.138)	(0.229)	(0.124)
13	$Primary_{ijkt}$						−0.57***	−0.28***	−0.74***
							(0.059)	(0.073)	(0.057)
14	$Primary_{ijkt} \times GSP\_DVING\_Rec_{ijt}$						0.47***	0.41***	0.49***
							(0.099)	(0.122)	(0.098)
15	$Primary_{ijkt} \times GSP\_LDC\_Rec_{ijt}$						2.35***	2.15***	2.45***
							(0.124)	(0.136)	(0.152)
16	$Primary_{ijkt} \times GSP\_OTH\_Rec_{ijt}$						1.16***	1.42***	1.30***
							(0.160)	(0.335)	(0.157)
17	$GSP\_DVING\_Don_{ijt}$		0.01	−0.10	0.07	0.04	−0.15	0.10	−0.04
			(0.031)	(0.155)	(0.115)	(0.138)	(0.165)	(0.135)	(0.141)
18	$GSP\_LDC\_Don_{ijt}$		−1.02***	0.32	0.12	0.04	0.34	0.30	−0.02
			(0.065)	(0.291)	(0.140)	(0.057)	(0.264)	(0.291)	(0.089)
19	$GSP\_OTH\_Don_{ijt}$		−0.54***	−0.30***	−0.27***	−0.24***	−0.29***	−0.22	−0.26***
			(0.040)	(0.075)	(0.051)	(0.053)	(0.074)	(0.171)	(0.086)
20	$Primary_{ijkt} \times GSP\_DVING\_Don_{ijt}$						0.12	−0.09	0.24**
							(0.110)	(0.135)	(0.105)
21	$Primary_{ijkt} \times GSP\_LDC\_Don_{ijt}$						−0.06	−0.52**	0.16
							(0.179)	(0.240)	(0.182)
22	$Primary_{ijkt} \times GSP\_OTH\_Don_{ijt}$						−0.02	−0.12	0.06
							(0.221)	(0.364)	(0.223)
Hypothesis testing									
H1	10=11=12	χ^2	11.86***	29.15***		16.44***			
		$prob > \chi^2$	0.003	0.000		0.001			
H2	10=11	χ^2	11.56***	16.87***		13.46***			
		$prob > \chi^2$	0.001	0.000		0.001			

Continued on next page…

Table 2. – continued from previous page

			Dep. Var. : X_{ijt}	Dep. Var. : X_{ijkt}					
			Nonag. Sector	Ag. Sector					
			Full Sample	Full Sample	Pre–URAA	Post–URAA	Full Sample	Pre–URAA	Post–URAA
	Variables		1	2	3	4	5	6	7
H3	11=12	χ^2	11.72***	21.15***		10.23***			
		$prob > \chi^2$	0.000	0.000		0.006			
H4	10=12	χ^2	6.98***	18.69***		9.59***			
		$prob > \chi^2$	0.008	0.000		0.008			
H5	13=14=15=16	χ^2					413.11***	275.53***	377.12***
		$prob > \chi^2$					0.000	0.000	0.000
H6	13=14	χ^2					95.49***	13.10***	175.93***
		$prob > \chi^2$					0.000	0.001	0.000
H7	13=15	χ^2					361.11***	255.10***	318.93***
		$prob > \chi^2$					0.000	0.000	0.000
H8	13=16	χ^2					139.29***	23.03***	222.56***
		$prob > \chi^2$					0.000	0.000	0.000
H9	14=15	χ^2					359.05***	232.15***	263.19***
		$prob > \chi^2$					0.000	0.000	0.000
H10	14=16	χ^2					94.65***	24.26***	127.67***
		$prob > \chi^2$					0.000	0.000	0.000
H11	15=16	χ^2					409.46***	242.26***	325.94***
		$prob > \chi^2$					0.000	0.000	0.000
	No. of obs.		373,339	1,156,181	654,608	490,866	1,156,181	654,608	251,539
	R^2		0.715	0.713	0.695	0.691	0.715	0.696	0.692
	Log-pseudolikelihood		-4.695e+13	-5.167e+12	-1.866e+12	-2.542e+12	-4.997e+12	-1.814e+12	-4.97e+11
	Time effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Country-pair effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses. Columns 2–4 also include product effects. Note that the agricultural dataset has two types of products: primary and processed. Therefore, columns 5–7, which include the indicator variable $Primary_{ijkt}$ to denote product type, do not include product effects. Likewise, column 1, in which the nonagricultural dataset has no product dimension, omits product effects.

Column 2 of Table 2 reports results from the agricultural sector. Note that the specification includes a dummy variable representing the post–Uruguay Round GSP effect ($URAA_{ijt} = 1$ if an exporter receives GSP preferences from the importer after the URAA implementation in 1995, and 0 otherwise). Including this variable is important because prior to the URAA, as per the Prebisch–Singer hypothesis, GSP preferences were limited to manufacturing sector products. URAA reforms to liberalize the agricultural sector were assimilated into the GSP program and into the multilateral trade agreements through WTO simultaneously (we will return to test for potential confounding trade effects across these programs later in sensitivity tests). Unlike the trade of nonagricultural products, here the URAA binary variable yields a significant and positive value (columns 1–2, variable 5); on average, the URAA has boosted recipients' agricultural exports by 43%. Further, even after controlling for the URAA effect, we find that *GSP_DVING* recipients' agricultural exports to high-income countries are about 9.4% higher than nonrecipients' exports. However, as in the trade of nonagricultural products, the agricultural exports for *GSP_LDC* recipients are hampered by this program, as their exports are 30.9% less than those of nonrecipients. This under-trading effect is also observed in the case of *GSP_OTH* recipients. For a given year, on average, their exports of agricultural products to GSP donors are 25.2% lower than exports to the donors by nonrecipients. The joint and paired χ^2 tests reported in the lower portion of Table 2 (column 2, H1–H4) provide additional support of this heterogeneity among recipients for GSP agricultural exports.

Columns 3–4 of Table 2 present separate regressions to identify the pre–and post–URAA GSP impacts for each recipient class. For the pre–URAA period, results show that Herz and Wagner's (2011) GSP trade impact appears in recipients' agricultural exports to donor countries (column 3, variables 10–12). Importantly—and consistent with the GSP design—following the URAA reforms, *GSP_DVING* recipient exports of agricultural products increased an average of 16.2% over those of nonrecipients (column 4). This increase is impressive compared to the null or negative results for *GSP_LDC* and *GSP_OTH* recipients for the same period and again underscores the importance of considering asymmetries across GSP recipients in assessing program outcomes. This finding is further substantiated by the results of hypothesis testing presented in Table 2 (column 4, H1–H4).

Thus far, our discussion has focused on assessing GSP outcomes for program recipients. Past literature on the political economy of tariff preferences has also explored whether nonreciprocal preferences are solely driven by "altruistic" motivation (see McCulloch and Pinera, 1977; Goodison and Stoneman, 2004; Shaffer and Apea, 2005; Suwa-Eisenmann and Verdier, 2007; Younas, 2008). The program has also drawn criticism that, far from promoting exports from less-developed countries, it has instead helped industrialized countries pursue their own trade interests with low-income countries (Bhattacharya and Rahman, 2000; Mattoo, Roy, and Subramanian, 2003). We explore this issue by examining reverse exports from GSP donors to different classes of recipient countries. The coefficients on $GSP\_DVING\_Don_{ijt}$, $GSP\_LDC\_Don_{ijt}$, and $GSP\_OTH\_Don_{ijt}$ reveal that donor exports to developing and LDC recipients are not economically different from their exports to average nonrecipients. However, depending on the specification, their agricultural supply to other territorial and state (GSP_OTH) recipients is 21%–26% less than the amount exported to an average nonrecipient (columns 2–4 of Table 2, variable 19). Based on these results, we cannot conclude that the GSP has helped industrialized countries promote their agricultural exports to less-developed countries. However, care should be taken when interpreting these results. Although LDC and developing countries are important trade partners, GSP recipient countries have a comparative advantage in agricultural products and primarily export these products. As such, recipient countries may not have a large absorptive capacity for agricultural imports from donor countries or elsewhere. Therefore, the evidence that agricultural exports from donor to recipient countries are not higher compared to nonrecipients does not necessarily imply that GSP donor countries participating in this program are driven by an "altruistic" motivation toward GSP recipient countries.

GSP Effect Considering Heterogeneity in Export Composition

Why are LDC and other territorial and state GSP recipients—which were intended to be the largest beneficiaries of the GSP program—actually incurring a significant decline in exports? To investigate this issue further, we examine the composition of agricultural exports of GSP recipients using a number of specifications. Table 2 (columns 5–7) presents these results and accompanying statistical tests.

We use interaction terms to examine whether the effect of GSP exports is more pronounced in the case of primary agricultural products—which in general require fewer intermediate products and services in the production process—than in the case of the processed agricultural products (column 5 of Table 2). Recall that it is primary products which *GSP_LDC* recipients trade more intensively with the GSP donors. It turns out that export-composition is a significant determinant of GSP impacts on recipients' exports to donor countries. LDCs exported 5.9 times more[14] and *GSP_OTH* recipients exported 1.8 times more primary than processed agricultural products to GSP donor countries. In contrast, the value of *GSP_DVING* recipients' exports of primary agricultural products was 10% less than the value of their exports of processed agricultural products. Note that the above results allude to the question: What is the GSP impact when a given recipient exports primary agricultural products instead of processed agricultural products? These results suggest that the GSP impact is pronounced for the products that recipients export more intensively. Alternatively, one may also ask: What is the GSP impact on recipients' exports of primary agricultural products relative to nonrecipients? We find that, relative to nonrecipients, *GSP_LDC* exports of primary agricultural products are 43% higher,[15] *GSP_OTH* exports are 16% higher, and *GSP_DVING* exports are 4.1% higher. Moreover, several joint and pairwise tests reject the hypothesis that there are no statistical differences across recipients'

[14] Calculated using column 5 coefficients of $Primary_{ijkt}$ and $Primary_{ijkt} * GSP\_LDC\_Rec_{ijt}$

[15] Calculated using Table 2, column 5 coefficients on $GSP\_LDC\_Rec_{ijt}$ and $Primary_{ijkt} \times GSP\_LDC\_Rec_{ijt}$.

exports of primary agricultural products (variables 13–16, column 5, H5–H11), which underscores the importance of considering export composition across recipients in evaluating program outcomes.

We also explore whether these patterns of export composition show up in pre– and post–URAA samples, presented in columns 6–7 of Table 2. Trade theory based on producer-level differences predicts that unilateral trade liberalization increases export demand when there are no export market frictions. Theoretical predictions, however, are ambiguous when there are supply-side constraints. Combined, we would expect to see a positive impact in recipients' exports following the URAA reform, and at least in a product type in which they have a comparative advantage. The results in general support the theory. The GSP has benefited recipients' exports of primary agricultural products in all cases. However, the extent of those benefits varies across recipients and is particularly high for *GSP_LDC* recipients after the implementation of URAA. Relative to nonrecipients, we find *GSP_LDC* recipients' exports of primary agricultural products to be 44.7% more for the pre–URAA sample versus 120.3% more for the post–URAA sample. Similarly, exports of *GSP_OTH* recipients increase by 24.6% more versus 49.2%, and *GSP_DVING* recipients' exports increase by 1% more versus 37.7% relative to nonrecipients in the pre– versus post–URAA periods. Again, hypotheses tests support the asymmetric GSP impact due to heterogeneity in export composition (columns 6–7, H5–H11).

Recall that the purpose of the GSP program is to facilitate exports from recipient countries (and not vice versa). For the interested reader, we repeat these analyses for GSP donors. In examining donor exports, we find that the coefficients on $GSP\_DVING\_Don_{ijt}$ and $GSP\_LDC\_Don_{ijt}$ are not statistically significant (columns 5–7 in Table 2, variables 17–18). Further, donors' agricultural exports to other territorial and state $(GSP\_OTH\_Don_{ijt})$ recipients are 22.8%–25.2% less than the amount exported to an average nonrecipient (columns 5–7, variable 19). These negative results for $(GSP\_OTH\_Don_{ijt})$ appear in trade of both primary and processed agricultural products. In one exception, however, donor exports of primary agricultural products to *GSP_DVING* recipients are found to be positive for the post–URAA period (column 7, variable 20).

Sensitivity Tests

In this section, we investigate whether our findings are sensitive to model selection and estimation techniques. Table 3a presents the results. To be concise, we report only the GSP variable of interest. As a starting point, and considering that the URAA reforms were assimilated into both the GSP and the WTO programs simultaneously, we investigate how the results change when we include two binary variables, $URAA\_GSP_{ijt}$ and $URAA\_WTO_{ijt}$, each coded mutually exclusive of the other. That is, the former takes a value of 1 if an exporter receives GSP preferences from the importer in the post–URAA period, and 0 otherwise; and the latter is equal to 1 if both trade partners are WTO members and the exporter does not receive GSP preferences from the importer after the URAA, and 0 otherwise. We find the coefficient on $URAA\_GSP_{ijt}$ to be positive and statistically significant, indicating that compared with nonrecipients, GSP recipients' agricultural exports increased by 18.5% after the URAA implementation (column 1). While the effect seems modest, this URAA GSP effect is significantly different from URAA effects on agricultural trade between WTO members,[16] which we find increases members' trade by 15%. We also investigate how the results change in the short and long run leading to and following the URAA reforms. Positive and statistically significant effects were found for 5 and 10 years before and several years after URAA implementation. For example, relative to nonrecipients, GSP recipients exported 16% more in 1985, 18.5% more in 1990, 11.6% more in 1995, 6.2% more in 2000, 10.5% more in 2005, and 1.5% more in 2010 (column 2). However, estimates were not statistically significant for 1975, merely 3 years after GSP implementation. These results contradict Herz and Wagner's (2011) conclusions, which were based

[16] This is supported by test of equality of the two coefficients. The equality is rejected at the 1% level, $\chi^2 = 24.64$.

Table 3a. Sensitivity Tests

	PPML Estimates					Negative Binomial Estimates		
	X_{ijkt} Full Ag.	X_{ijkt} Full Ag.	X_{ijkt} k=Primary	X_{ijkt} k=Processed	$X_{ijt,HS6}$	X_{ijkt} k=Primary	X_{ijkt} k=Processed	$X_{ijt,HS6}$
Variables	1	2	3	4	5	6	7	8
$URAA\_GSP_{ijt}$	0.17**							
	(0.069)							
$URAA\_WTO_{ijt}$	0.14**							
	(0.062)							
$GSPRec_{ijt}(1975)$		0.01						
		(0.105)						
$GSPRec_{ijt}(1985)$		0.15**						
		(0.063)						
$GSPRec_{ijt}(1990)$		0.17***						
		(0.057)						
$GSPRec_{ijt}(1995)$		0.11***						
		(0.033)						
$GSPRec_{ijt}(2000)$		0.06*						
		(0.032)						
$GSPRec_{ijt}(2005)$		0.10***						
		(0.032)						
$GSPRec_{ijt}(2010)$		0.015***						
		(0.004)						
$GSPRec_{ijt}$					−0.19			−0.066
					(0.236)			(0.07)
$Prefmargin_{ijt,HS6}$					0.073***			0.05***
					(0.011)			(0.003)
GSP_DVING_{ijt}			0.22**	0.12***		0.23***	0.065***	
			(0.106)	(0.023)		(0.01)	(0.018)	
GSP_LDC_{ijt}			0.14*	0.27		0.38***	−0.77***	
			(0.082)	(0.21)		(0.018)	(0.03)	
No. of obs.	1,429,640	1,133,888	249,047	266,396	2,005,317	220,646	235,731	2,005,317
Log-pseudolikelihood	−2.01E+12	−1.68E+12	−3.13E+11	−3.69E+11	−2.078e+12	−2.40E+06	−2.70E+06	−2.55E+07
	Imp-prd-year	Imp–prd–year	Imp–year	Imp–year	Imp–prd–year	Country-pair	Country-pair	Country-pair
	Exp–prd–year	Exp–prd–year	Exp–year	Exp–year	Exp–prd–year	Year	Year	Year
	Exp–imp–prd	Country-pair–prd	Country-pair	Country-pair				Product

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses. Specification 1 includes the following additional variables, which are not reported here: $GSP\_DVING\_Rec_{ijt}$, $GSP\_LDC\_Rec_{ijt}$, $GSP\_OTH\_Rec_{ijt}$, $GSP\_DVING\_Don_{ijt}$, $GSP\_LDC\_Don_{ijt}$, $GSP\_OTH\_Don_{ijt}$, RTA_{ijt}, $RTA\_Different_{ijt}$, WTO_Both_{ijt}, and WTO_Onein_{ijt}. Other included but unreported variables in specification 2 are RTA_{ijt}, $RTA\_Different_{ijt}$, WTO_Both_{ijt}, WTO_Onein_{ijt}, and seven $GSPDon_{ijt}$ variables for each of the 7 years shown above. Unreported variables in columns 3, 4, 6, 7 are $EUGSP\_DVINGRec_{ijt}$, $EUGSP\_LDCRec_{ijt}$, $USGSP\_DVINGRec_{ijt}$, $USGSP\_LDCRec_{ijt}$, WTO_Both_{ijt}, WTO_Onein_{ijt}, RTA_{ijt}, and $RTA\_Different_{ijt}$. Unreported variables in columns 5 and 8 are RTA_{ijt}, $RTA\_Different_{ijt}$, WTO_Both_{ijt}, and WTO_Onein_{ijt}. All negative binomial estimates also include $GDP_{i(j)t}$ and $GDPPC_{i(j)t}$. Imp-prd-year, Exp-prd-year, Imp-year, and Exp-year represent importer-product-year, exporter-product-year, importer-year, and exporter-year fixed effects, respectively.

on aggregated trade, that the GSP harms recipients' exports in the long run but are consistent with the claims that recent proliferation in preferential trade agreements might have reduced the effective preferences for recipients (e.g., Anderson and Neary, 2003; Ozden and Reinhardt, 2005; Kee, Nicita, and Olarreaga, 2009; Fugazza and Nicita, 2013).

We next examine how the GSP effect on recipients' exports changes once we control for EU and U.S. GSP programs, the two largest GSP donors. We model the developing country and LDC recipients of each program separately but include the other territorial and state recipients in the "least developed" category for each program.[17] To partial out the EU and U.S. GSP impact from remaining GSP donors, we follow hierarchical coding of the GSP variable: If the European Union or the United States is the donor, the recipient is not included in either GSP_DVING or GSP_LDC recipients. Further, most GSP_OTH recipients in our sample receive GSP preferences through EU and/or U.S. GSP programs only. Therefore, to avoid potential collinearity among these variables, we drop GSP_OTH recipients and donors. Since we found GSP effect to be more pronounced in the period following the URAA in a majority of our specifications, here we focus only on the post–URAA GSP effect. The results are impressive. Even when we separate the EU and U.S. GSP effect from other GSP programs, we find that, relative to nonrecipients, GSP_DVING recipients' primary agricultural exports to other GSP donors are 24.6% more and those of GSP_LDC recipients' exports are 15% more (column 3 of Table 3a). In the case of processed agricultural products, GSP_DVING recipients' exports to GSP donors other than the European Union or the United States are 12.7% higher than those of nonrecipients (column 4). Not surprisingly, results concerning GSP_LDC recipients' exports of processed agricultural products are not statistically significant.[18]

Due to limited availability of tariff data, up to this point we used GSP binary variables (e.g., $GSPRec_{ijt}$) constructed at a country level for our analysis. Often, even if a country is eligible, many products are exempt from GSP preferences.[19] It is also plausible that recipients do not trade in all eligible products. Therefore, we also evaluate shorter panel data (2000–2010) for which trade flows, MFN tariff ($MFN_{jt,HS6}$), and applied tariff rates ($Tariff_{ijt,HS6}$) are available.[20] We adopt a preference margin approach in considering the product-level tariff details in bilateral trade. While many metrics are available, we follow Carrère and De Melo (2006) to estimate the margin ($Prefmargin_{ijt,HS6}$).[21] This metric is convenient for our use because it does not require additional information on elasticity estimates and exogenous trade weights.[22] We then use this margin, and its interaction with the variable $GSPRec_{ijt}$, in a gravity equation to examine the GSP effect on recipients' exports (column 5 of Table 3a). The results indicate that a unit increase in GSP preference margin relative to MFN rate (and assuming world price to be unitary, see Carrère and De Melo, 2006, for details) increases recipients' agricultural exports by 7.3%. However, after accounting for GSP tariff preferences, the $GSPRec_{ijt}$ coefficient is not statistically significant, indicating that the GSP increases recipients' agricultural exports primarily by reducing tariffs. This result is not surprising given the generally accepted wisdom that GSP "side conditions" are trade deteriorating in nature.

The results presented above incorporate recent advances in the specification of the gravity model. However, a well-known problem with Poisson models is that due to over-dispersion (conditional variance being larger than the conditional mean), which is often the case for trade data, both the standard errors and p-values are too low. Therefore, a negative binomial model known to allow

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[17] We code different types of recipients of EU and U.S. GSP programs as follows: $EUGSP\_DVING\_Rec_{ijt}$ and $EUGSP\_LDC\_Rec_{ijt}$; and $USGSP\_DVING\_Rec_{ijt}$ and $USGSP\_LDC\_Rec_{ijt}$, respectively.

[18] We purposely focus our discussion on overall GSP impact and not on individual GSP programs. Donor-level details and changes thereof are not within the scope of this paper.

[19] While we recognize that utilization is an important issue, we do not explicitly incorporate a measure of this. However, we do control for its effect by using exporter–product–year and importer–product–year dummies in our estimation.

[20] This is a slightly updated version (extended the sampling period from 2002–2008 to 2000–2010) of the dataset used in exploring the three sources of heterogeneity.

[21] $Prefmargin_{ijt,HS6} = \frac{MFN_{jt,HS6} - Tariff_{ijt,HS6}}{1 + Tariff_{ijt,HS6}}$.

[22] Many previous studies discuss potential problems associated with the use of elasticity estimates and trade weights (e.g., Kee, Nicita, and Olarreaga, 2009; Fugazza and Nicita, 2013; Sharma, Grant, and Boys, 2015).

Table 3b. LATE Estimates Using Fuzzy Regression Discontinuity Design (RDD)

	1990	1995	2000	2005	2010
$GSPRec_{ijt}$ (local linear regression estimates)	0.99	1.41***	1.43*	0.68**	0.65*
Standard error	(0.712)	(0.352)	(0.884)	(0.324)	(0.383)
Confidence interval	[−1.04, 2.27]	[0.94, 2.42]	[−0.34, 3.19]	[0.14, 1.58]	[−0.59, 1.27]
Optimal bandwidth	0.317	0.249	0.202	0.362	0.313
Effective no. of obs. (left of threshold, right of threshold)	(178, 372)	(552, 338)	(378, 334)	(923, 797)	(447, 824)
$GSPRec_{ijt}$ (covariate-adjusted estimates)	−0.004	1.41***	1.45*	0.75**	0.65*
Standard error	(0.730)	(0.346)	(0.860)	(0.323)	(0.379)
Confidence interval	[−2.23, 1.16]	[0.95, 2.41]	[-0.08, 3.98]	[0.24, 1.68]	[−0.59, 1.26]
Optimal bandwidth	0.317	0.249	0.202	0.362	0.313
Effective no. of obs. (left of threshold, right of threshold)	(178, 372)	(552, 338)	(378, 334)	(923, 797)	(447, 824)

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses. The dependent variable in all RDD regressions is X_{ijkt}, where $k =$ primary agricultural product. The optimal bandwidths in these regressions are estimated following Imbens and Kalyanaraman (2012).

for more general patterns of heteroskedasticity (e.g., Kennedy, 2003; Cameron and Trivedi, 2005; Santos Silva and Tenreyro, 2006) is also used to assess the robustness of these results. While the magnitudes are smaller, the results are broadly consistent with the findings from the PPML regression. For example, in our post–URAA sample, we find that *GSP_DVING* recipients' exports of primary agricultural products are 27.1% higher and that of *GSP_LDC* recipients' exports are 46.2% higher relative to nonrecipients (column 6 of Table 3a). In the case of processed agricultural products, *GSP_DVING* recipients' exports are 6.7% more relative to nonrecipients but those of *GSP_LDC* recipients are 53.7% less (column 7). Further, we find that increasing the preference margin by one unit increases recipients' agricultural exports by 5% (column 8). Also, as in the PPML estimation, once we account for tariff preferences separately, GSP recipients' exports of agricultural products are not statistically significant.

One of our main findings is that LDC recipients export substantially more primary agricultural products relative to nonrecipients. We have taken a number of steps to ensure that we capture the actual impact of the GSP program by accounting for historic, economic, or trading-partner characteristics using an extensive series of fixed effects. It is possible, however, there are some residual characteristics associated with LDC that are unobservable and remain omitted from our set of regressors; if so, this could lead to an omitted-variable bias in our estimates. The gravity equation has also been criticized for potential collinearity among its predictor variables. Therefore, we also estimate the GSP effect using a fuzzy regression discontinuity design (RDD). (See Thistlethwaite and Campbell, 1960; Angrist and Lavy, 1999; Hahn, Todd, and Van der Klaauw, 2001; Ludwig and Miller, 2007; Lee, 2008; Carneiro, Heckman, and Vytlacil, 2011; Calonico, Cattaneo, and Titiunik, 2014; Gelman and Imbens, 2018, for application of RDD to nonexperimental data such as this). Appendix C outlines the validity and details of this estimation procedure.

Note that the RDD estimates are interpreted as local average treatment effect (LATE). In fuzzy RDD, LATE is equivalent to the difference in mean outcomes for the treatment and comparison groups divided by the difference in treatment receipt rates for both groups in a local neighborhood around the cutoff. Allowing for potential anticipatory trade increase in the period leading to URAA and spacing estimates at 5-year intervals, we report RDD outcomes for 5 years starting in 1990. For a casual interpretation, we first present the RDD outcomes in Figure 4. In the figure, the primary agricultural exports for GSP recipients are different from those of nonrecipients in each case. For a more systematic intrepration, the coefficient estimates are provided in Table 3b. In the neighborhood of cutoff thresholds, relative to nonrecipients, we find that recipients' exports of primary agricultural products are 3 times more in 1995 and 2000, 0.97 times more in 2000, and 0.92 times more in 2010. The LATE estimate was not statistically significant for 1990. While these results are similar to PPML estimates, we have pre-identified five variables that do not balance around the cutoff. Therefore, we

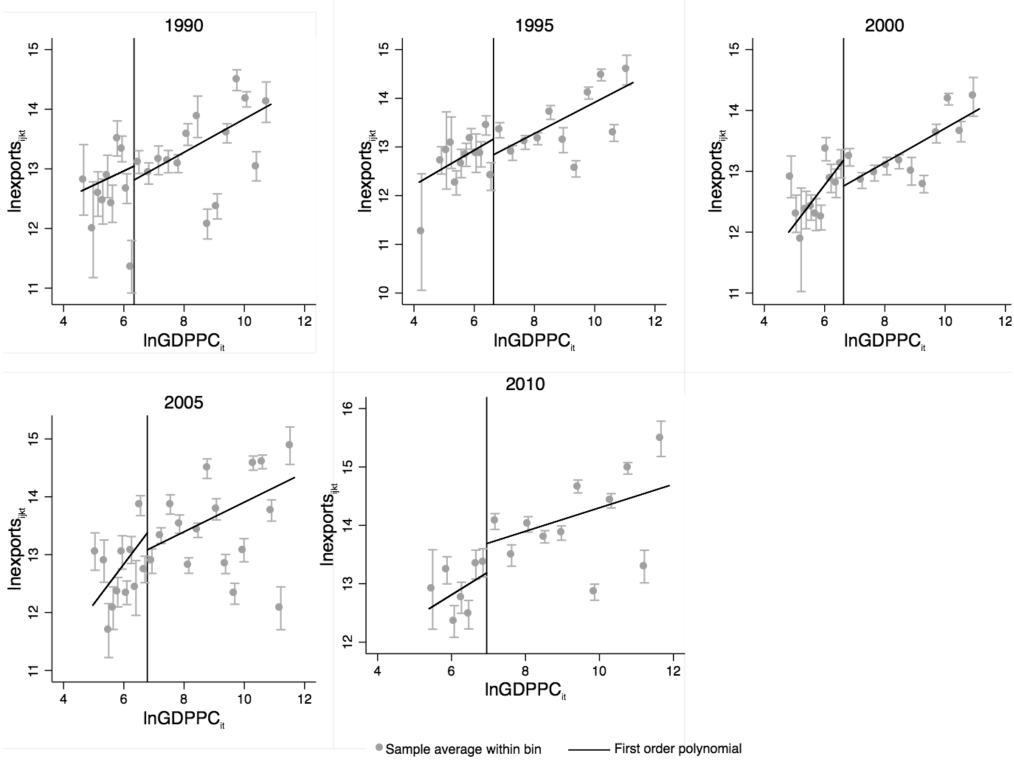

Figure 4. RDD Outcomes by ***$GDPPC_{it}$***

Notes: Outcomes (Exports of primary agricultural products) on the *y*-axis. Treated observations ($GSPRec_{ijt}$) appear on the left side of the threshold in all figures. The cut-off threshold (C_t) are as follows: $C_{1990} = 6.34$, $C_{1995} = 6.64$, $C_{2000} = 6.63$, $C_{2005} = 6.78$, $C_{2010} = 6.95$. The cut-off values are based on World Bank (2017) categorization of countries into low-income category for respective years. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within optimal bandwidths for the fuzzy RDD estimated following Imbens and Kalyanaraman (2012).

proceed with covariate-adjusted RDD estimation (also presented in Table 3b). Although there is a slight increase in precision level (standard errors decrease) in all cases, we find that including covariates produces very similar LATE coefficients. While the application of RDD in this literature is scant, in a comparable study Ritzel and Kohler (2017) use a difference-in-differences model (based on synthetic control method) and find similar trade liberalization effects in LDC exports of agricultural and food products to Switzerland. Further, the pattern these authors observe in recipient exports over time is also consistent with our results in PPML estimation. These findings suggest that the GSP has benefited intended beneficiaries at least in their exports of primary agricultural products.

Conclusion

The most comprehensive study examining export facilitation by the GSP program portrays the outcome of the GSP as being rather “dark” (Herz and Wagner, 2011): Using aggregated merchandise trade data, the authors find that exports of GSP receiving countries are negatively impacted in the long run. Our descriptive analysis of the outcomes of GSP provisions across product types, recipient classes, and compositions of recipient export bundles suggests that a more nuanced examination of this topic is warranted. Of particular relevance, we find three heterogeneities are important in evaluating GSP outcomes. First, the differences in tariff rates available to GSP recipients and nonrecipients are greater in the agricultural sector compared with the nonagricultural sector. Second, the GSP program offers greater product coverage and tariff reductions to the least-developed countries. Third, *GSP_LDC* recipients' exports to high-income countries mainly consist of primary agricultural products, while developing countries have a more balanced export portfolio of primary and processed products.

We then revisit Herz and Wagner's (2011) findings by offering a systematic and nuanced consideration of the program outcomes in light of the above three heterogeneities that pertain to preference coverage and supply side constraints. When these heterogeneities are fully addressed, we find that the GSP program has successfully facilitated exports among intended beneficiaries. Importantly, these benefits vary by product and recipient types. This analysis finds that GSP programs offer a significant and positive effect on recipients' exports to high-income countries for agricultural products but not necessarily for nonagricultural products. For example, in the agricultural sector, we find that recipients' exports to high-income countries are up to 82.2% higher than those of nonrecipient countries. Counter to the findings of other studies (Ozden and Reinhardt, 2005; Herz and Wagner, 2011), we find that the GSP effect is pronounced and positive, even in the case of LDCs when considering exports of primary agricultural products. For example, LDC recipients exported 5.9 times more primary agricultural products than processed agricultural products to GSP donor countries. However, this same effect turns out to be only 43% higher compared with nonrecipients' exports of primary agricultural products. Even after controlling for the two largest donors, the European Union and the United States, we find that GSP has facilitated a 15% increase in LDC recipients' primary agricultural exports. In the case of developing countries as well, the GSP appears to have functioned as intended. We find that *GSP_DVING* recipients' exports of primary agricultural products were 10% less compared with their exports of processed agricultural products, but this effect is 4.1% higher compared with nonrecipients' exports of primary agricultural products.

Since economic, geographic, and industrial characteristics influence the types of products traded by different countries, identifying the effect of the GSP program is challenging. We provide an alternative specification and estimation technique, RDD, whereby we compare similar countries around the threshold to evaluate program outcomes. Consistent across our specifications and estimation techniques, after URAA implementation, recipients' agricultural exports to donor countries are particularly high in the products that recipient countries trade more intensively. For example, relative to nonrecipients, *GSP_LDC* recipients' exports of primary agricultural products were 44.7% higher for the pre–URAA sample versus 120.3% higher for the post–URAA sample; 24.6% versus 49.2% for *GSP_OTH* recipients; and 1% versus 37.7% for *GSP_DVING* recipients. Further, *GSP_DVING* recipients' exports of processed products were found to be 17.4% more for the post–URAA period compared with nonrecipients. These results suggest that GSP programs and subsequent URAA reforms have enabled LDCs to export primary agricultural products to donor countries. Further, in the case of developing countries with an increasing competitive advantage in processed agricultural product production, trade liberalization in agricultural products appears to have facilitated the transition from primary to processed agricultural product exports. Reflecting on the Prebisch–Singer hypothesis about terms of trade though, it appears that the GSP has not been successful in fostering a similar transition from primary to processed agricultural products for LDCs. Export liberalization can increase exports, but it is also well known that liberalization-induced productivity changes largely depend on supply-side market frictions thereof.

This paper offers avenues where program outcomes can be best identified and finds that its performance is generally consistent with its design, at least in the agricultural sector. However, our aggregation of all nonagricultural products into a single, composite sector depicting bilateral trade between donors and recipients may mask some important sectors and products where a positive and economically significant nonagricultural GSP effect may be present. Testing our hypothesis for specific case studies would have been an excellent approach to further validate our results. This approach would require additional details on GSP and trade variables at commodity levels that are beyond the scope of the current study. These would be two fruitful areas for research in the future.[23]

Some authors have suggested eliminating the GSP program completely (e.g., Panagariya, 2003; Ozden and Reinhardt, 2005; Herz and Wagner, 2011). However, this research shows that the benefits of the GSP program are not wholly "dark;" incrementally improving GSP programs rather than eliminating them entirely seems to be a prudent path forward. Efforts toward this end are already underway (UN Conference on Trade and Development, 2003; European Commission, 2016). Further, recognizing the constraints that recipients face in participating in this program, some donors are taking actions to reduce the administrative burden of GSP, ease RoO requirements, and concentrate trade preferences offered through GSP programs to countries with the greatest need (European Commission, 2016). Some donor countries are also stabilizing the program renewal period, product and country graduation rule, and extent of trade preferences offered through GSP programs.[24] These measures are expected to provide intended beneficiaries with the needed assurance in long-term planning to export their agricultural products to high-income countries through provisions in GSP programs. If such revisions continue to systematically address problematic areas, the GSP could potentially develop into a coherent system of trade preferences with program outcomes that are well-aligned with its objectives.

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[24] For example, in October 2012, the European Union increased the renewal period for their GSP program from 3 to 10 years.

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Appendix A: Countries in the Dataset

Afghanistan (AFG)	†Cyprus[a,b,c] (CYP)	Kuwait (KWT)	Saint Kitts and Nevis (KNA)
Albania (ALB)	†Czech Republic[a,b,c] (CZE)	Kyrgyzstan (KGZ)	Saint Lucia (LCA)
Algeria (DZA)	Democratic People's	Lao People's Democratic	Saint Vincent and
Andorra (AND)	Republic of Korea (PRK)	Republic (LAO)	the Grenadines (VCT)
Angola (AGO)	Democratic Republic	†Latvia[a,b,c](LVA)	Samoa (WSM)
Antigua and Barbuda (ATG)	of the Congo (COD)	Lebanon (LBN)	Sao Tome and Principe (STP)
Argentina (ARG)	†Denmark[a,b,c] (DNK)	Lesotho (LSO)	Saudi Arabia (SAU)
Armenia (ARM)	Djibouti (DJI)	Liberia (LBR)	Senegal (SEN)
Aruba (ABW)	Dominica (DMA)	Libya (LBY)	Serbia and Montenegro (SCG)
†Australia[b,c] (AUS)	Dominican Republic (DOM)	†Lithuania[a,b,c] (LTU)	Seychelles (SYC)
†Austria[a,b,c] (AUT)	Ecuador (ECU)	†Luxembourg[a,b,c] (LUX)	Sierra Leone (SLE)
Azerbaijan (AZE)	Egypt (EGY)	Macedonia (MKD)	Singapore (SGP)
Bahamas (BHS)	El Salvador (SLV)	Madagascar (MDG)	†Slovakia[a,b,c] (SVK)
Bahrain (BHR)	Equatorial Guinea (GNQ)	Malawi (MWI)	†Slovenia[a,b,c] (SVN)
Bangladesh (BGD)	Eritrea (ERI)	Malaysia (MYS)	Solomon Isds (SLB)
Barbados (BRB)	†Estonia[a,b,c] (EST)	Maldives (MDV)	South Africa (ZAF)
†Belarus[a,b] (BLR)	Ethiopia (ETH)	Mali (MLI)	†Spain[a,b,c] (ESP)
†Belgium[a,b,c] (BEL)	Fiji (FJI)	†Malta[a,b,c] (MLC)	Sri Lanka (LKA)
Belize (BLZ)	†Finland[a,b,c] (FIN)	Mauritania (MRT)	Suriname (SUR)
Benin (BEN)	Sudan (SDN)	Mauritius (MUS)	Swaziland (SWZ)
Bermuda (BMU)	†France[a,b,c] (FRA)	Mexico (MEX)	†Sweden[a,b,c] (SWE)
Bhutan (BTN)	Gabon (GAB)	Mongolia (MNG)	†Switzerland[a,b] (CHE)
Bolivia (Plurinational	Gambia (GMB)	†Morocco[b] (MAR)	Syria (SYR)
State of) (BOL)	Georgia (GEO)	Mozambique (MOZ)	Tajikistan (TJK)
Bosnia Herzegovina (BIH)	†Germany[a,b,c] (DEU)	Myanmar (MMR)	Thailand (THA)
Botswana (BWA)	Ghana (GHA)	Nepal (NPL)	Togo (TGO)
Brazil (BRA)	†Greece[a,b,c] (GRC)	†Netherlands[a,b,c] (NLD)	Tonga (TON)
Brunei Darussalam (BRN)	Grenada (GRD)	New Caledonia (NCL)	Trinidad and Tobago (TTO)
†Bulgaria[a,b,c] (BGR)	Guatemala (GTM)	†New Zealand[a,b,c] (NZL)	Tunisia (TUN)
Burkina Faso (BFA)	Guinea (GIN)	Nicaragua (NIC)	†Turkey[a,b,c] (TUR)
Burundi (BDI)	Guinea-Bissau (GNB)	Niger (NER)	Turkmenistan (TKM)
Cŏted'Ivoire (CIV)	Guyana (GUY)	Nigeria (NGA)	Uganda (UGA)
Cabo Verde (CPV)	Haiti (HTI)	†Norway[a,b] (NOR)	Ukraine (UKR)
Cambodia (KHM)	Honduras (HND)	Oman (OMN)	United Arab Emirates (ARE)
Cameroon (CMR)	†Hungary[a,b,c] (HUN)	Pakistan (PAK)	†United Kingdom[a,b,c] (GBR)
†Canada[a,b,c] (CAN)	†Iceland[a,b,c] (ISL)	Palau (PLW)	United Republic of
Central African	†India[b] (IND)	Panama (PAN)	Tanzania (TZA)
Republic (CAF)	Indonesia (IDN)	Papua New Guinea (PNG)	Uruguay (URY)
Chad (TCD)	Iran (IRN)	Paraguay (PRY)	†United States of
Chile (CHL)	Iraq (IRQ)	Peru (PER)	America[a,b,c] (USA)
†China[b] (CHN)	†Ireland[a,b,c] (IRL)	Philippines (PHL)	Uzbekistan (UZB)
China, Hong Kong	Israel (ISR)	†Poland[a,b,c] (POL)	Vanuatu (VUT)
SAR (HKG)	†Italy[a,b,c] (ITA)	†Portugal[a,b,c] (PRT)	Venezuela (VEN)
China, Macao SAR (MAC)	Jamaica (JAM)	Qatar (QAT)	Viet Nam (VNM)
Colombia (COL)	†Japan[a,b] (JPN)	†Republic of Korea[b] (KOR)	Yemen (YEM)
Comoros (COM)	Jordan (JOR)	Republic of Moldova (MDA)	Zambia (ZMB)
Congo (COG)	†Kazakhstan[a,b] (KAZ)	†Romania[a,b,c] (ROM)	Zimbabwe (ZWE)
Costa Rica (CRI)	Kenya (KEN)	†Russia[a,b] (RUS)	
†Croatia[a,b,c] (HRV)	Kiribati (KIR)	Rwanda (RWA)	

Notes: ISO codes are provided in paranthesis. † indicates GSP providers
[a] GSP provided to developing countries.
[b] GSP provided to least-developed countries.
[c] GSP provided to other countries.

Appendix B: Generalized System of Preferences (GSP) Database

In the prior literature, the GSP variable is generally modeled as a binary variable limited to indicate a country's status as a GSP recipient. To permit a more nuanced consideration of the effects of the GSP program, we develop a set of GSP variables that indicate both that a country is a GSP recipient and the class to which it belongs. Several steps are required to construct these variables. As a starting point, a comprehensive list of the entire existing nonreciprocal programs is made from the WTO's Preferential Trade Agreement database (World Trade Organization, 2017b). Lists of GSP donor and recipient countries are accessed from the earliest possible handbooks on each donor country's GSP. Depending on the extent of tariff preferences and product coverage, each recipient was further classified into one of three GSP classes, discussed in the Model section. This also includes information on when a country started receiving (offering) GSP preferences. Program updates on new recipients or changes in a donor's status are drawn from more recent 18 GSP handbooks and 8 UNCTAD newsletters. Additional GSP program information is available through the WTO's database on preferential trade agreements, which integrates WTO news updates.

Appendix C: Regression Discontinuity Design (RDD) Estimation

Because the gravity equation has also been criticized for potential collinearity among its predictor variables, we also estimate the GSP effect using a regression discontinuity design (RDD). As country selection into a GSP recipient class is mainly guided by its classification into an income group, we use $GDPPC_{it}$ as the running variable. Yet not all countries classified into low-income categories by the World Bank (2017) receive GSP preferences. Further, some emerging economies and countries in transition also receive GSP preferences. Hence, while $GDPPC_{it}$ does not generate a sharp RDD design, as described below, it does provide for an identification strategy for fuzzy RDD. As Hahn, Todd, and Van der Klaauw (2001) prove, when there is fuzziness, the local average treatment effect (LATE) can be inferred for the subset of observations induced into treatment at the cutoff. Therefore, LATE in fuzzy RDD is equivalent to the difference in mean outcomes for the treatment and comparison groups divided by the difference in treatment receipt rates for both groups in a local neighborhood around the cutoff.

Before estimating the LATE coefficients, we first examine the continuity of the conditional density of $GDPPC_{it}$ in the neighborhood of the cutoff threshold to confirm the validity of the fuzzy RDD. We follow the local linear density estimation technique described by McCrary (2008) and use default optimal bandwidth and bin size delivered by the McCrary algorithm for the density estimates. Allowing for potential anticipatory trade increase in the period leading to URAA and spacing estimates at 5-year intervals, we report five conditional density estimates starting in 1990. Appendix D presents these density functions. Note that we allow the cutoff threshold to change by time, as in World Bank (2015). For each density estimate, we find the clustering of observations on either side of the neighborhood of the threshold $GDPPC_{it}$ to be very similar. Specifically, we find that the difference between the frequency to the right and to the left in the neighborhood of the threshold is not statically significant at the 5% level for all reported years (point estimates being 0.004, 0.037, 0.12, 0.19, 0.018 for 1990 to 2010, in that order). However, the automatic procedure seems to over-smooth the density plot. For example, for 2010, the procedure selected bin-size $= 0.025$ and bandwidth $= 1.47$. Therefore, we also tested for manipulation by scaling the bandwidth by a factor of 0.1 for each year. We did not find evidence of manipulation with the scaled bandwidths. Therefore, we conclude that there is no precise sorting of countries in the neighborhood of the threshold. An additional requirement for the validity of RDD is that the gravity equation covariates for international trade just above and below the cutoff point be balanced. That is, when there is no manipulation, countries around the threshold score do not differ significantly in terms of observable and unobservable variables. To investigate this issue further, we run a number of discontinuity regressions using our baseline gravity equation covariates, in turn, as dependent variables. That is, we regress $Area_i$, $Lang_{ij}$, $Colony\_1945_{ij}$, $Curcol_{ij}$, and $Comcol_{ij}$ on the forcing variable, $GDPPC_{it}$. While these variables balance out (Appendix E presents an example density estimate), WTO_Both_{ijt}, WTO_Exp_{ijt}, WTO_Imp_{ijt}, RTA_{ijt}, $RTA\_Different_{ijt}$, and $Dist_{ij}$ do not balance. The imbalance does not necessarily limit the applicability of the RDD approach. Recall that, in our case, some countries with similar values of the running variable are on different sides of the threshold, which implies that countries in the neighborhood of the threshold must be different in some covariates. Following Ludwig and Miller (2007), Lee (2008), McCrary (2008), and Van der Klaauw (2008), we handle this imbalance by incorporating these variables in our set of covariates in the RDD estimation.

High-order polynomial regressions have been known to attach faulty weights to observations, especially at the bounds (see Gelman and Imbens, 2018, for the details). Further, in these regressions, the probability that the confidence interval fails to include 0 is shown to exceed the nominal type I error rate. Therefore, we report RDD estimates using a local linear estimation technique (as in Gelman and Imbens, 2018). Recall that LATE estimates are interpreted for observations in the neighborhood of the threshold. We present the LATE estimates for each of 5 years in Table 3b.

Appendix D

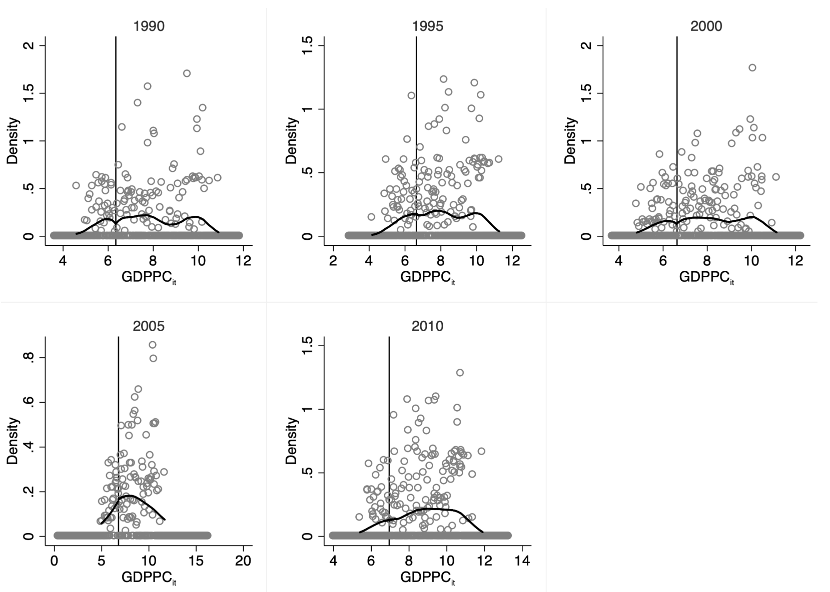

Figure D1. Density of Forcing Variable ($GDPPC_{it}$)

Notes: The cut-off thresholds (C_t) are as follows: $C_{1990} = 6.34$; $C_{1995} = 6.64$, $C_{2000} = 6.63$, $C_{2005} = 6.78$, $C_{2010} = 6.95$. The cut-off values are based on World Bank (2017) categorization of countries into low-income category for respective years. All density estimates are constructed using user-written commands for *DCdensity* in McCrary (2008) and use default bandwidths.

Appendix E

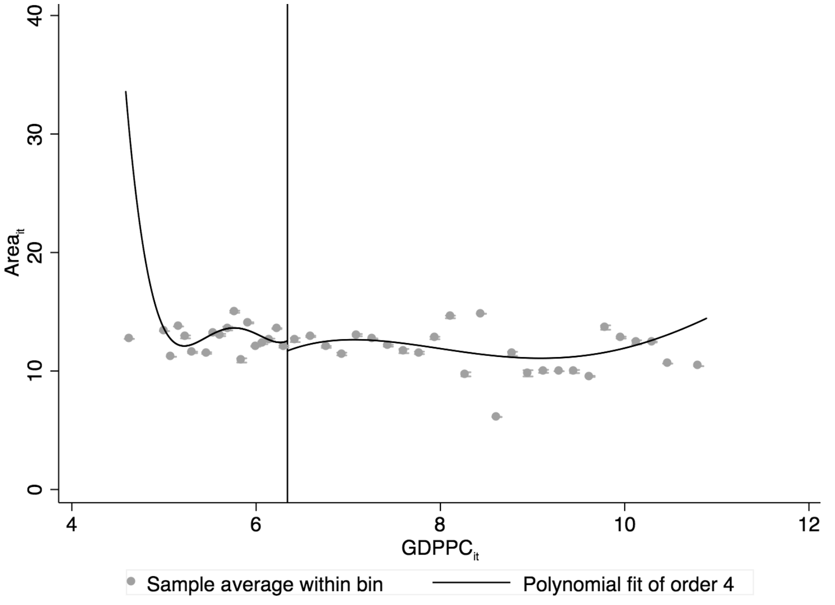

Figure E1. RDD Outcome by ***GDPPC$_{it}$***

Notes: Area (in logarithmic form) of the exporter on the *y*-axis. This figure is for 1990. Treated observations (for $GSPRec_{ijt}$) appear on the left side of the threshold ($C_t = 6.34$). The figure represents a higher-order polynomial fit of order four and a 95% confidence interval based on a triangular kernel within optimal bandwidth for the fuzzy RDD estimated using the procedure outlined in Imbens and Kalyanaraman (2012).