



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.



Global Trade Analysis Project

<https://www.gtap.agecon.purdue.edu/>

This paper is from the
GTAP Annual Conference on Global Economic Analysis
<https://www.gtap.agecon.purdue.edu/events/conferences/default.asp>

PRELIMINARY DRAFT

**The Joint Impact of Specific Tariffs and Preferential Trade Agreements: Do
Low Income Countries Gain or Lose?[†]**

Sohini Chowdhury*

April 2009

WORK IN PROGRESS

My paper attempts to evaluate the distortions from the non-MFN features of the applied import tariff schedules of WTO member countries, in agricultural trade. Although these countries are bound by the WTO MFN clause to levy MFN import tariffs, the advalorem equivalents of their applied tariff schedule contains non-MFN features – due to the presence of specific tariffs and preferential trade agreements (PTAs). My results show that the global distortions generated by specific tariffs in agriculture are big enough to completely wash out any gains from PTAs in agriculture, suggesting that the non-MFN features of applied import tariff schedules generate a net loss in global welfare and trade surplus. Moreover, the biggest chunk of these losses accrue to the low income countries (LICs)¹ and developing countries, which is ironical since it is the interests of precisely these low income countries that the WTO's MFN clause is meant to protect. A policy implication of these results is that future WTO ministerial conferences should focus more on eliminating specific tariffs in agriculture rather than on increasing PTAs in agriculture, since the efficacy of these PTAs is compromised in the presence of specific tariffs.

* Ph.D. Candidate, Department of Economics, Purdue University. Email: schowdhu@purdue.edu

[†] Comments and suggestions provided by Chong Xiang, Tom Hertel, David Hummels, Luca Salvatici, David Laborde, Badri Narayanan Gopalakrishnan, Anca Cristea and Tasneem Mirza are greatly appreciated

¹ World Bank 2004 country classification (54 countries).

1. Introduction

To promote non-discrimination in global trade, the WTO requires its members to levy MFN tariffs on their imports. But, the advalorem equivalents (AVEs) of the applied import tariff schedules of the WTO member countries is seen to have significant non-MFN features. The two factors responsible for injecting non-MFN features into the applied tariff schedules are specific tariffs and preferential trade agreements (PTAs). The goal of my paper is to evaluate the distortions generated by the non-MFN features (from the joint effects of specific tariffs and PTAs) of the applied tariff schedules. My results suggest that these non-MFN features generate substantial welfare and trade surplus losses for the world as a whole, with the biggest chunk of these losses accruing to LICs and developing countries. This is ironical since it is the interests of precisely these low income countries that the WTO's MFN clause is meant to protect. The analysis in this paper shows specific tariffs to be the main culprit, in the sense that the distortions from specific tariffs in agriculture are big enough to wash out any gains from PTAs in agriculture, not just for the LICs, but for the world as a whole. This suggests that the WTO ministerial conferences in future should focus more on eliminating specific tariffs in agriculture, rather than on increasing the spread of PTAs in agriculture. The following paragraphs discuss the channels through which specific tariffs and PTAs affect the welfare and market access of countries through their non-MFN features.

Specific tariffs are fixed tariffs levied per unit of the commodity. Their incidence is highest in the agricultural sector worldwide where they are used as the main instrument of protection (see Section 3). To make them comparable to advalorem tariffs, they are converted into their AVEs by dividing by the f.o.b price of exports. Formally, the AVE of specific tariffs

s_{ijk} , imposed by importer i on imports of good k from exporter j , with p_{jk} as the fob price (exclusive of all trade costs) of good k in j is given by

$$AVE_{ijk} = \frac{s_{ijk}}{p_{jk}} \quad (1)$$

Since low income countries (LICs) export lower quality and lower priced varieties (Schott 2004), they end up facing higher AVEs from the same MFN specific tariff rates vis-à-vis rich countries. This means that although WTO member countries are bound by contract to apply MFN tariff rates - either advalorem, specific or both, on all trading partners, the presence of specific tariffs makes the AVEs of the applied tariff rates non-MFN. The existence of PTAs between countries is the other source of non-MFN features in applied import tariff rates. A large number of LICs benefit from PTAs in agricultural trade which consequently lower the effective tariff rates faced by them vis-à-vis the developed countries. In a nutshell, this means that the effective tariff rates faced by LICs vis-à-vis developed countries are governed by two opposite forces - specific tariffs which raise their AVEs, and PTAs which lower their AVEs. The purpose of this paper is to determine the joint impact of PTAs and specific tariffs on welfare and market access in LICs. This is achieved through a stage-wise elimination of each effect followed by a results analysis at each stage.

My paper also studies the welfare impacts of specific tariffs and PTAs on the developed importing countries. This is based on the premise that MFN specific tariffs having a cross-exporter level of variation are more distortionary than MFN advalorem tariffs and may generate a greater deadweight loss (DWL) in the importing country. On the other hand, levying lower tariffs on LICs through PTAs might successfully counter this additional DWL through a lower allocative efficiency loss, but might also erode away some of the Terms of Trade (TOT) gains for the importer, suggesting that the impact of specific tariffs in the presence of PTAs on

importers will depend on the relative strengths of the allocative efficiency losses and TOT gains faced by them. To obtain additional insights into the trade restrictiveness of the alternative tariff schedules, the corresponding Trade Restrictiveness Indices (TRIs) and the Market Access Overall Trade Restrictiveness Indices (MAOTRIs) are also estimated, along with the DWLs and export value losses. In fact, the empirical estimation of TRI and MAOTRI in a large country partial equilibrium model is another value addition of this paper as discussed in section 2.

The rest of the paper is organized as follows: section 2 discusses the relevant literature and section 3 presents some preliminary data analysis. Section 4 discusses the methodology in two separate parts – the PE and GE model. Section 5 concludes with the last two sections showing the reference list, figure and tables.

2. Literature Review

My paper relates to three strands of literature – Preferential Trade Agreements (PTAs), specific tariffs and the Trade Restrictiveness Indexes (TRIs).

PTAs have been the subject of countless studies since the late 80s – a period which witnessed a domino-effect-induced sharp rise in their proliferation rates. Viner's 1950 classic paper was a watershed in the study of the welfare effects of PTAs. His paper showed that a customs union might not necessarily be welfare improving for its members. Viner argued that whether or not a customs union is welfare improving for its members and for the world as a whole depends on whether it is trade diverting or trade creating. Bhagwati and Panagariya (1996) show that even PTAs among "natural trading partners" are not necessarily trade creating as believed earlier (Krugman, 1991; Summers, 1991; Lutz, 1989). Trade diversion, in the sense of diverting away imports from a more efficient non-member to a less efficient member, is a result

of the ‘beggar-thy-neighbor’ discriminatory nature of PTAs. Moreover, the uncontrolled proliferation of PTAs the world over (the number of Regional Trade Agreements in the world is estimated to be around 400 by 2010; Lamy, 2006) has created a ‘spaghetti bowl’ of trade deals that actually hinder world trade (Bhagwati, 1996). Of even greater concern is the belief that this spaghetti bowl falls much harder on the small and poor countries of the world which lack the resources and negotiating leverage to navigate against the tangled weave of rules and regulations (Baldwin and Seghezza, 2008). This is consistent with the findings of Stibora and Vaal (2006) that joining a PTA does not guarantee welfare gains for the low income country, unless it’s so poor that it cannot import the higher-ranked goods that rich countries produce.

Specific tariffs, being fixed tariffs per unit of the commodity discriminate against exporters of low quality varieties. Since the exporters of low quality varieties are the low income countries (Schott, 2004), MFN specific tariffs generate a higher AVE and higher welfare and market access losses for LICs vis-à-vis developed countries facing the same MFN specific tariff rates. As a source of further discrimination against LICs vis-à-vis developed countries, specific tariffs are observed to be concentrated in the trade of agricultural commodities (Section 3) which form the primary exports of LICs.

The TRI and MAOTRI are tariff aggregating indices used to quantify the trade restrictiveness of tariff schedules in lieu of the less economically meaningful import weighted average. The TRI, first proposed by Anderson (1994) is a welfare-equivalent tariff aggregator. It is the uniform tariff which if applied to home imports would leave home welfare unchanged. An analogous concept is the MAOTRI (Kee et al, 2005b) which is an export value-equivalent tariff aggregator, defined as the uniform tariff which if applied to home imports would keep foreign exports unchanged. The MAOTRI is a slight modification of the MTRI which is defined by

Anderson (2003) as the import-value equivalent tariff. Although most empirical studies of the TRI and MTRI have been performed in a general equilibrium framework (Cipollina and Salvatici, 2006; Anderson and Neary, 2005; Antimiani and Salvatici, 2005), enforcing a few assumptions enables these indices to be computed in a partial equilibrium framework (Corden, 1966; Kee et al, 2005b; Irwin, 2007) with fewer data requirements. Feenstra (1995) and Kee et al (2005b) have redefined the TRI and MAOTRI in a model with linear import demand curves as mentioned in section 4.2.1

All partial equilibrium studies estimating the TRI, MTRI and MAOTRI have focused on the small country scenario with exogenous world prices. Although Anderson (1995) provides a theoretical framework for a general equilibrium estimation of the TRI in large country case, it is a full blown general equilibrium model with strong data requirements. Dakhila and Temimi (2006) suggest a modified version of the TRI in a large country, measuring trade restrictiveness using optimal tariffs instead of free trade as the benchmark. They argue that using optimal tariffs as benchmark ensures the existence and uniqueness of the TRIs in a large country. Anderson provides a counter-argument saying that the non-existence and non-uniqueness of the TRIs associated with using free trade as the benchmark are of theoretical concern only and are unlikely to show up during empirical estimation. But an empirical application of Dakhila and Temimi's theoretical model would require data on optimal tariffs, along with the usual general equilibrium data requirements. To overcome these data requirement issues, section 4.2.3 suggests a simple solution for estimating the TRIs and MAOTRIs in a large country in a partial equilibrium framework with CES import demand and export supply curves, using free trade as the benchmark.

3. Summary Statistics

3.1 US Imports

Figures 1 and 2 show the incidence of the specific tariff and advalorem tariff components of the US applied MFN tariff schedule for 2001 in each of the hs2 commodity categories imported by the US. The tariffs corresponding to each hs2 category is obtained as a simple average over all the hs6 products falling under that category. The figures indicate that while MFN advalorem tariffs are distributed uniformly across product groups, the category of tobacco and substitutes (hs2 =24) being an outlier, MFN specific tariffs are concentrated mainly in the agricultural commodities with the sectors facing high (≥ 100 USD per ton) MFN specific tariffs being dairy produce (04), vegetable plaiting materials (14), sugar and confectionary (17), cereals, flour, starch, milk (18), cocoa and its preparations (19), miscellaneous edible preparations (21), tobacco and its substitutes (24), footwear, gaiters (64), headgear (65), clocks and watches (91).

Schott showed the empirical existence of a significant positive relationship between unit values and per-capita income in the manufacturing industry, which when compared to agriculture is characterized by greater quality differentiation and a stronger correlation between the exporter's level of quality supply and his endowment of skill and capital. I test the strength of this relation in the agriculture sector where specific tariff tariffs are predominant. My results in table 1 show that the positive relationship carries over to the agricultural sector also, though in a diluted but significant strength. I estimate the following regression pooling across all j's and all k's which fall under $hs2 \leq 24$ (agricultural goods), with hs6 commodity fixed effects

$$\ln ave_{jk} = \alpha_k + \beta \ln percapitaGDP_j + \xi_k \quad (2)$$

I get a $\hat{\beta} = -0.14$ which is highly significant with pretty low standard errors equal to 0.016, suggesting that doubling per capita GDP lowers the AVEs (corresponding to the

base specification) of specific tariffs on agricultural goods by 14% on an average. As an additional exercise, I rerun the above regression separately for those hs2 commodities which show high incidence of specific tariffs, pooling over all varieties with hs6 commodity fixed effects. The significant negative relation between the AVEs and exporter percapita GDP establishes that MFN specific tariffs have non-MFN AVEs systematically biased against the exporters of low quality varieties – the developing countries. Plotting the standard deviation of unit values for each hs6 commodity in Fig3 shows the extent of dispersion of unit values within each hs6 commodity which confirms that unlike MFN advalorem tariffs, MFN specific tariffs have an additional tier of cross exporter variation associated with them.

3.2 World Imports

Figures 4 and 5 compare the distribution of MFN and preferential specific and advalorem tariffs across all agricultural commodities, by all importers. These figures are obtained as simple averages over all importers and do not show significant differences between the MFN and preferential rates. The average specific tariff rate for tobacco (hs2 =24) is huge (>7000 USD per ton) and has therefore been excluded from Fig. 5 for fear of dwarfing all the other values. Figure 6 shows the distribution of MFN specific tariffs across all importers and figure 7 shows the distribution of the AVEs of MFN and preferential specific tariffs across all exporters. Table 2 shows the import tariffs rates by region in the base data of the GTAP database. It is evident from the table that agricultural goods (AGRI) on average face higher tariff rates relative to non-agricultural goods (NAGRI). Also, import barriers for agricultural commodities are highest in the LICs and lowest in the USA-Canada region. And lastly, on an average, tariff rates on LIC exports in agriculture are the lowest. This is most likely the result of the numerous trade benefits enjoyed by LIC exports in agriculture.

4. Research Methodology

The research methodology is a sequential two-stage procedure. In the first stage, all preferential trade agreements in agriculture are eliminated by moving from preferential tariffs (tp) to MFN tariffs (tm) in all agricultural commodities. In the second stage, starting from the updated data from the first stage, all specific tariffs in agriculture are converted into their mean advalorem tariff equivalents (tc). The resulting cumulative change in welfare and market access shows the joint effect of specific tariffs and PTAs. The mean advalorem tariff equivalent (tc) corresponding to the importer i - commodity k pair is constructed as the trade weighted mean of the AVEs over all exporters j exporting commodity k to importer i.

Formally, tc for a particular importer i is defined as

$$tc_i = \{tc_{ik(1)}, tc_{ik(2)}, \dots, tc_{ik(K)}\} \quad (3)$$

Where, $k(1), k(2), \dots, k(K)$ are the K hs6 commodities imported by importer i

$$\text{And } tc_{ik} = \text{tradewtdmean} \left(\frac{s_{ik}}{p_{ijk}} \right), \text{ averaged over all } j \quad (4)$$

Comparing the three tariff schedules we see that while tp is non-MFN due to the presence of both PTAs and specific tariffs, tm is non-MFN from the non-MFN AVEs of the specific tariffs. tc on the other hand is pure MFN, having replaced all specific tariffs with their trade weighted mean AVEs. As an alternative form on measuring the restrictiveness of the 3 different tariff schedules, I also compute the corresponding TRI_{US} and $MAOTRI_{LIC}$.

There are two separate sections to this paper. The first section discusses three partial equilibrium models with increasing levels of complexities. Starting from a linear benchmark model, the limitations of each model are discussed paving the way for the next more complex model. Because of data constraints, each of these models consider the US to be the only

importer, importing from all the other countries. All other countries export only to the US. In my partial equilibrium framework, the TRI and MAOTRI are implicitly defined as follows:

$$TRI_{US}: \sum_j \sum_k DWL_{US}(t) = \sum_j \sum_k DWL_{US}(TRI_{US}) \quad (5)$$

$$MAOTRI_{LIC}: \sum_j \sum_k \Delta X_{US}(t) = \sum_j \sum_k \Delta X_{US}(MAOTRI_{LIC}) \quad , \text{ where } j \in \{\text{all LICs}\} \quad (6)$$

Where $t = \{t_{11}, t_{12}, \dots, t_{jK}\}$ is a non-uniform tariff vector and TRI_{US} and $MAOTRI_{LIC}$ are scalars.

One drawback of these PE models is that they ignore the sequential nature of the solution procedure through failure to update the data after the first step. This is because the PE models consider the simulations to be movements along a linear line, assuming the same starting point for step 1 and step 2. Consequently, the sum of the effects of moving from tp to tm , and tm to tc is exactly equal to the effect of moving from tp to tc directly so that the two-step solution procedure essentially reduces to a single step in these PE models. This problem is addressed through a full blown general equilibrium model with multiple importers described in section 4.3.

4.1 Data Sources and Aggregation Issues

The partial equilibrium analysis uses disaggregated US bilateral import and tariff data sourced from the Feenstra compiled NBER data set and the MAcMap-HS6v2.02 data set respectively. While the trade data corresponds to the year 2001, the tariff data is for the year 2004. The Feenstra dataset contains bilateral US import values and import quantities at the HS10 level of commodity disaggregation. The MAcMap-HS6 database provides information on the advalorem and specific components of the MFN and preferential tariff rates, for a set of 163 importers, 208 exporters and 5113 hs6 commodities. The dataset also contains data on the different unit values – bilateral, importer, exporter and exporter reference group (ERGUV). The sensitivity of my results to the choice of unit values used in computing the AVEs of specific

tariffs is discussed in section 4.3.5. Finally, data on elasticity of substitution for US imports and the export supply elasticities faced by the US, by hs8 and hs4 commodity category respectively, are from Broda et al (2006) and Broda et al (2008) respectively. The US GDP and the combined GDP for all LICs for the year 2004 is obtained from the World Development Indicators to be equal to US\$1170 billion and US\$1220 billion respectively.

The data used for the general equilibrium analysis is taken from the GTAP version 7 database containing trade and tariff data for goods and services for the year 2004. The trade data for the 113 regions and 57 commodities is taken from Comtrade and the tariff data is taken from MAcMap-HS6v2.02. To facilitate analysis, the data is further aggregated to just 2 commodities – AGRI (agriculture: HS01-24) and NAGRI (non-agriculture), and 5 regions – USACAN (USA and Canada), EU27 (27 EU countries), JPNSEA (Japan, Hong Kong, Malaysia, Singapore, Taiwan, Korea), LIC (Low Income Countries as per the World Bank classification) and ROW (Rest of the World). The GTAP database contains only the preferential applied tariff rates from MAcMap aggregated to the GTAP level. To obtain the MFN applied tariff rates at the GTAP level of aggregation, the MFN applied tariff rates at the HS6 level from MAcMap are aggregated through simple unweighted means using a Statistical Analysis System program.

One major drawback of using the GTAP database to run tariff scenarios is the substantial loss of information from aggregating the hundreds of tariff lines within each GTAP sector. An ideal tool in such a case is to use the TASTE (The Tariff Analytical and Simulation Tool for Economists) program. The TASTE program allows the user to translate a scenario of changes in bound tariff rates, described in the HS6, 200-country level of detail into a matrix of changes in applied tariff rates which are averaged to the user level of detail (Horridge and Laborde, 2008). This matrix contains percentage changes in the power of tariff which can be used directly to

shock the GTAP model. TASTE is not used in the current version of my paper because of the following problem: in TASTE, tariff scenario changes can only be specified through changes in the bound tariff rates. These user-specified changes in bound tariff rates are then converted into equivalent changes in MFN applied rates and preferential applied rates using information on the binding overhang in TASTE. The results of the tariff scenario change are presented as a matrix showing the old and new bound and applied tariff rates for each commodity-importer-exporter combination. Since my theory relies on changing the final applied rates directly, TASTE can only be applied in my case after calculating the equivalent % changes in bound tariff rates required to generate the necessary % changes in applied tariff rates. This would require detailed information the binding overhang for each commodity-importer pair. The current version of my paper therefore doesn't apply TASTE and instead applies the tariff changes on final applied tariffs directly as shocks in GTAP as discussed in details in section. The drawback of applying the tariff shocks directly in GTAP is that the tariff changes are no longer applied at the tariff line level but are aggregated to a very broad level and therefore result in significant loss of information. Till the methodology in my paper is modified to run tariff scenarios using TASTE, we have to rely on the results obtained from directly shocking the GTAP model.

4.2 Partial Equilibrium Models

4.2.1 Model 1: small country linear model

The importing country, the US, is assumed to be significantly 'small' with linear import demand curves and facing horizontal export supply curves. Using the formula for static DWL popularized by Johnson (1960), yields the following analytical expressions for the DWL faced

by the US and the combined aggregate export value loss faced by all LICs from exports to the US

$$DWL_{US}(t) = \frac{1}{2} \sum_j \sum_k q_{jk} \sigma_k t_{jk}^2 p_{jk} \quad (7)$$

$$\Delta X_{LIC}(t) = \sum_j \sum_k q_{jk} \sigma_k t_{jk} \quad , \text{ where } j \in \{\text{all LICs}\} \quad (8)$$

q_{jk} is the quantity of imports of commodity k from exporter j and σ_k is the import demand elasticity of substitution between the j -armington varieties of good k and p_{jk} is the world price of imports of commodity k from exporter j .

Applying the linear model simplifications suggested by Feenstra (1995) and Kee et al (2005b) to (5) and (6) generates the following analytical expressions for the TRI and MAOTRI for the linear model:

$$TRI_{US} = \frac{1}{2} \left[\frac{\sum_j \sum_k q_{jk} \sigma_k t_{jk}^2 p_{jk}}{\sum_j \sum_k q_{jk} \sigma_k p_{jk}} \right]^{1/2} \quad (9)$$

$$MAOTRI_{LIC} = \frac{\sum_j \sum_k q_{jk} \sigma_k t_{jk}}{\sum_j \sum_k q_{jk} \sigma_k} \quad , \quad \text{ where } j \in \{\text{all LICs}\} \quad (10)$$

Model 1 has two major limitations. Firstly, comparisons of DWL_{US} and ΔX_{LIC} for the three different tariff scenarios is only made possible by assuming that the import demand substitution elasticities corresponding to the tariff schedules t_p , t_m and t_c are the same. This is because we observe elasticities only for the actual case of $t = t_p$. The other two scenarios are hypothetical with non-computable import demand elasticities since imported quantities in the hypothetical cases are not observed. Secondly, assuming the US to be a small country importer makes it impossible to compute the exporter's DWLs and the TOT gains/losses accruing to the US and its exporters. Since analyzing the DWLs faced by LICs exporting to the US is a crucial point of this paper, the 'small importing country' assumption is inadequate for our purposes.

In order to counter the first problem, we propose a CES model of import demand in the following section which ensures constant import demand substitution elasticities along the import demand curve. In order to counter the second problem, we propose a model with the US facing positively sloped CES export supply curves in section 4.2.3.

4.2.2 Model 2: small country model with CES import demand

Import demand curves are CES, export supply curves are flat

$$q_{dj k} = a_{dj k} p_{dj k}^{-\sigma_k} \quad (11)$$

Here $p_{dj k}$ is the tax inclusive US domestic price of imports of commodity k from exporter j defined as

$$p_{dj k} = p_{jk} (1 + t_{jk}) \quad (12)$$

Where p_{jk} is the c.i.f world price of imports

With data on $q_{dj k}$, p_{jk} and σ_k , $a_{dj k}$ is estimated as

$$\widehat{a_{dj k}} = q_{dj k} p_{dj k}^{\sigma_k} \quad (13)$$

The aggregate DWL faced by US is

$$DWL_{USA}(t) = \sum_j \sum_k \widehat{a_{dj k}} p_{jk}^{1-\sigma_k} \left[\frac{1}{\sigma_k - 1} - \frac{\sigma_k}{\sigma_k - 1} (1 + t_{jk})^{1-\sigma_k} + (1 + t_{jk})^{-\sigma_k} \right] \quad (14)$$

The combined aggregate export value loss faced by all LICs from exports to the US is given by

$$\Delta X_{LIC}(t) = \sum_j \sum_k \widehat{a_{dj k}} - \sum_j \sum_k \widehat{a_{dj k}} (1 + t_{jk})^{\sigma_k - 1} \quad (15)$$

Where $j = \{\text{all LICs}\}$

Following (5) and (6), the TRI and MAOTRI are defined implicitly as

$$\begin{aligned} TRI_{US} &: \sum_j \sum_k \widehat{a_{dj k}} p_{jk}^{1-\sigma_k} \left[\frac{\sigma_k}{\sigma_k - 1} (1 + TRI_{US})^{1-\sigma_k} + (1 + TRI_{US})^{-\sigma_k} \right] \\ &= \sum_j \sum_k \widehat{a_{dj k}} p_{jk}^{1-\sigma_k} \left[\frac{\sigma_k}{\sigma_k - 1} (1 + t_{jk})^{1-\sigma_k} + (1 + t_{jk})^{-\sigma_k} \right] \end{aligned} \quad (16)$$

$$\text{MAOTRI}_{\text{LIC}}: \sum_j \sum_k \widehat{a}_{\text{djk}} (1 + \text{MAOTRI}_{\text{LIC}})^{\sigma_k - 1} = \sum_j \sum_k \widehat{a}_{\text{djk}} (1 + t_{\text{jk}})^{\sigma_k - 1}, \text{ where } j = \{\text{all LICs}\} \quad (17)$$

Although the TRI and MAOTRI cannot be explicitly defined from equations (16) and (17), they can be numerically solved using Matlab. Table 2 shows the results.

The DWL, export loss, TRI and MAOTRI corresponding to each tariff scenario is obtained by replacing t with t_p , t_m and t_c in the above expressions, while keeping unchanged all other parameters of the model including the σ_k 's since the model is CES. The results from the model are explained in section 4.2.4

Although the CES import demand functional form permits counterfactual exercises, it does not permit the analysis of the exporters DWL since by the small country assumption, the export supply curves faced by the US are horizontal. This problem is solved using a model with both CES import demand and export supply curves as discussed in the following section.

4.2.3 Model 3: large country model with CES import demand and CES export supply

The model assumes the US as the only importer, facing CES import demand and export supply curves.

This import demand curves for US imports are given by

$$q_{\text{djk}} = a_{\text{djk}} p_{\text{djk}}^{-\sigma_k} \quad (18)$$

The export supply curves faced by the US are given by

$$q_{\text{sjk}} = a_{\text{sjk}} p_{\text{sjk}}^{S_k} \quad (19)$$

Where, j is an exporter index, k is a good index, σ_k is the import demand elasticity of substitution between the various armington import varieties of good k , and S_k is the price elasticity of supply of exports of good k from the rest of the world as faced by the US. a_{djk} and a_{sjk} are the shift

parameters corresponding to the import demand and export supply curves respectively. The values of a_{djk} are estimated as in (12) using information on the bilateral import quantities, prices and the import demand elasticities of substitution. The import tariff introduces a wedge between the prices paid by the domestic consumers and the prices received by the foreign suppliers as

$$p_{djk} = p_{sjk}(1 + t_{jk}) \quad (20)$$

All other variables are endogenously determined. The distribution of the tariff incidence between the US importer and LIC exporter is determined by the import demand and export supply elasticities σ_k and S_k .

p_{jk} is the free trade equilibrium price defined from the model equations as

$$p_{jk} = p_{sjk}(1 + t_{jk})^{\frac{\sigma_k}{\sigma_k + S_k}} \quad (21)$$

Solving the model generates analytical expressions for the aggregate deadweight losses faced by the US from levying import tariffs on agricultural commodities and the aggregate deadweight losses and import value losses accruing to all LICs from these import tariffs, all as functions of the tariff rate t .

The aggregate DWL faced by US is given by the expression

$$DWL_{US}(t) = \underbrace{\sum_j \sum_k \widehat{a_{djk}} p_{jk}^{1-\sigma_k} \left[\frac{1}{\sigma_k - 1} + (1 + t_{jk})^{\frac{-S_k \sigma_k}{\sigma_k + S_k}} - \frac{\sigma_k}{\sigma_k - 1} (1 + t_{jk})^{\frac{S_k(1-\sigma_k)}{\sigma_k + S_k}} \right]}_{\text{Allocative Efficiency Loss}} \quad (22)$$

$$- \underbrace{\sum_j \sum_k \widehat{a_{djk}} p_{jk}^{1-\sigma_k} (1 + t_{jk})^{\frac{-S_k \sigma_k}{\sigma_k + S_k}} \left[1 - (1 + t_{jk})^{\frac{\sigma_k}{\sigma_k + S_k}} \right]}_{\text{TOT Loss}}$$

The combined aggregate DWL of all LICs exporters is given by

$$DWL_{LIC}(t) = \underbrace{\sum_j \sum_k \widehat{a_{djk}} p_{jk}^{1-\sigma_k} \left[\frac{S_k}{(S_k + 1)} (1 + t_{jk})^{\frac{-\sigma_k(S_k + 1)}{S_k + \sigma_k}} + \frac{1}{(S_k + 1)} - (1 + t_{jk})^{\frac{-S_k \sigma_k}{\sigma_k + S_k}} \right]}_{\text{Allocative Efficiency Loss}} \quad (23)$$

$$+ \underbrace{\sum_j \sum_k \widehat{a}_{jk} p_{jk}^{1-\sigma_k} (1+t_{jk})^{\frac{-S_k \sigma_k}{\sigma_k + S_k}} \left[1 - (1+t_{jk})^{\frac{-\sigma_k}{\sigma_k + S_k}} \right]}_{\text{TOT Loss}}, \quad \text{where } j = \{\text{all LICs}\}$$

The combined aggregate export value loss faced by all LICs from exports to the US is given by

$$\Delta X_{\text{LIC}}(t) = \sum_j \sum_k \widehat{a}_{jk} p_{jk}^{-\sigma_k} \left[(1+t_{jk})^{\frac{-\sigma_k S_k}{\sigma_k + S_k}} - 1 \right], \quad \text{where } j = \{\text{all LICs}\} \quad (24)$$

The following special cases are observed from (22), (23) and (24):

1. When $t_{jk} = 0$, for all j, k

TOT loss and allocative efficiency loss for both the US and each LIC exporter is 0. That is, DWL for both importers and exporters is 0. Although $DWL = 0$, welfare is not optimum for the US since DWL can be positive from positive TOT gains. Export value losses for the LICs = 0.

2. When $S_k = \infty$ for all k , indicating a flat export supply curve faced by the US,

The TOT gains for the US and TOT losses for each LIC are 0

3. When $\sigma_k = \infty$, for all k , indicating a flat import demand curve faced by the US,

The allocative efficiency losses for the US are 0

Following (5) and (6), the TRI and MAOTRI in this model are implicitly defined as

$$\text{TRI}_{\text{US}}: \sum_j \sum_k \widehat{a}_{jk} p_{jk}^{1-\sigma_k} \left[-\frac{\sigma_k}{\sigma_k - 1} (1 + \text{TRI}_{\text{US}})^{\frac{S_k(1-\sigma_k)}{\sigma_k + S_k}} - (1 + \text{TRI}_{\text{US}})^{\frac{\sigma_k(1-S_k)}{\sigma_k + S_k}} \right] = \sum_j \sum_k \widehat{a}_{jk} p_{jk}^{1-\sigma_k} \left[-\frac{\sigma_k}{\sigma_k - 1} (1 + t_{jk})^{\frac{S_k(1-\sigma_k)}{\sigma_k + S_k}} - (1 + t_{jk})^{\frac{\sigma_k(1-S_k)}{\sigma_k + S_k}} \right] \quad (25)$$

$$\text{MAOTRI}_{\text{LIC}}: \sum_j \sum_k \widehat{a}_{jk} p_{jk}^{-\sigma_k} (1 + \text{MAOTRI}_{\text{LIC}})^{\frac{-\sigma_k S_k}{\sigma_k + S_k}} = \sum_j \sum_k \widehat{a}_{jk} p_{jk}^{-\sigma_k} (1 + t_{jk})^{\frac{-\sigma_k S_k}{\sigma_k + S_k}} \quad (26)$$

Although (25) and (26) do not provide explicit analytical solutions for the TRI and MAOTRI, their numerical solutions can be obtained using Matlab. The solutions are presented in table 2.

4.2.4 Results: Welfare and Market Access Losses

Table 2 shows the US welfare and LIC market access losses corresponding to the different tariff schedules, obtained from the three different models. Table 4 shows the decomposition of the DWLs accruing to the US and its LIC exporters as obtained from model 3. The results are consistent with theory and show that the DWL faced by the US is largest in model 1 and smallest in model 3. This is because the area of the Harberger's triangle is the largest in model 1 owing to the linear import demand curve. This area decreases in model 2 owing to the convex CES import demand curve. The allocative efficiency loss is even smaller in model 3, since in this model these losses are shared by the exporters. Moreover, the TOT gains in model 3 further reduce the overall DWL faced by the US. Comparing the import value losses, they are almost equal for models 1 and 2 but are lower in model 3 because in model 3 the domestic prices in the US do not rise by the full extent of the import taxes owing to the positively sloped export supply curves faced by the US.

The results are also consistent with the DWL_{US} estimates obtained in other studies. Table 3 compares the DWL_{US} and $\left(\frac{DWL}{GDP}\right)_{US}$ values obtained from models 1 and 3 to the estimates obtained in other studies. The literature summarizing the US costs of protection (Irwin, 2007; Feenstra, 1995) emphasizes the following points:

1. The DWLs accruing to the US from “tariffs only” has steadily fallen over the years to less than half of 0.1% of GDP. This is on account of the lowering of applied tariffs, an increase in the number of imports classified as ‘duty free’ and a steady shift towards less transparent non-tariff trade barriers like quotas . This observation is consistent with my DWL/GDP estimates of 0.06% and 0.03% from models 1 and 3 respectively

2. A partial equilibrium estimation of the DWL underestimates the DWL from a general equilibrium estimation as it fails to account for the cross-price effects and income effects. This is discussed further in section 4.3.4.
3. A higher variation in tariffs generates a higher DWL since the DWL from tariffs is proportional to the squares of tariffs. Since my models contain a cross-exporter variation in tariff lines, along with the usual cross commodity variation, my estimates of DWL are higher than the DWL values estimated from the other “tariffs only”, “no TOT effects” partial equilibrium models in the literature.

The other factor contributing to the relatively high DWL values in Model 1 is the use of the Broda elasticities of substitution which have a higher mean and higher variance than the import demand elasticities used in the other studies. Table 5 shows the comparison between the Kee et al elasticities and Broda elasticities.

Table 4 shows the results from model 3, decomposing the welfare losses accruing to the US and LICs into allocative efficiency (AE) losses and TOT gains/losses. The extremely low TOT gains accruing to the US can be attributed to the relatively low foreign supply elasticities faced by the US (Broda, 2008) compared to the elasticities of substitution of import demand (Broda, 2006). The mean and sd of these elasticities are shown in table 5. The values in the table show that the foreign export supply curves faced by the US are on average flatter than the import demand curves. Step 1 of the analysis compares the US welfare losses and the LIC export losses from the applied preferential tariff rates t_p to those from the MFN applied tariff rates t_m . The results in table 4 indicate that when the US removes all preferential benefits in the import of agricultural goods, the LICs together incur an additional welfare loss from an increase in AE loss and a worsening of TOT. The US on the other hand faces an increase in AE loss and an

improvement in its TOT. Overall, there is an improvement in US welfare indicating that the TOT gains are larger than the AE losses. The results suggest that while the US loses from extending preferential tariff rates to LICs in agriculture, the LICs benefit from the resulting increases in welfare and market access. The US welfare loss stems mainly from lower TOT gains.

Step 2 of the analysis compares the US welfare losses and the LIC export losses corresponding to the MFN applied tariffs t_m to those corresponding to the mean AVE tariff equivalents t_c . t_{ck} for commodity k is constructed as the import-weighted mean of the AVEs corresponding to k , the mean taken over all exporters j . The results of the comparison shown in table 4 indicate that in the absence of PTAs, when the US converts all specific tariffs in agriculture to advalorem tariffs, all LIC exporters together incur a welfare gain from an AE gain and an TOT gain. Additionally, there is an increase in LIC exports to the US. The US on the other hand faces an AE gain and a TOT loss. Overall, there is an improvement in US welfare indicating that its TOT losses are smaller than its AE gains. The results suggest that both the US and its LIC exporters stand to gain from eliminating specific tariffs in agriculture.

Finally, comparing the initial and final scenarios i.e the welfare and market access losses corresponding to t and t_c shows that US specific tariffs in agriculture generate welfare and market access losses for LICs, which completely neutralize the benefits of the preferential treatment that the US extends to these countries in terms of lower tariff rates in agricultural imports.

4.2.5 Results: TRI and MAOTRI

Table 2 also shows the TRI and MAOTRI results corresponding to the different models.

While the MAOTRI values depend only on the means of the tariff schedule, the TRI values depend on both the mean and variance. Since my models take into account the cross exporter variation in tariffs, along with the usual cross commodity variation, the TRI estimates obtained from model 1 should be significantly higher than the estimates obtained in other studies. But the TRI estimate from model 1 (5.56%) is almost equal to the Kee et al (2005b) estimate of 5.3%. This is consistent with Irwin's (2007) empirical observation that the TRI estimates are sensitive to the level of disaggregation only up to a certain level. Further disaggregation beyond a certain level results in no significant increase in the TRI. The TRI estimate from model 3 is significantly lower in comparison (3.32%), consistent with a lower DWL. Although I use the Broda elasticities which are higher than the elasticities used in other studies, the TRI and MAOTRI estimates are not affected significantly since the elasticities appear in both the numerator and the denominator. This is consistent with Irwin's (2007) argument that the TRI estimates are not very sensitive to the choice of elasticities. I estimate the MAOTRI for LICs wrt the US at 12.7% from the linear model. Since the US has the lowest tariff barriers among all QUAD countries, this is consistent with the Kee et al MAOTRI estimate for LICs wrt the QUAD countries at 14%.

Clearly, moving from preferential tariffs to MFN applied tariffs generates higher export value losses for the LICs, since the latter tariffs are higher. A subsequent move to the MFN AVE tariff rates results in a gain in export values as these tariff rates are lower than the MFN applied rates. The model shows that these gains are high enough to counter the first stage losses, implying that the losses faced by LICs from specific tariffs outweigh the gains from PTAs. The question is better addressed by a general equilibrium model described in section 4.3.

4.2.6 Sensitivity of Results

The results obtained might be sensitive to the choice of unit values used in computing the AVEs of specific tariffs. This is because the greater the dispersion in the within-commodity cross-exporter unit values, the greater will be the distortionary effects of specific tariffs, particularly the bias against LIC in the form of higher AVEs. Since the exporter's unit value (computed as the median unit value of worldwide exports from a particular exporter) or the exporter's reference group unit value (ERGUV, computed as the median unit value of worldwide exports from an exporter's reference group) have a lower dispersion than the bilateral unit values, using these instead of bilateral unit values will generate lower distortions from specific tariffs, especially for LICs. An alternative way of stating this is that the specific tariffs-generated welfare and trade balance losses obtained in 4.2.4 and 4.2.5 are the upper bound of losses. Using the ERGUVs would generate the lower bound of these losses.

4.3 General Equilibrium Model

4.3.1 GTAP Model and Experiment

Trade issues by nature require an analytical framework that allows a holistic view of world economies. This is not only because of the inter-linkages between various sectors in any given economy but also because of the relationships between sectors in one economy to the rest of the world economies. These national, regional and global linkages may occur either in the inputs or products markets or as are usually the case, in both. Therefore, in order to avoid ignoring these linkages, a general equilibrium methodology such as one using the Global Trade Analysis Project (GTAP) model is one of the analytical instruments be used in this study. The global computable general equilibrium (CGE) modeling framework of the Global Trade Analysis

Project (GTAP) (Hertel, 1997) provides the best available *ex ante* analysis of the economic and trade consequences of changing tariff scenarios.

The GTAP model is a comparative static, global computable general equilibrium model based on neoclassical theories. The model assumes perfect competition in all markets, constant returns to scale in all production and trade activities, and profit and utility maximizing behavior of firms and households respectively. The model includes: demand for goods for final consumption (Constant Difference Elasticity form), intermediate use and government consumption, demands for factor inputs (Constant Elasticity of Substitution functional form), supplies of factor and goods and the international trade of goods and services. The model employs the simplistic but robust assumption of perfect competition and Constant Returns to Scale in production. Bilateral international trade flows are handled using the Armington assumption by which products are exogenously differentiated by origin (Armington, 1969). In the standard closure, global investment adjusts to global savings so that the national balances of payments are endogenous. The model is solved using the GEMPACK software (Harrison and Pearson, 1996). Full documentation of the GTAP model and the database can be found in Hertel (1997) and also in Narayanan and Walmsley (2008).

This paper uses version 7 of the model based on 2004 database. An experiment with two sequential shocks is performed to analyze the joint impact of specific tariffs and PTAs. The first shock eliminates all preferential treatments given in agricultural imports. This is achieved by switching the tariffs on agricultural imports from preferential (tp) to MFN (tm). Using the updated data after the first shock, the second shock converts all specific tariffs in agriculture into their mean AVEs. This is done by switching the tariffs imposed on agricultural imports from MFN (tm) to MFN AVE (tc). The base tariff rates (pre-simulation) and the updates tariff rates

after each shock are shown in tables 6 and 7 respectively. The changes in welfare and trade balances resulting from each shock are analyzed at depth in the following section.

4.3.2 Results: Welfare Changes

The results suggest that PTAs and specific tariffs have different welfare impacts on different regions. The results shown in tables 8 and 9 suggest that the interaction of PTAs and specific tariffs in agriculture create losses equivalent to US\$13 billion in the global economy, with 84% of these losses accruing to the LICs.

A stage-wise analysis of the results shows that eliminating PTAs in agriculture generates a welfare loss in all regions excepting in JPNSEA and USACAN. The results are better understood by analyzing the changes in the allocative efficiency (AE) and Terms of Trade (TOT) components. Eliminating PTAs creates an AE loss in *every* region, irrespective of whether the region is a net importer or a net exporter. This is expected since PTAs are eliminated by a hypothetical move from the preferential rates (t_p) to the MFN rates (t_m) and the MFN rates are never lower than the preferential rates. LICs face the largest losses, followed by EU27 and ROW suggesting that LICs are the biggest recipients of preferential treatment. Most of the within - EU27 trade benefits from free trade agreements, so EU27 also faces large AE losses from the hypothetical elimination of PTAs. As an importer too, EU27 faces AE losses from PTA elimination since it extends substantial preferential treatments on its agriculture imports, so that removing these PTAs and moving to a higher MFN tariff increases its AE losses. A similar argument explains the US AE losses – the fact that the US is a net importer and offers substantial preferential treatment on its agriculture imports. It is useful to note at this point that the ROW group consists mostly of the developing lower- and upper- middle income countries, the only

exceptions being Australia and New Zealand. Since these developing countries also benefit from PTAs, they face an AE loss from PTA removal. The AE losses accruing to JPNSEA is significantly lower when compared to all the other regions. This is probably because the countries in JPNSEA are neither big recipients of preferential treatment in agriculture as exporters, nor are they big donors of preferential treatment as importers. Also, since these countries are net importers of agriculture, the importer logic is more accurate in explaining the low AE losses in JPNSEA from a hypothetical PTA elimination.

Regarding the TOT effects, the three developed regions face TOT gains from elimination of PTAs in agriculture, while the LICs and developing countries face TOT losses. The LICs and ROW being net exporters of agriculture face TOT losses from the higher MFN tariffs (tm) instead of the lower preferential tariffs (tp). By a similar logic, the net importers of agriculture JPNSEA, USACAN and EU27 face TOT gains from levying these higher tariffs. In JPNSEA and USACAN, the TOT gains wash out the AE losses creating an overall welfare gain in these two regions. This is not the case in EU27 where the TOT gains are not high enough to counter the AE losses. In LICs and ROW, the TOT losses added to the AE losses create very high overall welfare losses. In fact, these two groups together account for 94.83% of the global welfare losses from agricultural PTA elimination while LICs alone account for 62%. So to summarize the results of the first shock, removal of PTAs in agriculture generate welfare losses for all regions excepting USACAN and JPNSEA as shown in table 8. The table shows only the major and relevant effects affecting welfare, minor effects like the savings-investment changes are not displayed.

The results from converting all specific tariffs in agriculture to their mean AVE, as a move from MFN applied tariffs (tm) to mean AVE tariffs (tc) show that all regions gain in

welfare, excepting JPNSEA and EU27. A decomposition of these welfare effects show that USACAN and LIC are the only two regions facing AE gains. For importers, the conversion of specific tariffs into advalorem tariffs reduces the cross-exporter level of distortion associated with MFN specific tariffs vis-à-vis MFN advalorem tariffs. But for exporters, it reduces AE in regions which initially faced low applied MFN AVEs (t_m) (EU27, JPNSEA, USACAN) and increases AE in regions which initially faced high applied MFN AVEs (t_m) (LIC, ROW). This is because t_c is constructed as the average of the t_m over all regions. Therefore, the AE result for each region is determined by the relative strengths and directions of the importer and exporter effects. The results show that for LIC and ROW, both these effects work in the same direction to increase AE. For JPNSEA, USACAN and EU27, the exporter effect works against the importer effect but is not strong enough to counter the positive importer effect. The exporter effect is stronger in EU27 and JPNSEA compared to USACAN because of the very low t_m faced by these two regions as seen from Table 7. So the negative exporter effect partially chokes off the positive importer effect from conversion of specific tariffs to advalorem tariffs in JPNSEA, EU27 and USACAN.

Considering the TOT effects, the net importers of agriculture face TOT losses while the net exporters of agriculture face TOT gains. The results in table 9 are clear in showing that only LICs and ROW gain TOT while all other regions lose. This also suggests that LICs and ROW are the primary global suppliers of agricultural goods, so that when their TOT improves, their importers' TOT worsens. Combining the AE and TOT effects show that the conversion of specific tariffs to advalorem tariffs improves welfare for USACAN, LIC and ROW and for the global economy as a whole. LICs account for 67.8% of the global welfare gains whereas LICs and ROW together account for 102%.

Finally, comparing the results from the two simulations shows that a sequential elimination of PTAs and specific tariffs in agriculture improves the welfare of USACAN, LIC and ROW while making EU27 and JPNSEA worse off. The overall gains to the global economy is USD 13 billion, with 84% of these gains accruing to LICs alone and 124% accruing to the combined group of LICs and ROW. The results obtained for USACAN and LIC are consistent with the results obtained from the partial equilibrium model in section 4.2 in terms of the direction of the effects, although the values are different by an order of magnitude. Some possible explanation for these discrepancies based on the differences of the PE and GE models are discussed in section 4.3.4

4.3.3 Results: Trade Balance Changes

We also analyze the region-wise changes in trade balance corresponding to each region. The results show that the abolition of PTAs in agriculture by a shift from tp to tm results in an improved trade balance for the world as a whole, suggesting that PTAs in agriculture generate more trade diversion than trade creation. Table 10 shows that the PTAs in agriculture benefit LIC, EU27 and JPNSEA by increasing their exports relative to imports. A subsequent move to tc , equivalent to a conversion of specific tariffs in agriculture to advalorem tariffs, generates a net export value gain for JPNSEA, LIC and ROW. These gains are the highest for LICs since they face the highest AVEs of MFN applied tariffs tm . Finally, considering the cumulative effects of the two shocks, it is seen that specific tariffs and PTAs in agriculture together generate a trade surplus loss of US\$ 19.77 billion for the world as a whole, with the LICs accounting for 72% of these losses and the LICs and ROW together accounting for 116%.

4.3.4 Comparing the PE and GE results

There are a couple of factors contributing to the differences in the PE and GE results. Firstly, the PE model considers the US as the only importer. So the DWLs and export value losses accruing to the LICs are only with respect to exports to the US, brought about by US import tariffs. Since the US import tariffs are considerably lower than the import tariffs of other countries (Section 3), this explains the rather small value of the DWL/GDP for the LICs at 0.33% (Table 4). Secondly, the PE model, unlike the GE model doesn't consider the effects of input taxes and subsidies and export subsidies. Such domestic protection measures are very high for the US and interact with the import tariffs to affect welfare. Thirdly, the PE model ignores income effects. The move from t_m to t_c generates additional real income for the US which increase the US demand for imports, some of these imports being sourced from the LICs. This pushes the LIC even welfare higher. All these effects, with multiple importers, are taken care of in the GE model. This explains why the *changes* in the equivalent variation (EV) in income corresponding to the changes in the tariff schedules are significantly larger in the GE model.

4.3.5 Sensitivity of Results

The first check of robustness is with the use of alternative unit values as described in section 4.2.5. The results from this test are not yet ready.

The sensitivity of my results is also checked with respect to the values of two crucial parameters - the elasticity of substitution between the imported armington varieties (ESUBM) in agriculture, and the elasticity of substitution between the domestic and composite imported varieties (ESUBD) in agriculture. But since in the GTAP model ESUBM is derived as twice the value of ESUBD, a x% change in ESUBD is equivalent to a x% change in ESUBM. So the

sensitivity analysis is performed only w.r.t ESUBD. The value of ESUBD for agriculture in the base data is 2.37. The experiment is rerun with a +10% and -10% change in ESUBD for agriculture. The results presented in table 11 are consistent with the theory that an increase (decrease) in ESUBD or ESUBM magnifies (dampens) the quantity effect of tariff changes, leaving unchanged the direction of these effects.

5. Conclusions

The results of my analysis suggest that future WTO ministerial conferences should focus more on converting specific tariffs in agriculture into advalorem tariffs rather than on increasing preferential treatments to LICs. This is because for the world as a whole, the losses from specific tariffs outweigh the gains from the various preferential trade agreements, with the low income and developing countries having to bear a massive share of these losses both in terms of welfare and market access.

6. References

- Anderson, J. E., Neary, J. P. "Measuring the Restrictiveness of Trade Policy", *The World Bank Economic Review*, 8, 151-69 (2005)
- _____"The Mercantilist Index of Trade Policy", *International Economic Review*, 44 (2), 627-649 (2003)
- _____"A New Approach to Evaluating Trade Policy, *Review of Economic Studies*, 21 (6), 107-125 (1996)
- Antimani, A., Salvatici, L. "EU Trade Policies, benchmarking Protection in a General Equilibrium Framework", *LLRR Working Paper No.31* (2005)
- Badri Narayanan G., Terrie L. Walmsley, (Editors), "*Global Trade, Assistance, and Production: The GTAP 7 Data Base*", *Center for Global Trade Analysis, Purdue University*, 2008
- Baldwin, A., Seghezza, E., "Are Trade Blocs Building or Stumbling Blocks?" *CEPR Discussion Paper DP6599*, 2008

- Bhagwati, J., Panagariya, A. "The Theory of Preferential Trade Agreements: Historical Evolution and Current Trends", *AER* 1996
- Bouet, A et al "A Consistent, Advalorem Equivalent measure of Applied Protection across the world: The MAcMap-HS6 database", *CEPR, working Paper no. 2004-22*(2004)
- Boumellassa H., Laborde, D., Mitaritonna, C. "A consistent picture of the protection across the world in 2004: MAcMapHS6 version 2", *IFPRI Discussion paper*. 2009
- Broda, C., Weinstein, D.E. "Globalization and the Gains from Variety", *QJE*, 121(2) 2006
- Broda, C., Limao, N., Weinstein, D.E. "Optimal Tariffs and Market Power: The Evidence", *AER* 98(5) 2008
- Bureau, J. & Salvatici, L. "Agricultural Trade Restrictiveness in the EU and US", *IIIS Discussion Paper No. 59, Jan 2005*
- Cipollina, M., Salvatici, L. "Measuring Protection: Mission Impossible?" *Trade AG Working Paper No. 06/07* (2006)
- Corden, W.M. "The Effective Protective Rate, the Uniform Tariff Equivalent and the Average Tariff, *Economic Record*, 42, 200-216 (1966)
- Dakhila, S., Temimi, A. "An Extension of the Trade Restrictiveness Index to Large Economies", *Review of International Economics*, 14(4), 678-682, 2006
- Feenstra, R. C. "Estimating the Effects of Trade Policy" *Handbook of International Economics* (Ed.) Grossman, G. and Rogoff, K., 3(30), 1533-1595
- Gibson et al "Profiles of Tariffs in Global Agricultural markets " *USDA, Agricultural Economic Report* 796 (2001)
- Harrison, J.W., Pearson, K.R. "Computing Solutions for large General Equilibrium Models using GEMPACK", *Computational Economics*, 1996
- Hertel, T.W. "Global Trade Analysis: Modeling and Applications", *Cambridge University Press*, 1997
- Horridge, J.M. and Laborde, D., "TASTE: a program to adapt detailed trade and tariff data to GTAP-related purposes", *GTAP Technical Paper*, Centre for Global Trade Analysis, Purdue University, 2008
- Irwin, D.A. "Trade Restrictiveness and Deadweight loss from US Tariffs 1859-1961" *NBER Working Paper*, (2007)
- Johnson, H., "The Cost of Protection and the Scientific Tariff", *Journal of Political Economy*, No. 4 1960
- Kee, H.L., Nicita, A., Olarreaga, M. "Import Demand Elasticities and Trade Distortions", *Centre for Economic Policy Research, Working Paper No. 4669, London, UK* (2005a)

-
- _____ “Estimating Trade Restrictiveness Indices, *The World Bank Group* (2005b)
- Krugman, P. “The Move Towards Free Trade Zone”, *Economic Review*, 1996
- Laborde, D., ‘Mesures et détermination endogène des droits de douane’ *Ph.D. thesis, Université de Pau et des Pays de l'Adou.*, 2008
- Lamy, P. “Gabriel Silver Memorial Lecture”, *Columbia University*, 2006
- Magee, S. “The Welfare Effects of Restrictions on U.S Trade” *Brookings Papers on Economic Activity*, 3, 1972
- Narayanan, B., Walmsely, T., “GTAP 7 Base Data Documentation”, *Center for Global Trade Analysis*, 2008
- Rousslang, D., Tokarick, S. “Estimating the Welfare Costs of Tariffs: The Roles of Leisure and Domestic Taxes” *Oxford Economic Papers*, 47, 1995
- Schott, P. “Across-Product versus Within-Product Specialization in International Trade”, *QJE*, 119(2), 2004
- Stern, R. “The U.S Tariff and the Efficiency of the U.S Economy” *AER* 54, 1964
- Stibora, J., De Vaal, A. “Does Preferential Trade Benefit Poor Countries? A General Equilibrium Assessment with Nonhomothetic Preferences”, *QJE*, 119(2), 2004
- Summers, L. “Regionalism and the World Trading System”, *Policy implications of trade and currency zones*, 1991
- US International Trade Commission “Economic Effects of Significant US Import Restraints” *Publication 3701, Fourth Update June 2007*
- Viner, J. “The Customs Union Issue”, *New York Press*, 1950

7. Figures and Tables

Fig. 1: Incidence of MFN Advalorem Tariffs in US imports

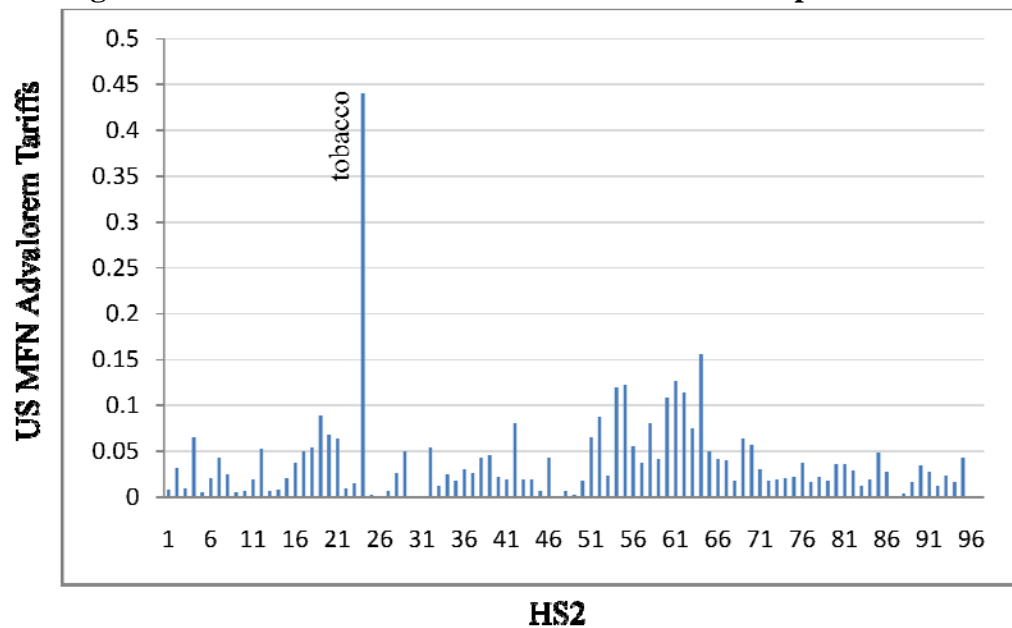


Fig. 2: Incidence of MFN Specific Tariffs in US imports

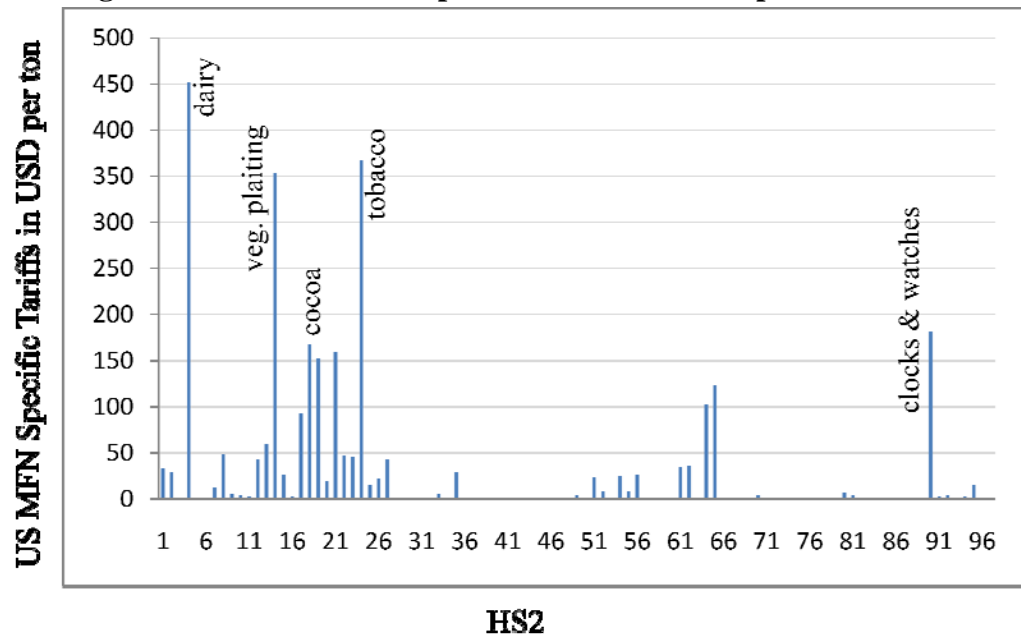


Figure 3: Plot comparing the dispersion of the AVEs of US MFN specific tariffs within each agricultural hs6 commodity group (hs2 01-24), using bilateral UVs and ERGUVs

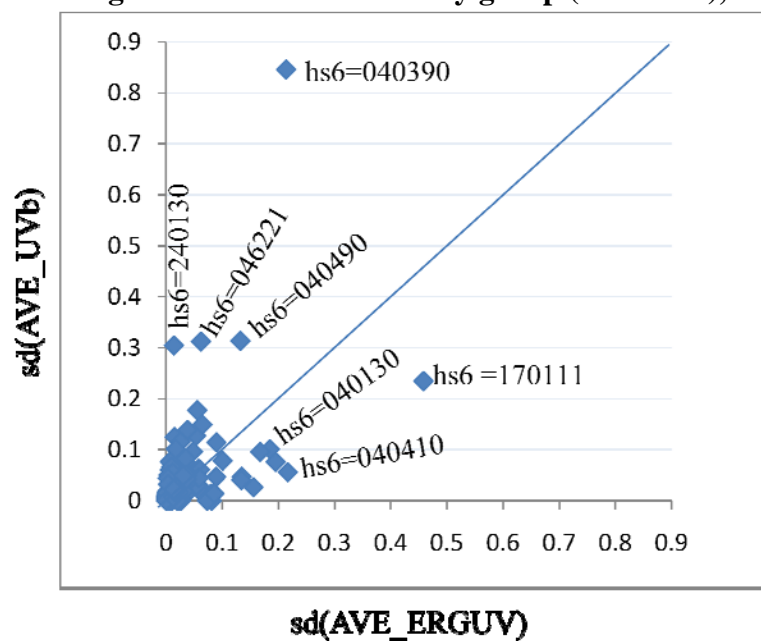


Figure 4: World Incidence of MFN and Preferential Advalorem Tariffs by Agricultural Commodities

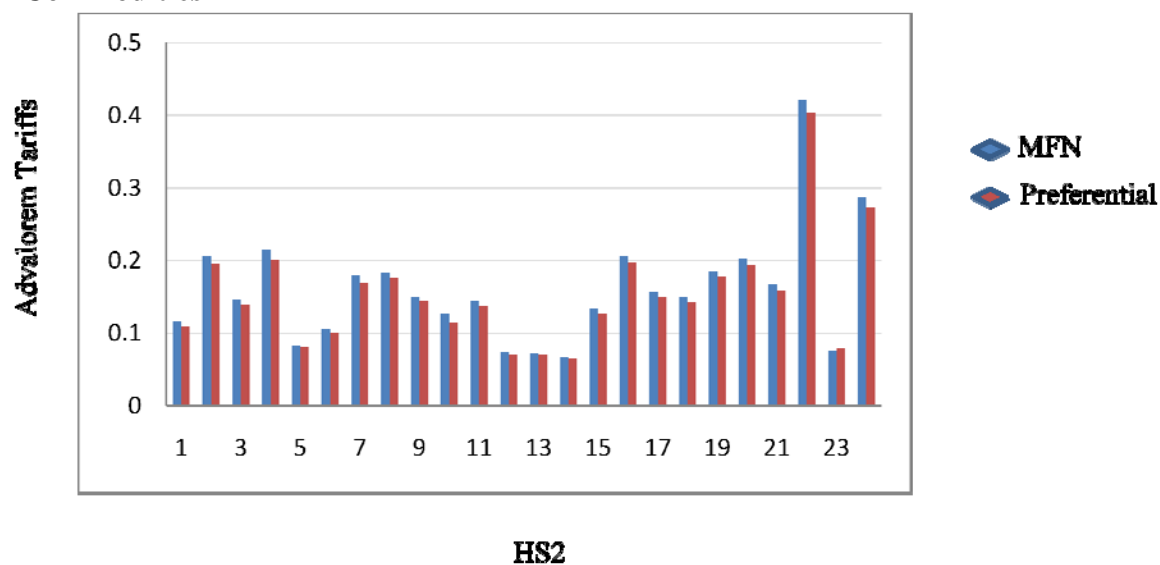
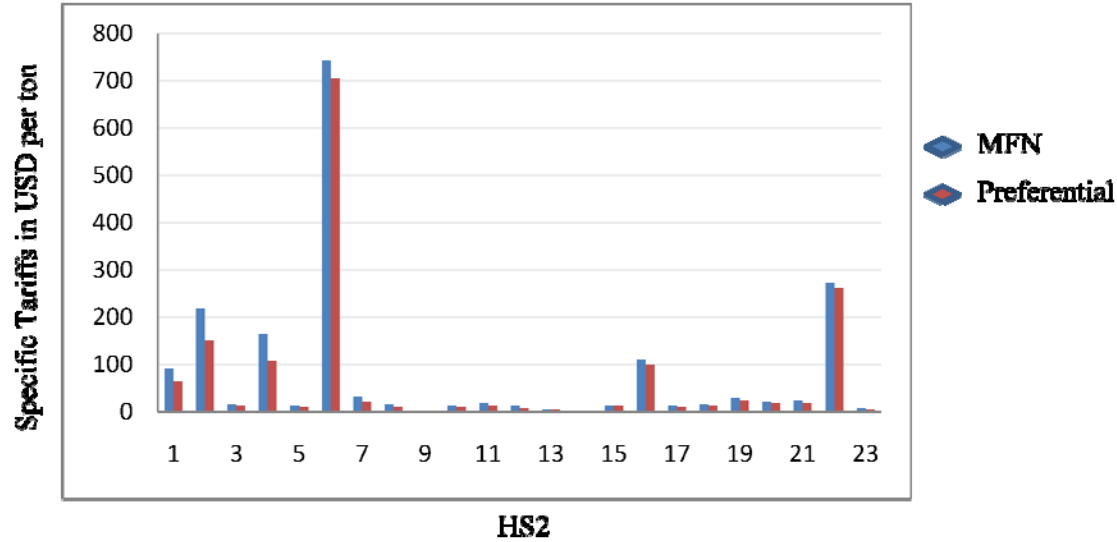


Figure 5: World Incidence of MFN and Preferential Specific Tariffs by Agricultural Commodities



Note: The specific tariffs in tobacco (hs2 =24) are equal to 7240 USD per ton. This is an unusually high value and has not been shown in the graph above because it would dwarf all the other values.

Figure 6: Distribution of MFN Specific tariffs in Agriculture across Importers

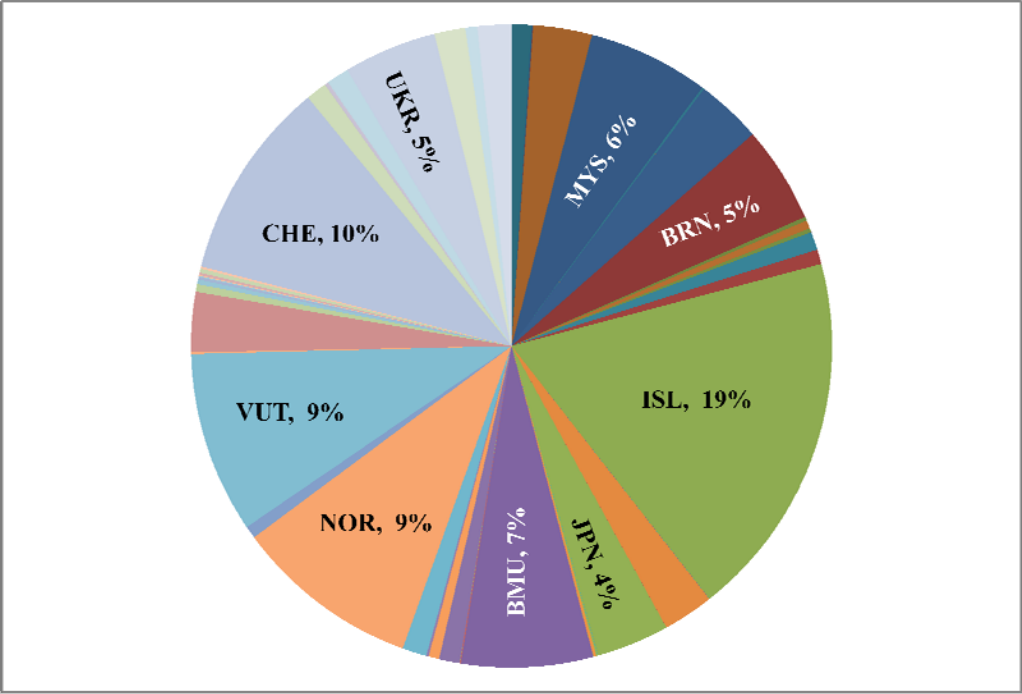


Figure 7: Preferential Specific tariffs vs MFN Specific tariffs in Agriculture by Importers

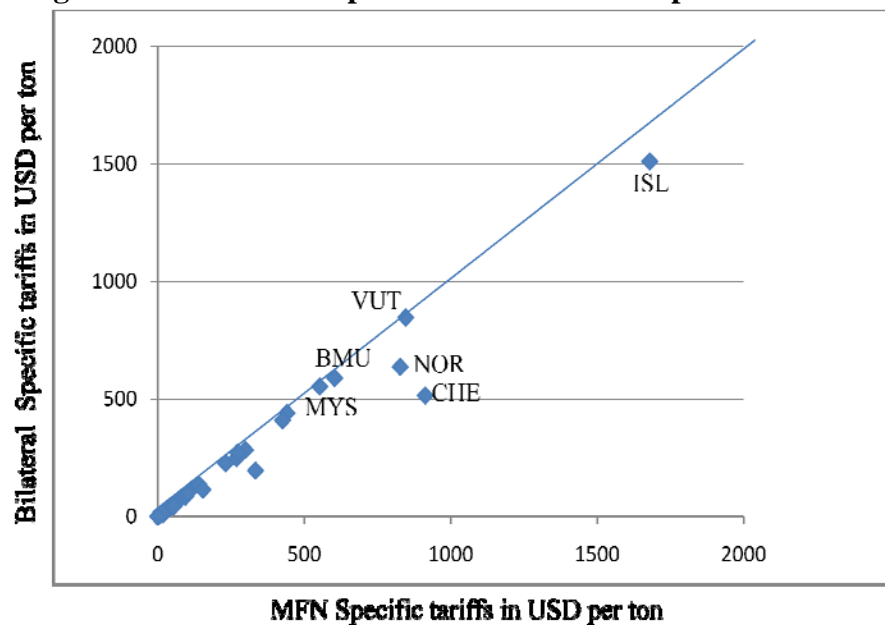
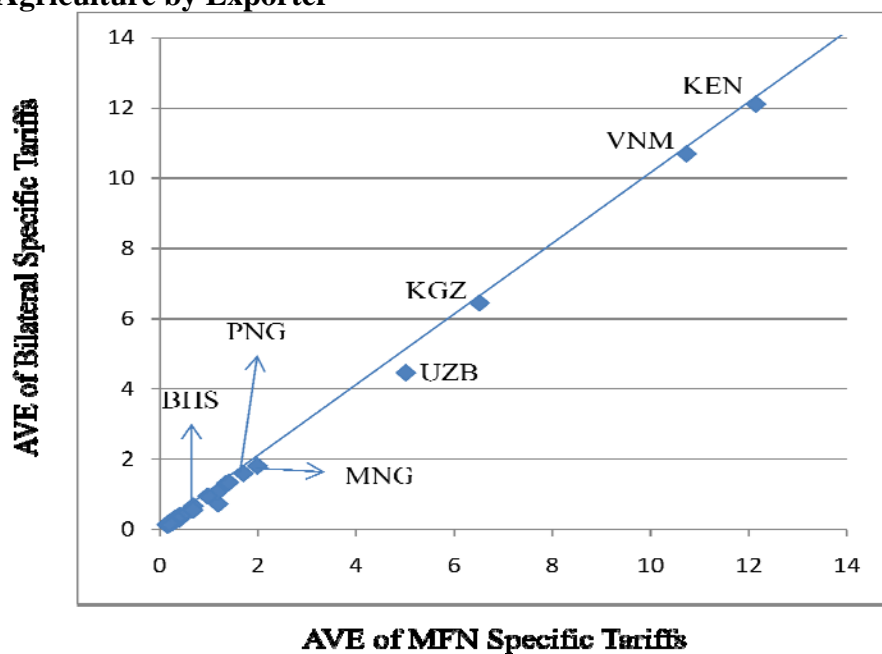


Figure 8: AVE of MFN Specific Tariffs vs AVE of Preferential Specific Tariffs in Agriculture by Exporter



Clearly, the LICs and developing countries are the ones facing the highest AVEs of specific tariffs

Table 1: Results from the fixed effects regression of ln(unit values) and ln(AVEs) separately, on ln(percapita GDP), pooling across all exporters of the US, with hs6-product fixed effects, for selected commodity groups.

Commodity group	Coefficient on percapita GDP	
	Dependent variable = ln(UVb)	Dependent variable = ln(AVE_UVb)
Hs2 ≤ 24 (agri)	0.15 (0.0108, 0.00)	-0.14 (0.0160774, 0.00)
Hs2 > 24 (non-agri)	0.31 (0.0061463, 0.00)	-0.33 (0.0198125, 0.00)
Hs2 > 60 (mnfcs)	0.348 (0.0080642, 0.00)	-.373 (.0218037, 0.00)
Hs2 = 04 (dairy)	0.062 (0.0595999, 0.30)	-0.092 (0.0544869, 0.092)
Hs2 = 14 (veg. plaiting)	0.24 (0.155545, 0.126)	Insufficient observations
Hs2 = 17 (sugar & confec.)	0.16 (0.057994, 0.006)	-0.159 (0.062975, 0.012)
Hs2 = 18 (cereals, flour)	0.164 (0.0366882, 0.00)	-0.116 (0.0512963, 0.024)
Hs2 = 21 (misc. edibles)	0.252 (0.0576489, 0.00)	-0.306 (0.794627, 0.00)
Hs2 = 22 (beverages)	0.133 (0.0464268, 0.004)	-0.125 (0.0471548, 0.008)
Hs2 = 24 (tobacco & subs.)	0.109 (0.0801113, 0.176)	-0.109 (0.0801113, 0.176)

N.B: The table shows that the relationship observed by Schott between bilateral unit values (UV_b) and exporter per capita GDP of manufactured goods, is also seen in agricultural goods, but to a weaker extent. The bolded entries show the commodity groups showing a statistically significant relationship. The numbers within the parenthesis are the standard errors and the p-values respectively.

Table 2: The DWL (in million US\$) accruing to the US and the export value losses (in million US\$) accruing to the LICs, the TRI (in%) and MAOTRI (in%) corresponding to the different tariff schedules under the different models

	tp		tm		tc	
	DWL _{US}	ΔX_{LIC}	DWL _{US}	ΔX_{LIC}	DWL _{US}	ΔX_{LIC}
Model 1	6101.21	4223.56	6217.56	4535.47	5894.53	4110.15
Model 2	6088.67	4235.02	6202.43	4446.45	5784.02	4127.02
Model 3	3160.43	3552.92	3275.64	3667.92	3008.07	3441.15
	TRI _{US}	MAOTRI _{LIC}	TRI _{US}	MAOTRI _{LIC}	TRI _{US}	MAOTRI _{LIC}
Model 1	5.56	12.70	5.68	12.82	5.43	12.67
Model 2	6.42	14.20	6.55	14.34	6.36	14.11
Model 3	3.32	11.36	3.39	11.41	3.22	11.31

N.B: All DWL, ΔX , TRI and MAOTRI values are computed with respect to the free trade scenario. The export value losses corresponding to the LICs are only with respect to exports to the US.

Model 1: Model with linear import demand and linear horizontal export supply

Model 2: Model with CES import demand and linear horizontal export supply

Model 3: Model with CES import demand and CES export supply

Table 3: Comparison of the estimates of the DWL (in million US\$) accruing to the US from various studies

Year of Study	1951	1960	1971	1987	1990	2004	2005	2009a	2009b
DWL_{US}	183	217	493	1900-3000	N.A	N.A	3700	6101	3160
DWL/GDP (%)	0.05	0.04	0.04	0.04-0.06	N.A	N.A	0.03	0.052	0.027
TRI (%)	N.A	12.5	N.A	N.A	6	5.3	N.A	5-6	3.32

1951: Stern (1964), partial equilibrium, tariffs only, no TOT effects

1960: Irwin (2007), partial equilibrium, tariffs only, no TOT effects

1971: Magee (1972), partial equilibrium, tariffs only, no TOT effects

1987: Rousslang and Tokarick (1995), general equilibrium, tariffs only, no TOT effects

1990: Anderson and Neary (2005), general equilibrium, tariffs only (No TOT effects)

2004: Kee, Nicita, Olarreaga (2005b), partial equilibrium, tariffs only, no TOT effects

2005: U.S International Trade Commission (2004), general equilibrium, dynamic, no TOT effects

2009a: Chowdhury (2009), partial equilibrium, tariffs only, no TOT effects

2009b: Chowdhury (2009), partial equilibrium, tariffs only, with TOT effects

Table 4: Decomposition of the DWLs (in million US\$) corresponding to the different tariff schedules from Model 3

	tp			tm			tc		
	AE Loss	TOT loss	Total DWL	AE loss	TOT loss	Total DWL	AE loss	TOT Loss	Total DWL
USA	3432.91	-272.48	3160.43	3607.27	-331.63	3275.64	3285.38	-277.31	3008.07
LIC	4550.22	272.48	4822.7	5321.55	331.63	5653.18	4492.68	277.31	4215.37

N.B:

For the US, DWL/GDP = 0.027%

For the LICs, DWL/GDP = 0.39%

Table 5: Summary Statistics of the Broda elasticities vs the Kee et al elasticities

Variable	Obs	Mean	Std. Dev
elas	3250	-12.2615	37.41835
sigma	4602	10.68214	27.66511
omega	1055	3.562428	13.95345

elas: Kee et al (2005a), US import demand elasticities ,estimated from a translog GDP share function

sigma: Broda et al (2006), elasticities of substitution between US imports

omega: Broda et al (2008), elasticities of export supply faced by the US

Table 6: Import Tariff rates tp (in %) by region

Exporter Importer	Commodity	JPNSEA	USACAN	EU27	LIC	ROW
JPNSEA	AGRI	11.248	26.468	23.543	17.932	27.903
	NAGRI	2.212	1.066	1.895	2.093	1.610
USACAN	AGRI	4.254	6.242	6.638	3.806	10.777
	NAGRI	1.696	0.000	1.255	1.991	0.699
EU27	AGRI	8.975	12.289	1.398	16.356	14.565
	NAGRI	2.199	0.997	0.004	1.288	0.234
LIC	AGRI	21.677	7.388	16.764	13.157	12.905
	NAGRI	7.093	3.619	6.698	6.292	6.802
ROW	AGRI	13.276	19.994	17.493	9.453	5.084
	NAGRI	5.363	2.342	3.872	5.127	2.224

Table 7: Import Tariff rates (%) tm and tc (in the shaded boxes) on agriculture by region

Exporter Importer	Commodity	JPNSEA	USACAN	EU27	LIC	ROW
JPNSEA	AGRI	23.06 26.19	26.98 26.19	23.677 26.19	30.160 26.19	27.08 26.19
USACAN	AGRI	5.020 8.34	6.630 8.34	7.870 8.34	11.16 8.34	11.05 8.34
EU27	AGRI	10.780 13.60	13.889 13.60	10.379 13.60	17.98 13.60	14.98 13.60
LIC	AGRI	21.89 23.51	21.78 23.51	20.37 23.51	31.54 23.51	22.00 23.51
ROW	AGRI	17.84 19.89	20.32 19.89	18.05 19.89	22.48 19.89	20.77 19.89

Table 8: Change in welfare (in million US\$), moving from tp to tm

	AE	TOT	Total Welfare
JPNSEA	-723.64	1661.62	937.98
USACAN	-5501.57	6900.81	1399.24
EU27	-9410.21	5122.61	-4287.6
LIC	-14347.62	-9121.47	-23469.09
ROW	-8100.35	-4271.04	-12371.39
Total	-38083.40	292.54	-37790.86

% of total welfare losses accruing to LIC = 62%

% of total welfare losses accruing to (LIC+ROW) = 94.8%

Table 9: Change in welfare (in million US\$), moving from tm to tc

	AE	TOT	Total Welfare
JPNSEA	1111.60	-1892.91	-781.31
USACAN	4400.19	-3163.06	1237.13
EU27	993.51	-2654.44	-1660.49
LIC	25768.83	8728.33	34550.33
ROW	11850.04	5777.87	17627.55
Total	55724.17	6795.78	50973.21

% of total welfare gains accruing to LIC = 67.8%

% of total welfare gains accruing to (LIC+ROW) = 102%

Table 10: Trade Balance (exports – imports) changes (in USD millions), by region.

Shocks Region	tp to tm (1)	tm to tc (2)	(1)+(2)
JPNSEA	-3689.78	2614.25	-1075.53
USACAN	9819.67	-1189.19	8630.48
EU27	-4232.11	-6628.47	-10860.58
LIC	-7904.14	22152.63	14248.49
ROW	-5463.30	14298.00	8834.70
Total	-11469.67	31247.22	19777.55

% of total trade surplus accruing to LIC = 72%

% of total trade surplus accruing to (LIC+ROW) = 116%

Table 11: Region-wise welfare changes (in USD millions) from the simultaneous elimination of PTAs and specific tariffs in agriculture, for different values of ESUBD (AGRI)

	ESUBD(AGRI)		
	2.13 (base case -10%)	2.37 (base case)	2.6 (base case +10%)
JPNSEA	-1881	-1856	-1872
USACAN	9892	9867	9986
EU27	-12473	-12521	-12585
LIC	11053	11081	11100
ROW	5238	5256	5273
Total	13160	13182	13230