The WTO Promotes Trade, Strongly But Unevenly

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Abstract

This paper furnishes robust evidence that the WTO has had a strong positive impact on trade, amounting to about 120 percent of additional world trade (or US$ 8 trillion in 2000 alone). The impact has, however, been uneven. This, in many ways, is consistent with theoretical models of the GATT/WTO. The theory suggests that the impact of a country's membership in the GATT/WTO depends on *what* the country does with its membership, with *whom* it negotiates, and *which products* the negotiation covers. Using a properly specified gravity model, we find evidence broadly consistent with these predictions. First, industrial countries that participated more actively than developing countries in reciprocal trade negotiations witnessed a large increase in trade. Second, bilateral trade was greater when both partners undertook liberalization than when only one partner did. Third, sectors that did not witness liberalization did not see an increase in trade.

Key words: GATT, WTO, gravity model

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I. INTRODUCTION AND MOTIVATION

The General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO), were set up to promote world trade. That trade increased courtesy of this institution may seem self-evident. However, in one of the first and very few careful empirical analyses of this question, Rose (2002 and 2004a), concludes that there is no evidence that the WTO has increased world trade.

We aim to reconcile the apparent inconsistency between the well-entrenched belief in the benefits of the WTO and Rose's conclusion. This reconciliation relies on examining several asymmetries in the GATT/WTO system and on utilizing a properly specified empirical framework.

While the existing economic theory of the GATT/WTO (a la Bagwell and Staiger, 2002 and 2005) does not explain why all of these asymmetries are present, it helps to predict the consequences of these asymmetries for bilateral trading patterns. This paper tests whether these asymmetries and the associated patterns of bilateral trade are there in the data. The GATT/WTO system, by design, focuses on mutually-agreed reductions of trade barriers (the reciprocity principle) and nondiscriminatory treatment between countries (the most-favored nation or MFN principle). According to the theory, these design features are geared to help governments escape from the Prisoner's dilemma stemming from the adverse terms-of-trade effects associated with unilateral tariff reductions. Furthermore, with trade negotiations occurring through time, these design features help to preserve the value of concessions that a government wins in a current negotiation against erosion in a future negotiation to which it may not be a party.

This theory has important implications for formulating and testing the impact of membership in the GATT/WTO. In particular, a country that actively negotiates reciprocal MFN tariff cuts with other countries is more likely to enjoy expanded bilateral trade than one that does not. By the same token, the reciprocity principle should be reflected in different trade values between members and non-members, and also within GATT/WTO members between those that actively negotiate tariff reductions and those that do not. Furthermore, the less a sector is covered by trade liberalization efforts, the less likely that GATT/WTO membership will have significant impacts in the sector.

Since developed member countries engaged actively in reciprocal liberalization under GATT, while developing members were largely exempted from these obligations, the theory predicts that the trade of the developed members, especially that among themselves, would increase significantly. In contrast, the trade of the developing members would change very little. This is the first asymmetry that we examine empirically.

As non-member countries do not participate in reciprocal liberalizations under GATT/WTO, and member countries do not have legal obligations to extend the benefits of tariff concessions to non-members, the theory predicts that the developed members would discriminate between imports

from other GATT/WTO members and imports from non-members. This is the second asymmetry that we examine empirically.

Given the first and the second asymmetries, the theory predicts that those products that are exported heavily by developing country members and non-members such as agriculture, textiles, and clothing, are unlikely to be covered seriously by the reciprocal liberalization among the developed members. In contrast, the theory predicts that those manufactured products that are largely produced and exported by developed countries are likely to be subjected to more dramatic liberalization. This is the third asymmetry that we examine empirically.

The conclusion of the Uruguay Round and the founding of the WTO have partially remedied the developing country exemption. In particular, developing countries that wanted to join the WTO after 1994 have been required to engage in serious trade liberalization. This sets them apart from the old developing members. This leads to the fourth and final asymmetry that we examine empirically.

In addition to these asymmetries, we also refine the existing literature methodologically by applying a theory-consistent specification of the gravity model. With these changes, we find robust evidence that the WTO/GATT has promoted world trade in an economically and statistically significant way. By our estimate, world imports are higher by about 120 percent or about US$8 trillion in 2000 alone (relative to the counterfactual of a world without the WTO). Thus, not only is Rose's (2004a) verdict on the ineffectiveness of the WTO overturned, but in a manner consistent with the design of the GATT/WTO system. In short, this paper questions Rose's conclusions but at the same time offers empirical evidence supportive of the underlying theory of the GATT/WTO. [1]

The rest of the paper is organized as follows. Section II discusses the four asymmetries in more detail. Section III explains what our econometric specification is, and how it differs from that of Rose. It also explains our data and their sources. Section IV reports the core empirical results and various extensions and robustness checks. Section V concludes.

I. FOUR ASYMMETRIES IN THE GATT/WTO SYSTEM

A. Developed Versus Developing Country Members

It is well-recognized that the WTO, and especially its predecessor the GATT, has been a two-tier organization, with far greater liberalization obligations undertaken by its developed than its developing country members. As Table 1 shows, developed countries, under successive rounds of

[1] Tomz et. al. (2004) also finds a positive impact of the GATT if colonies, newly independent states and other entities that de facto applied GATT rules are included.

trade negotiations, have successfully reduced their tariff barriers. These numbers suggest that industrial countries, under the aegis of the GATT, reduced their average tariffs from over 15 percent in 1947 to about 4.5 percent today.

This, combined with the fact that the rules have required that developed countries not impose nontariff barriers (especially quantitative restrictions), has meant that the WTO should have been a motor of overall trade liberalization by industrial countries. Of course, during the post-war era industrial countries did seek recourse to nontariff barriers, in violation of the spirit if not the letter of WTO rules. They included voluntary export restraints (in cars and steel), explicit quantitative restrictions (agriculture and clothing), and antidumping. Although many of these barriers were sectoral in nature, their imposition could have offset the effects of the tariff liberalization. Whether they did so is an empirical question that we allow the data to settle.

In contrast, and since the early days of the GATT, developing countries have had far fewer obligations to liberalize. This reluctance of developing countries to take on obligations to liberalize under the WTO was codified under the principle of special and differential treatment (S&D), which has defined the terms of developing country participation or rather virtual non-participation. In terms of developing countries' own liberalization, S&D consisted of two elements. First, developing countries have not, until the Uruguay Round, really participated in tariff liberalization in the various rounds. This is reflected in Table 2 which illustrates that until the Uruguay Round developing countries had "bound" less than a third of their tariff lines compared to nearly 85 percent for industrial countries.[2] That is, developing countries had no commitments as regards their tariffs for over two-thirds of their imports. And even on the 30 percent of the bound lines, the commitments to liberalize were weak because the bound rate was well above the applied (the pre-negotiation) rate, typically by over 10 to 15 percentage points. Second, the permissiveness of the GATT toward developing countries extended not just to tariff liberalization but also the basic rules on nontariff barriers, particularly their use of quantitative restrictions for balance of payments reasons that was sanctioned under Article XVIII:B of the GATT.[3]

Indeed, a number of the large developing countries invoked the right to use quantitative restrictions on their imports for the major part of the post-war period; in some instances this right extended to over five decades. In practice, the right to use quantitative restrictions generally coincided

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[2] When a country "binds" its tariffs in the GATT/WTO (or undertakes tariff "bindings"), it commits not to raise its tariffs above the level at which the tariff is "bound." Note that these numbers relate to the late 1980s; for much of the post-war period, the proportion of bindings was even smaller.

[3] For a discussion of the history and consequences of the article, see Eglin (1987) and WTO (2003).

with their actual use. This use of quantitative restrictions was a crucial aspect of special and differential treatment.[4]

This discussion implies that developed country members should be more open than developing country members: indeed, the theory predicts the asymmetric effect of membership given this asymmetric behavior of members regarding what they did with that membership. In addition, the theory of the GATT/WTO which emphasizes reciprocity also predicts that the developed countries should be more open to imports from other developed country members than to imports from developing country members.

B. Imports of Members from other Members Versus Imports from Non-members

To the extent that WTO members engage in reciprocal trade liberalization and that the MFN principle imposes an obligation to apply equal tariff treatment only to GATT/WTO member countries, the theory predicts a differential volume effect in imports by members from other members versus non-members. This would be a natural hypothesis to make and one that is consistent with the theoretical model.

On the other hand, it is possible that when a GATT/WTO member commits to reduce its trade barriers, it often does so across all trade partners by extending the benefits to non-members. Indeed, it appears to be the case that countries in their national tariff schedules have generally extended MFN to non-members, except on political grounds, the most notable example being the former communist countries that were not granted MFN status by the United States. The Jackson-Vanek amendment of 1993 provided for the extension of MFN even to communist countries provided they allowed emigration. If this is generally true, and if non-members do not liberalize unilaterally, then there should be no difference between the volume of imports by members from other members who do not liberalize (e.g. developing country members) and that from non-members. This would, of course, not be entirely consistent with the prediction of the Bagwell and Staiger (2005) model, although adding domestic political economy considerations to the model may explain it.

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[4] Selected examples of the use of trade restrictions for balance of payments reasons are presented in Table 3 of the longer, on-line version. In the context of a gravity model, uniform reduction in trade barriers need have no impact on trade volumes as shown in Anderson and van Wincoop. Disaggregating industrial and developing country membership allows non-uniform reductions by these groups of countries to be explicitly captured.

C. Liberalized versus Exempted Sectors

Over the many rounds of multilateral negotiation to reduce trade barriers, there has been asymmetry across sectors. Since developing country members were not as actively engaged in reciprocal liberalization as developed country members, the theory of GATT/WTO predicts that trade liberalization should occur on products of export interest to developed countries but should not occur on products that are primarily of export interest to developing country members and non-members. Indeed, while developed countries brought down progressively many of their trade barriers on products produced and exported by developed countries, they exempted a number of key sectors—agriculture, textiles and clothing, i.e., sectors of key export interest to developing countries—from their liberalization efforts. In fact, sixty years after the establishment of the GATT, tariffs remained high in these sectors. The rules on the prohibition of quantitative restrictions were themselves bent to allow their use in these sectors. The Multi-Fiber Arrangement, which was a vast system of bilateral quantitative restrictions imposed by developed countries on their imports from developing countries, was a violation of the basic rules of the GATT. The same was true of agriculture. Table 3 confirms that the food, clothing, and footwear sectors are indeed highly protected sectors, with average tariffs well above the average for the industrial sector as a whole, and with significant peak tariffs, particularly in agriculture.

D. New Versus Old Developing Country Members

With the conclusion of the Uruguay Round and the creation of the WTO, this permissiveness toward developing countries started to change. As the Uruguay Round progressed, it became clear that one of its objectives was to narrow the gap between developed and developing countries in terms of their respective obligations. This objective was particularly important in defining the terms of accession of new WTO members, namely those that joined after the Uruguay Round negotiations had commenced. In the long on-line version, a table (Table 5) illustrates this by comparing key post-WTO liberalization commitments of developing countries that were members before the WTO and of those that joined after the WTO. The former undertook fewer obligations to bind tariffs in the industrial sector (58 percent versus 94 percent for the post-WTO acceders), bound tariffs at much higher levels in the industrial sector (33 percent versus 17 percent) and in the agricultural sector (63 percent versus 28 percent). The Chinese accession in 2001, of course, was the most extreme example of the principle of greater liberalization being demanded of post-WTO members. The accession came at the end of a 13-year process in which the list of liberalization obligations imposed on China grew steadily. China was given a shorter phase-in period to complete the liberalization obligations than earlier developing country members. At the end of the phase-in period, China's trade regime will be more open than most of the existing developing country members of the WTO today. The Chinese case has its special

features, but the more demanding nature of liberalization obligations applied to other new WTO members as well (See Tang and Wei, 2006).

These four asymmetries are suggested by the theory and easy to understand. The question is whether they actually show up in the data on the patterns of trade. Furthermore, once these asymmetries are taken into account, would the data reveal that the WTO has promoted trade substantially and in the way it has been designed? The next section explains the methodology and the data that are used to examine these questions.

II. ECONOMETRIC SPECIFICATION AND DATA

A. Model and Estimation Issues

The theory of the GATT/WTO and the discussion in the last section have clear implications for bilateral trade impacts and thus naturally lead to the use of the gravity model of trade that has enjoyed empirical success in terms of its ability to explain a relatively large fraction of variations in the observed volume of trade. The gravity model can be justified by a variety of theories, including monopolistic competition (Helpman and Krugman, 1985) and a Heckscher-Ohlin model with specialization (Anderson, 1979; Deardorff, 1998; and Anderson and van Wincoop, 2003).

Empirically, it has been used to analyze the effects of regional trade blocs (see Frankel, 1997 and the references cited therein) and currency unions (Frankel and Rose, 2000; Glick and Rose, 2002; Rose, 2000; and Persson, 2001) among other subjects. In contrast to a majority of earlier studies (and to Rose, 2004a), we adopt the version of the gravity model suggested by Anderson and van Wincoop (2003) that includes country fixed effects in the regression. More precisely, our benchmark specification is of the following form:

$$\begin{aligned}\text{LogImport}(j,k,t) = Z(j,k)\,\gamma + \sum \alpha_{it}\, M_{it} + \sum \theta_{ht}\, X_{ht} + \beta_1 FTA(j,k,t) + \beta_2 GSP(j,k,t) + \\ \beta_3 WTO\text{-}DVED(j,k,t) + \beta_4 WTO\text{-}DING(j,k,t) + e_{j,k,t} \qquad (1)\end{aligned}$$

M_{it}'s are a list of time-varying importer dummies (that take the value of one if $i=j$, and zero otherwise). X_{ht}'s are a list of time-varying exporter dummies (that take the value of one if $h=k$, and zero otherwise). The M_{it}'s and X_{ht}'s are essentially dummies that serve to proxy for "multilateral resistance" in Anderson and van Wincoop (2003) (see below). These dummies were not included in most of the regressions in Rose (2004a).

$Z(j,k)$ is a list of variables, including greater circle distance between j and k, dummies for common language, colonial links, shared borders, and common currencies. Essentially, the list

includes all the covariates in Rose (2004a).[5] *FTA*(*j*,*k*,*t*) is a dummy variable that takes on a value of 1 if *j* and *k* belong to a common free trade area or common market in year *t*. *GSP* (*j*,*k*,*t*) is a dummy variable that takes on a value of 1 if the *importing* industrial country grants preferences under the generalized scheme of preferences (GSP) to exporting country *k* in year *t* and where *j* and *k* are not members of a free trade area or common market in year *t*.

WTO-DVED(*j*,*k*,*t*) is a dummy variable for *importer j* that is a developed country WTO member and where *j* and *k* are not in a common free trade area or customs union and where *j* does not grant GSP preferences to *k* in year *t*. *WTO-DING*(*j*,*k*,*t*) is a dummy variable for *importer j* that is a developing country WTO member and where j and k are not in a common free trade area or customs union and where *j* does not grant GSP preferences to *k* in year *t*. $e_{j,k,t}$ is a normally distributed random error term that has a zero mean and a constant variance. At a broad level, theory suggests that $\beta_3 > \beta_4$ given that developed country members did the liberalizing and developing country members did not. We test this below.

There are several important differences between our specification and that in Rose (2004a) that are worth making clear at the outset. First, we focus on imports by *j* from *k* as the regressand, whereas Rose focused on the average of *j*'s imports from *k* and *j*'s exports to *k*. All theories that underlie a gravity-like specification yield predictions on unidirectional trade rather than total trade. Hence, our specification is more closely aligned with the theory. Moreover, the trade effects of the WTO and the GSP really relate to imports (an important exception, stemming from Bagwell and Staiger (2002 and 2005), is noted below). When a country *j* grants GSP preferences to *k*, or when *j* liberalizes its imports under the WTO, there is reason to expect *j*'s imports from k to increase but there is no theoretical reason why *j*'s exports to *k* should also increase by the same proportion. Even if Abba Lerner symmetry were to hold—that is, removal of import barriers serves to raise exports as well as imports—it would only do so at the level of a country's aggregate rather than bilateral trade. For these reasons, Rose's (2004a) specification of using the sum of imports and exports as the left-hand-side variable would be unnecessarily restrictive. It is interesting to note that Rose (2004b), which is subsequent to and in fact cites the working paper version of this one, adopts a specification that has one directional imports rather than total trade as the left-hand side variable.

Second, a more important difference between this paper and Rose (2004a) relates to the country fixed effects. As Deardorff (1998), Anderson and van Wincoop (2003), and Wei (1996) emphasized, the standard gravity model might have been misspecified in ignoring a "multilateral

[5] Because we include time-varying importer and exporter fixed effects, other country-specific covariates such as GDP, GDP per capita, and land area are redundant.

resistance" or "remoteness" term. Anderson and van Wincoop (2003) suggest that empirically, the inclusion of country fixed effects captures "multilateral resistance" reasonably well and thus corrects this misspecification. We would stress here that the Anderson and van Wincoop (2003) model requires fixed effects for both importers and exporters: trade between any two countries depends on the multilateral resistance of both importers and exporters (see also Helpman, Melitz and Rubinstein (2004) for a different rationale for including both importer and exporter fixed effects). In Rose (2004a), the benchmark regression and indeed all specifications, save one, do not include country fixed effects. In their illustrative application, Anderson and van Wincoop (2003) use fixed effects in a pure cross-section context. Here, we take the idea of multilateral resistance to its logical conclusion in a panel context by using time-varying importer and exporter fixed effects.[6]

Third, our definition of the GSP and WTO dummies is different from that in Rose. We rely on the fact that FTAs, the GSP, and the WTO involve different degrees of liberalization, and hence define them mutually exclusively in order to be able to isolate the impact of each, purged of any "contamination" from the other.[7]-- Therefore, the WTO dummies in our analysis are coded to exclude country pairs belonging to the same FTA/customs union agreement or involved in GSP relationships. Similarly, the GSP dummy is coded to exclude country pairs belonging to an FTA or customs union.

To highlight the differences in our versus Rose's specifications of the dummies, consider the possible combinations of FTA and WTO membership. Any country pair ((j,k) has to fall into one of the following four categories:

1. Both are members of the WTO, but not members of a common FTA. We assume that there are n such pairs and that the "pure WTO effect" on trade is x; that is, trade would go up by x% if both are members of the WTO holding other factors constant.
2. Both are members of a common FTA, but at least one of them is not a member of the WTO. We assume that there are m such pairs, and that the pure FTA effect on trade is y.
3. Both are members of the WTO, and at the same time, members of a common FTA. We assume that there are p such pairs and that trade for such pairs would go up by z.
4. All other cases which represent the benchmark scenario.

Our paper and Rose (2004a) would classify cases 1, 2 and 4 above in exactly the same way. The only difference would be case 3, for which we would assign a value of 1 for the FTA dummy and

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[6] In Rose (2004b) which cites this paper, most of the specifications include country or country-pair fixed effects.

[7] We also report the results when these variables are defined as in Rose (2004a). It turns out that the GSP coefficients are affected much more than the WTO coefficients.

0 for the WTO dummy. Rose (2004a), on the other hand, would assign a value of 1 for both the FTA and WTO dummies. It is worth noting, at this stage, that the definition of the dummies in both our paper and Rose (2004a) are *exhaustive* in the sense that any country pair will be placed in one of the four categories. Our definition, however, is *mutually exclusive* in the sense that every country pair would fall into only one of the four categories, whereas under the definition in Rose (2004) some country pairs would fall in two categories.

The implications of these definitions are as follows. Under our approach, the estimated effect of WTO = x, which is the true WTO effect by assumption. Under Rose's (2004a) definition, the estimated effect of WTO on trade is a weighted average of x and (z-y) which is equal to [n/(n+p)] x + [p/(n+p)] (z-y). The term (z-y) reflects the assumption that in case 3, one needs to control for the effect of the FTA. Now, if one assumes that z = x+y, that is, the effects of an FTA and the WTO on trade are additive, the estimated effect of WTO on trade using Rose's definition = x, the same as ours. However, there is no reason to think that the effects of FTA and WTO are additive: indeed, between any two countries FTAs represent the culmination of trade integration, whereas the WTO represents some intermediate way station. In other words, if two countries are both members of the WTO and members of a common FTA, they would not be expected to trade more with each other than if they are simply members of a common FTA but not members of the WTO.

Therefore, generally speaking, we expect that $y \geq x$, and $z = y$. Then, the estimated effect of the WTO on trade using Rose's (2004a) definition would be [n/(n+p)] x , *which is less than x*, the true impact of the WTO. Thus, the larger the number of country pairs that fall under case 3, i.e., the larger is the value of p, the greater would be the downward bias in the Rose estimate of the WTO effect.

Finally, we discuss an extension to the specification in equation 1. The theory of the GATT/WTO á la Bagwell and Staiger (2005) makes predictions based not only on what a country does with its membership (which is the asymmetry expressed in equation 1) but also *who* it does it with. This suggests that the key dummies of interest should relate to pairs of countries and not just to the importing country. Accordingly, we also estimate a specification that allows for additional country-pair effects.

$$\begin{aligned}\text{LogImport}(j,k,t) = & Z(j,k)\,\gamma + \sum \alpha_{it}\, M_{it} + \sum \theta_{ht}\, X_{ht} + \beta_1 FTA\text{-WTO2}(j,k,t) + \beta_2 FTA\text{-WTO1}(j,k,t) + \\ & \beta_3 GSP\text{-WTO}(j,k,t) + \beta_4 GSP\text{-NWTO}(j,k,t) + \beta_5 WTODVED\text{-}WTODVED(j,k,t) + \\ & \beta_6 WTODVED\text{-}WTODING(j,k,t) + \beta_7 WTODVED\text{-N}WTO(j,k,t) + \beta_8 WTODING\text{-}WTO(j,k,t) + \\ & \beta_9 WTODING\text{-}NWTO(j,k,t) + \beta_{10} NWTO\text{-}NWTO(j,k,t) + e_{j,k,t} \qquad (2)\end{aligned}$$

The main difference with equation 1 is that the WTO, FTA, and GSP dummies are further decomposed according to importer-exporter relations. *WTODVED-WTODVED*(*j,k,t*) is a dummy variable taking the value of one if both *importer j* and *exporter k* are developed country WTO

members, and zero otherwise. *WTODVED-WTODING*(*j,k,t*) is a dummy variable for *importer j* that is a developed country WTO member and *exporter k* that is a developing country WTO member.

WTODVED-NWTO(*j,k,t*) is a dummy variable for *importer j* that is a developed country WTO member and *exporter k* that is not a WTO member. *WTODING-WTO*(*j,k,t*) is a dummy variable for *importer j* that is a developing country WTO member and *exporter k* that is also a WTO member.

WTODING-NWTO(*j,k,t*) is a dummy variable for *importer j* that is a developing country WTO member and *exporter k* that is also a WTO member. *NWTO-NWTO*(*j,k,t*) is a dummy variable for *importer j* that is not a WTO member and *exporter k* that is also not a WTO member.

Consistent with our discussion above, we also split the FTA and GSP dummies into two. *FTA*-WTO2*(j,k,t)* is a dummy where FTA members are also both WTO members while *FTA*-WTO1*(j,k,t)* is an FTA dummy where at least one is not a member of the WTO. Similarly, *GSP*-WTO*(j,k,t)* and *GSP*-NWTO*(j,k,t)* are both GSP dummies where the GSP recipient country is, respectively, a WTO member and non-member.

The theory of the GATT/WTO has a number of predictions about the coefficients in equation (2). Industrial countries actively took part in the reciprocal tariff reductions under the GATT and then the WTO, whereas most developing countries did not. This suggests that industrial countries' imports from other industrial countries that were GATT/WTO members should have seen a large increase in their trade. Industrial countries' imports from developing country members of the GATT should have seen smaller increases or no increases at all, and industrial countries' imports from non-members could have even witnessed a decline in trade. Thus, theory predicts that $\beta_5 > \beta_6 > \beta_7$, with $\beta_5 > 0$, β_6 possibly =0, and β_7 possibly being even negative.

It is worth noting that the magnitudes of the coefficients β_5, β_6, and β_7 also provide a natural test of the MFN principle and reciprocity. If members import more from other members than from non-members it could be because barriers are higher against non-members as the benefits of tariff cuts are not extended to non-members. But even if members and non-members are treated alike, average barriers can be higher on non-members because *products* of interest to the latter have not been the subject of reciprocal negotiations in the WTO. In many ways, this de facto exclusion or discrimination by way of this product composition effect has been acutely felt not just by non-members but also by developing country members of the WTO, who until the Uruguay Round saw very little liberalization on products (e.g., agriculture and textiles) of export interest to them. Thus if β_5 were substantially greater than β_6 it would suggest that reciprocity is at work but more through the product composition channel than the de jure channel of discrimination (which is disallowed against other members). On the other hand, if these two coefficients were also substantially greater than β_7, legal discrimination would also be at play.

Similarly, since many developing countries did not liberalize significantly under the successive GATT rounds or even in the WTO, one might expect β_8 =0 and by the same token, β_9 also

=0. If there was very little liberalization there might also be very little discrimination against non-members of the GATT/WTO.

The final prediction of the theory relates to the coefficient on trade between non-members (β_{10}). The GATT/WTO is in principle a discriminatory agreement relative to non-members, and hence can be expected to have impacts between on trade between members and between non-members. If the GATT/WTO does induce liberalization which is not extended to all countries, one prediction of the theory is that trade between non-members could increase because they become relatively more reliant on another. This is analogous to a situation of two countries that are each "remote" from the trading world geographically and hence trade more with each other as a result. Hence, according to the theory β_{10} could be positive. Extending this argument, it is also possible that as non-members get progressively excluded because of successive liberalization between members, they actually trade more with each other over time, so that β_{10} could also increase over time.

B. Data and Sources

The data that we use and their sources are explained in detail in Appendix 1 in the longer on-line version. Most of our data are from Rose (2004a) which are posted on his website. The main difference is our use of imports rather than total trade as the dependent variable which we obtain from the IMF's Direction of Trade Statistics. We deflate imports by the US consumer price index. Also we update all the Rose variables to the year 2000. Our panel data set consists of observations for every 5 years beginning in 1950 and ending in 2000.

The tariff and import data we use for the disaggregated estimations are obtained respectively from the TRAINS (Trade Analysis Information Systems) and COMTRADE databases of the United Nations. Descriptive statistics for the basic data, a list of countries in the aggregate and disaggregate estimations, a list of sectors used in the disaggregate estimations, a list of free trade areas and other detail about the data are described in the on-line version.

III. EMPIRICAL RESULTS

A. Basic Results

We now turn to the regression analysis. Tables 6 and 7 contain the core results for aggregate trade in panel and cross-section contexts, respectively. The basic Rose result about the ineffectiveness of the WTO in increasing trade is illustrated in column 1. Indeed, if membership in the WTO is undifferentiated, with all countries treated alike, our result is a more damning indictment of the WTO than even Rose. While he found that WTO membership had no effect on trade, we find that

membership has a significantly *negative* effect on trade: the average WTO member trades about 22 percent [exp(–0.252)–1] less than the average non-WTO members (Column 1 in Table 4).

But as we explained earlier, the evolution of the WTO and its precursor the GATT, most notably involving the special treatment of developing countries, makes it essential to treat this group differently from industrial countries. Once this is done as in column 2, we see that the average result of under-trading obscures a significant difference between the behavior of industrial country members of the WTO and its developing country members. The coefficient on the former is positive and highly significant. As will be seen, this is a result that is robust to a large number of changes in specification, estimation procedure, and sample.

On the other hand, the coefficient on the developing country WTO importer dummy is negative and significant.[8] This negative sign, as it turns out, is not robust; indeed, it is quite fragile. For example, when we exclude observations with values of trade less than $500,000, the negative coefficient turns positive although it is not significant (column 4 of Table 4). There are plausible reasons to believe that small-valued observations are subject to more sampling and measurement errors. In particular, idiosyncratic shifts in the behavior of a single importer or even a single shipment may dominate the variations in the reported import value.[9]

In columns 5-8 of Table 4, we report specifications (corresponding to equation 2) that use the information not just on who liberalized but also who this liberalization was done with. This also sheds light on features of the world trading system brought out by the results, including whether the key rationale of reciprocity underlying the GATT/WTO (Bagwell and Staiger, 2002) are supported by the data. Recall that subject to a few exceptions, members of the WTO are obliged to extend trade privileges granted to any country (member or non-member) to all other members of the WTO under the MFN principle.[10] But members are not obliged to extend the same privilege to non-members of the WTO. They can do so if they wish but there is no legal obligation to do so. If they did so (without a separate agreement with non-member countries), it would suggest that countries were undertaking unilateral rather than reciprocal trade barrier reductions.

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[8] It is worth noting that t-statistics for the industrial country WTO dummy is almost always above 10, signifying that the coefficient estimates have a high degree of precision.

[9] For these reasons, the remaining reported results will exclude observations with trade values less than $500,000, although we would emphasize that not doing so does not alter the basic conclusions.

[10] The exceptions include those for preferential trading agreements and for country-specific contingent protection such as anti-dumping and countervailing duty actions.

In column 5 of Table 4, each of the two WTO dummies (for importers that are developed and developing country members, respectively) is disaggregated further into two dummies, depending on whether the exporter is also a WTO member. For industrial country importers that are WTO members, imports from WTO members are greater than from non-members (with point estimates of 1.08 versus 0.91), and this difference is statistically significant.[11] It appears that non-members do not seem to benefit equally from the liberalization by member countries under the WTO. This difference, which highlights the benefits of WTO membership, could arise for three reasons. The first is explicit discrimination; that is, statutory barriers could be higher against imports from non-WTO members than from members. The second is a *de facto* discrimination via a product composition effect: though the statutory barriers are the same for all exporters, barriers are higher on *products* of greater interest to non-members because these products have not been the subject of the reciprocity negotiations in the WTO. The third relates to Lerner Symmetry: on average, WTO members (driven by industrial countries) tend to liberalize more than non-members, and so Lerner Symmetry implies that liberalization from member countries—even if it covers all products and is on an MFN basis—will generate more imports from WTO members (on average, liberalizers) than from non-members (non-liberalizers). And as a consequence, being out of the WTO can have three types of disadvantages.

Another way of testing whether unilateral or reciprocal liberalization dominates is to check trade between industrial countries and between industrial and developing countries, even those that are members of the GATT/WTO. The hypothesis is that since developing countries in the GATT did not engage in much tariff cutting, industrial countries did not in turn cut tariffs on products of interest to developing countries so that trade between industrial and developing countries was lower as a result (in terms of equation 2, the hypothesis is that β_5 should be greater than β_6). Column 6 of Table 4 sheds light on this question. The coefficient of the dummy relating to industrial country imports from other industrial country WTO members (β_5) is greater than that relating to imports from developing country WTO members (β_6) and this difference is statistically different.[12] In other words, industrial countries do trade more amongst themselves than with developing countries, *ceteris paribus.* The magnitudes of the coefficients suggest that industrial countries' imports from developing countries is about 40 percent less than imports from other industrial countries (holding other factors constant). Along the same lines, we find that $\beta_6 > \beta_7$, suggesting that industrial country imports from developing country members was greater than industrial country imports from non-members, which is

[11] The F-test (with a value of 10.1) rejects the null hypothesis of equal coefficients at the 5 % level.

[12] The F-test (with a value of 7.7) rejects the null hypothesis of equal coefficients at the 5 % level.

consistent with the fact that developing country members did a little more than non-members by way of liberalization.

But why is the coefficient on developed WTO members' imports from developing WTO members (β_6) still large (0.972) and significantly different from zero? Part of the answer is that the export composition of developing and developed WTO members do overlap. The MFN principle implies that when developed WTO members negotiate tariff concessions with other developed members, they are forced to extend them to developing country WTO members. Another explanation relates to the Lerner Symmetry point discussed above: developed country members trade more amongst themselves than developed country members trade with developing country members, which by Lerner Symmetry implies that they stimulated their exports in a way that developing country members (who did not cut their tariffs) did not.

In principle, developed WTO members can legally refrain from extending the benefits of lower tariffs to imports from non-WTO members. Indeed, this is predicted by the reciprocity rationale of the theory. Do the data support this prediction? Columns 5-8 of Table 4 show that the coefficient on imports of industrial countries from non-WTO members (β_7) is positive and significant rather than zero. This could arise from WTO members extending *some* (even a substantial portion) of their WTO-induced liberalization to non-members, even though the latter may not reciprocate. In our results, this public good benefit amounts to about 147 percent [exp(0.91)–1] additional exports for non-members to industrial country WTO members. This is substantial and suggests that it will be useful for theoretical models in the future to incorporate this feature. We also find that developing country imports from WTO members (β_8) is not significantly different from their imports from non-members (β_9) which is somewhat surprising, suggesting that they undertook similar levels of liberalization.

In columns 7 and 8, we disaggregate the WTO dummies further and add a dummy for developing country importers, WTO non-members that trade with other developing country WTO non-members (β_{10}). This coefficient has a negative sign and is significant (column 7), while column 8 shows that when this dummy is interacted with a time coefficient that coefficient is positive. In other words, non-members have on average traded less with each other than the average set of countries but this degree of under-trading is diminishing over time. This pattern is suggested by the theory of the GATT/WTO, under the interpretation that the process of GATT/WTO liberalization has deepened through time and not been fully extended to non-members, and so non-members have been put at a growing disadvantage in their attempts to sell into member country-markets and have as a result been induced through time to trade more with each other.

To see how the various effects evolve over time, the on-line version reports a sequence of cross-sectional estimations every five years from 1950 to 2000. The broad pattern is consistent with the results in the panel estimations of Table 4.

If these estimates are interpreted causally, we can quantify the contribution of the WTO to increasing global trade. The coefficient for the industrial country dummy in the panel regression reported in column 4 of Table 4 is 1.01. This implies that industrial countries' bilateral imports has on average been about 175 percent more [exp(0.52)–1] by virtue of their membership in the WTO. Taken literally, our results would imply that in 2000 alone, aggregate imports of industrial countries would have been higher by about $8 trillion than a world without the WTO, representing an increase in the world trade by about 120 percent.

This estimate is probably overstated because it does not take into account a substitution effect: if one country joined the WTO its aggregate trade would increase as we have estimated it; but if all countries joined the WTO there would be some displacement of imports from non-WTO members by those from WTO members. Having said that, we note that there are also reasons that our estimates may have understated the true impact of the WTO membership in raising world trade if there is positive feedback from higher trade to higher economic growth (see Frankel and Romer, 1999), which in turn spurs even more trade (the gravity equation examines trade for a given level of income). Of course, if the WTO had not accorded the freedom to developing countries to maintain trade barriers, and had required trade liberalization of them, the positive impact on global trade could have been greater still.

Another reason for a possible downward bias is that some of the trade promoting effect of the GATT/WTO could be absorbed by the time-varying importer and exporter fixed effects. This could happen if successful GATT/WTO rounds make a member country more open to imports from all trading partners, in a proportionate way, including its imports from non-members or FTA partners. For example, there may be policy spillover in trade liberalization: Once a member country cuts tariff on imports from other members, it finds it convenient to also cut tariff on imports from non-members. Alternatively, if non-members imports from other non-members go up after each successful GATT round, then the coefficient on members' imports from other members may underestimate the true trade-promoting effect of the GATT/WTO. To investigate this possibility, it is also useful to introduce non-time-varying fixed effects and compare the resulting estimates with those in Table 4. We estimated such regressions and found that the qualitative results remain unchanged. The point estimate of the GATT/WTO effect (for industrial country members' imports from other members) with non-time-varying fixed effect is in fact somewhat smaller than that with time-varying fixed effects (0.619 with time-invariant fixed effects versus 1.082 with time-varying fixed effects). Similarly, the coefficient on the industrial country members relative to that of the developing country members is also smaller in the specification with non-time-varying fixed effects than in the one with

time-varying fixed effects[13]. This suggests that the specification with time-varying importer/exporter dummies does not underestimate the GATT/WTO effect.

Table 5 reports a sequence of robustness checks, including the use of Rose's definitions of GSP and WTO dummies, the addition of country-pair random effects with and without importer and exporter fixed effects, and the exclusion of outliers.[14] As anticipated in the previous section, the WTO effect becomes smaller with the Rose definitions of FTA and WTO. However, as long as we retain the rest of our specification, even his definitions produce a positive and statistically significant effect of WTO on trade volume.

Based on the recent work of Helpman, Melitz and Rubinstein (2004), the last robustness check reported in Table 5 is to correct for a possible data selection bias arising from excluding zero-trade observations and to account for a possible omitted variable arising from firm-level heterogeneity in productivity. In this case, the value of the WTO coefficient for industrial countries is significant, and surprisingly, much greater than the value in the core specification. Aside from that, our core result—particularly the positive impact of the WTO on industrial countries' imports—remains broadly unchanged.

The only case in Table 5 where the industrial country coefficient declines significantly is in the specification with country-pair fixed effects estimations, where the coefficient value declines to 0.27, while remaining statistically significant. Conceptually, the specification that includes the country-pair fixed effects asks a "within" question: what does joining the WTO do to the import pattern over time for a given country-pair? The specifications that exclude country-pair fixed effects but otherwise include importer and exporter fixed effects ask a different, "between" question: do WTO members exhibit a different trade pattern from non-members?[15] Our paper has been focusing mostly on the "between" question and demonstrates that industrial country WTO members are

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[13] The results can be found in Subramanian and Wei (2003, NBER working paper 10024, Table 5).

[14] Specifically, we discard values of the dependent variable that are three and two standard deviations away from the mean, respectively.

[15] The underlying data set is a three-dimensional panel (importer, exporter, and year). The phrases "within" and "between" are usually used in the context of a two-dimensional (cross section and time series) panel. One could reduce the three-dimensional panel into two dimensions by treating importer-exporter pairs as the cross section. In this case, panel regressions that do not include country-pair fixed effects (even with importer and exporter fixed effects) correspond to "between" estimations. Those that include country-pair fixed effects correspond to "within" estimations.

significantly more open than non-members. On the "within" question, the effect is smaller numerically but still positive and non-trivial in economic term. The developing country dummy is generally positive and significant but the magnitudes are typically very small.

B. Asymmetry between Sectors

We now turn our attention to the asymmetry in the trade liberalization across sectors. The proposition that we wish to test is whether WTO membership has a differential impact on the import volumes of the industrial countries between protected and unprotected sectors. If WTO membership is a proxy for trade liberalization, then it should have had a greater impact on trade volumes where barriers came down compared with sectors where barriers have remained high. We would reiterate here that testing for asymmetry between sectors is also a test of the underlying theory of the GATT/WTO because the protected sectors in developed countries are those in which developing countries have a more substantial export presence. And because developing countries did not engage in tariff negotiations in these sectors, developed countries had less incentive to liberalize. For example, in 1990, developing countries accounted for 47 percent and 52 percent, respectively of industrial country imports in the clothing and footwear sectors; in contrast, they accounted for about 5 percent of industrial country imports in sectors that were relatively more liberalized.

To explore this issue, we go to a recently available data set on disaggregated bilateral trade (at the Harmonized System (HS) 4-digit level) that was not used by Rose or anyone else on this subject. We adopt a two-step strategy. In the first step, we identify sectors that are commonly considered to be highly protected by developed countries and sectors that are supposed to have been liberalized. In the second step, we fit a variation of the augmented gravity model to the data. The objective is to see whether actual patterns of trade reflect the reported difference in trade barriers.[16]

We begin by describing how we select disaggregated tariff categories into the highly protected and liberalized sectors. First, we sort United States (ad valorem) *MFN* tariff rates at the HS 4-digit level (on imports from other developed WTO members) in 1990 and 2001 in descending order. We do the same for the European Union's tariff rates.

Second, we identify the set of 4-digit sectors in which both the United States and the EU have had very little liberalization (defined as, agriculture, textiles and clothing, footwear, and other sectors with less than 2 percentage point tariff reduction from 1989 to 2000, and tariff rates in excess of five percent in both 1989 and 2000). Note that these sectors may have additional specific tariffs. We call this the protected manufacturing sector. A complete list of these products is presented in Appendix Table 3. For each country pair and year, we then sum up the 4-digit imports within each of these

[16] For details of the data used in this part of the analysis see the on-line version.

categories. Note that the data base does not have information on non-tariff barriers at this level of disaggregation. Therefore, while we are confident that the sectors that we have chosen are highly protected and have not been liberalized during the sample by developed countries, we cannot be sure if we have left out some other highly protected sectors (due to nontariff barriers).

Finally, we also collect the set of 4-digit sectors in which both the United States and the EU have reduced tariffs significantly (defined as sectors that started with tariffs greater than 5 percent in 1989 and ended with zero tariffs in 2000). We take out agricultural products and raw materials from this list on the ground that there may be various non-tariff barriers that the information in the data base does not capture. We label the remaining set of zero-tariff 4-digit sectors as liberalized manufacturing sectors.

We specify a system of five equations, one for each of the following sectors: (i) liberalized manufacturing; (ii) clothing; (iii) footwear; (iv) agriculture; and (v) other highly protected manufacturing.

$$\text{LogImport}(j,k,S,t) = Z(j,t)\,\gamma_1 + \sum \alpha_i\, M_{it} + \sum \theta_h\, X_{ht} + \beta_{1l} FTA(j,k,t) + \beta_{2l} GSP(j,k,t) + \beta_{3l}\, WTO\text{-}DVED(j,k,t) + \beta_{4l} WTO\text{-}DING(j,k,t) + e_{j,k,l,t} \quad (3)$$

where S is an index representing the 5 sectors for which this equation is estimated. The regressors are common for all the equations. The equations have the standard gravity formulations and are identical to that described in Section II. Since the error terms in the five equation are potentially correlated, we estimate them jointly using the Seemingly Unrelated Regression (SUR) technique. Each equation has time-varying importer and exporter fixed effects and year effects. To allow for maximum flexibility, we do not restrict the parameters on similar regressors in different equations to be the same. The hypothesis that we test is a simple one, and is consistent with the theory: sectors with the highest protection would have seen least reciprocal tariff reductions under the WTO. Hence, WTO membership should have less impact in these sectors than in sectors with greater liberalization.

The United Nations WITS trade database has disaggregated data beginning in 1989. Consistent with our aggregate estimations reported earlier, we use data for 1990, 1995, and 2000 and discard observations with import values less than US$500,000.

Table 6 presents the results for these estimations. The results for the sector with greater liberalization (column 1) are consistent with the prediction: for example, the industrial country WTO dummy is positive and highly significant. The developing country WTO dummy is also positive and significant. In other words, where industrial country liberalization has been greatest, there has been a modicum of response by developing countries in terms of their own liberalization.

For three of the four protected sectors—clothing, footwear and food—the coefficients of the industrial country dummy are either negative or insignificantly different from zero. By extension,

they are all significantly smaller than the coefficient in the liberalized sector. In the protected manufacturing sector (which excludes clothing, footwear and food), the industrial country WTO dummy is positive and significant. But here too the coefficient is significantly lower than that in the liberalized sector. This provides confirmation that the WTO has not had any significant impact on trade in clothing, footwear and food. [17] In agriculture, for example, the coefficient on the industrial country WTO dummy is -1.4. It appears that the exemption of agriculture from WTO disciplines has provided the freedom to industrial countries to throttle trade by introducing very high levels of protection. The permissiveness toward agriculture has proved very costly indeed because the coefficient estimates suggest that the typical industrial country imports of agricultural products is about 75 percent [exp(–1.4)–1] less than that of the average importer in our sample.

C. New versus Old Developing Country Members

The next question we address is whether there has been any change in the trading patterns of GATT/WTO members in the recent past. There is a priori reason to expect changes since the Uruguay Round is widely perceived to mark a watershed in the status of developing countries in the GATT/WTO system. Specifically, special and differential treatment came under attack in the Uruguay Round. A concerted effort was supposedly made to ensure that developing countries were integrated into the trading system, most notably by requiring them to take on more obligations to liberalize their trade regimes. In this regard, more progress has been made on the front of new entrants to the WTO. A non-member country that aspires to become a member has to make concessions and obtain approval from every existing member country. As a result, it is easier to demand that these new entrants reduce trade barriers to a greater extent than to do the same to the existing members. And as Table 5 illustrates, post-Uruguay Round accessions have indeed been qualitatively different in the sense of extracting more trade liberalizing concessions from prospective entrants. But does the trade volume data support the proposition that the Uruguay Round really marked a watershed for developing countries?

Table 7 attempts to shed light on this question. For the purposes of this table, developing country members are disaggregated into those that were members prior to the Uruguay Round ("old members") and those that joined after it ("new members"). Given that the Uruguay Round negotiations lasted eight years, the question arises as to what is the appropriate cut-off date that distinguishes a possible regime change in the way the WTO treated its old and new members.

One possibility would be to make 1995—the date of the formal creation of the WTO—as the cut-off point. But this would be too legalistic; indeed the creation of the WTO with its notion of a

[17] The developing country WTO dummy is also insignificant in three of the four protected sectors.

single undertaking—whereby all countries adhered to all the Uruguay Round agreements—was the *culmination* of the process of integrating developing countries into the trading system. In the absence of a strong justification for any one particular date, we allow the data to tell us whether and when there was a regime shift. Therefore, in our regressions, we successively define new members as those that joined after 1990, 1991, 1992, 1993, 1994, and 1995. We then test the hypothesis that WTO membership had a different impact on trade for these new members compared with the old ones.

These results are reported in Table 7. Regressions for the year 2000 are reported in columns 1–6 while those for 1995 are in columns 7–11. Three features stand out. First, the regressions for 2000 indicate that the coefficient on the new WTO member dummy is positive and significant for all definitions of new members except when 1995 is used as the cut-off date for defining new members. The average coefficient value is about 0.28, representing extra trade of about 30 percent for new members. Second, in the regressions for 2000, the coefficients on the dummies for new members are greater than those of the corresponding old members in every single regression. This is suggestive of a regime change associated with the Uruguay Round.

But how is one to reconcile regime change with the fact that the coefficient on new members becomes smaller in size and statistically insignificant when 1995 is used as the cut-off date? A plausible explanation is that the lag between the start of WTO membership and detectable liberalization efforts is longer than 5 years. Indeed, developing countries are often given very long periods, sometimes up to 15 years, to phase in their liberalization. Columns 7–11 shed some light on this issue by reporting regressions for bilateral imports in 1995, when little time has elapsed for the new WTO members. The coefficients on new members that were significant in the 2000 trade equation become small and insignificant. These results are consistent with the practice of having the liberalization obligations phased in over a period of time. Countries that joined in the early 1990s experienced no significant increase in openness in 1995 but by 2000 they appear to have done so that was worth about an extra 30 percent of trade.

We would note, however, that the coefficient on old developing country members is still not positive and significant. This suggests that their obligations to liberalize even after the Uruguay Round have not become stringent enough to actually lead them to be more open than non-WTO members. Evidently, eliminating special and differential treatment (S&D) still has a long way to go, and the creation of the WTO per se did not force radical changes on old developing country members.

These are important findings because they sit at odds with the popular view that developing countries were actually integrated into the trading system in the aftermath of the Uruguay Round. In trade terms this did not happen for the old members of the WTO. Although developing countries' *bound* tariffs may have come down in the Uruguay Round, actual tariffs barely budged.
Table 8 shows that, although the percentage of tariff lines for which bindings (commitments) were taken on by developing countries increased by 50 percentage points due to the Uruguay Round, the

actual tariff reductions brought about by the Round were much smaller: only 28 percent of tariff lines involved reductions in applied tariffs, and on these, the reduction was 8 percent. In other words, if tariff reductions are calculated on all tariff lines, the reduction would be about 2 percent. This lack of reductions in applied tariffs appears to be reflected in our result that old WTO members continued to be no more open than non-members even after the Uruguay Round. The irony relating to S&D in the Uruguay Round was that it was eliminated in areas—such as TRIPs—where maintaining it may actually have been welfare-enhancing. But S&D was preserved in the conventional area of trade liberalization in goods where its dilution would have been welfare-enhancing.[18]

IV. SUMMARY AND CONCLUDING REMARKS

Rose (2004a) has seriously called into question the effectiveness and hence the usefulness of the GATT/WTO as a multilateral institution. His analysis implies that the GATT/WTO, whose raison d'être is to promote trade, has failed to do so. Our paper shows, however, that the GATT/WTO has done a splendid job of promoting trade. The GATT/WTO has served to increase world imports substantially, possibly by about 120 percent of world trade (about US$8 trillion in 2000 alone). But this trade promoting role of the GATT/WTO has been uneven. This unevenness is related to four asymmetries in the system. The recent economic theory of the GATT/WTO helps to predict patterns of bilateral trade as a consequence of these asymmetries. Our empirical investigation has found evidence consistent with these asymmetries.

It is useful to note that the empirical results do not imply that developing countries have not benefited from WTO membership. A distinction needs to be made between developing country WTO members as exporters and importers. Our results suggest that there has been little impact of WTO membership on developing countries' imports. But the positive impact of WTO membership on industrial country imports meant that developing countries exports also increased significantly. Developing country exports to industrial countries, on our estimates, were at least one and a half times greater because of the GATT/WTO. In other words, despite not liberalizing themselves sufficiently, they enjoyed at least some of the benefits of industrial country liberalization, notwithstanding the exclusion of agriculture, clothing, and a few other sectors from GATT liberalization. While clearly beneficial for them, these unreciprocated benefits pose a challenge to the theory of the GATT/WTO, which merits further research.

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[18] Note that even "old" developing country members had to submit Article II schedules that bind their tariffs, some for the first time. However, since the bound rates tend to be so much higher than the applied rates, these members continued to "enjoy" S&D.

Appendix. Data Description and Sources

Aggregate estimations

Estimating the model requires data on bilateral trade, incomes, population, distance, as well as geographical, cultural, and historical information. The panel data set covers 172 countries during the five-year periods from 1950 to 2000. A list of countries in the on-line version. Our data set is a modified and updated version of Rose's (2002a) data set. We use bilateral imports rather than trade as the regressand which we obtain from the IMF's *Direction of Trade Statistics*. Bilateral imports are those reported by the importing country and measured in U.S. dollars and deflated by US CPI (1982–1983 prices) for urban areas (available from freelunch.com). Real GDP, per capita GDP and population data for 2000 come from the World Bank's *World Development Indicators* (WDI). WTO and FTA dummies for 2000 are extended based on the information available from the WTO official web site (wto.org).

Disaggregated estimations

The TRAINS (Trade Analysis Information System) of the UNCTAD contains information on tariff and nontariff barriers at the commodity level. We utilize the US and EU MFN tariff schedules for 1989 and 2001, reported in 8-digit HS 1988/1992 and HS 1996 classifications, respectively. Our objective is to determine the list of industries subject to high and zero protection both in the US and EU for 1989 and 2001 respectively. We use ad valorem rates for these purposes. For each product at 4-digit level we calculate a simple average of ad valorem rates applied to all 8-digit subsections within that sector. We treat a given industry as protected if its average tariff rate both in the US and the EU exceeded 10 percent. Similarly, a given 4-digit industry is considered unprotected if all the 8-digit subsections have zero tariffs (both ad valorem and non-ad valorem).

There are thirty three and forty one 4-digit industries that qualify as protected and unprotected, respectively. For each protected and unprotected industry, we obtain bilateral import data in 1990, 1995, and 2000 which cover 147 countries. The import data which come from the United Nations' COMTRADE database are disaggregated at the HS 1988/1992, 4-digit level and are deflated by US urban CPI (1982–1984 prices). We define four broad product categories—food, clothing, footwear, and miscellaneous manufacturing and, then, sort protected and unprotected industries by categories (A list of industries is in Appendix Table 3 of the on-line version). All unprotected industries fall into the miscellaneous manufacturing category. For a given year and country pair we obtain the value of imports in each broad category by summing bilateral imports of all products within that category. Thus, for protected industries our data contain bilateral imports in food, clothing, footwear, and manufacturing. All industries with zero tariff rates are aggregated into unprotected manufacturing. The remaining variables are the same as those used in the aggregate estimations.

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Table 1: MFN Tariff Cuts by Industrial Countries 1/

Implementation Period	Round	Weighted Tariff Reduction	Implied Tariff Level at period beginning 2/
1948–63	First five GATT rounds (1947–62) a/	36 percent	15.4
1968–72	Kennedy Round (1964–67) b/	37 percent	11.3
1980–87	Tokyo Round (1973–79) c/	33 percent	8.3
1995–99	Uruguay Round d/	38 percent	6.2

Source: WTO website: www.wto.org/english/thewto_e/minist_e/min99_e/english/about_e/22fact_e.htm

1/ Industrial products excluding petroleum.
2/ Derived from column 3 and applied to the 2001 tariff level (4.5%) reported in Finger, Ingco, and Reincke (1996).
a/ US only; b/ US, Japan, EC(6), and UK; c/ US, EU(9), Japan, Austria, Finland, Norway, Sweden and Switzerland;
d/ US, EU(12), Japan, Austria, Finland, Norway, Sweden, and Switzerland.

Table 2: Percentage of Tariffs "Bound" in the GATT Prior to Uruguay Round 1/

	Industrial Countries 2/	Developing Countries 3/
Industrial Products	84.7	31.8
All Merchandise Trade	80.2	30.1

Source: Table G.2 in Finger, Ingco, and Reincke (1996).

1/ The term "bound" refers to the commitment by countries in the WTO not to raise tariffs beyond a certain level. The fewer the "bound" tariffs, the less the commitment to liberalize trade barriers. The percentages are weighted averages over all product groups and by each country's MFN imports.
2/ Includes Australia, Austria, Canada, Switzerland, European Union, Finland, Hong Kong, Japan, Norway, New Zealand, Singapore, Sweden, and the U.S.
3/ Includes 21 countries for which data are available in the WTO's Integrated Data Base (see Table 1 in Finger, Ingco, and Reincke, 1996).

Table 3. Tariffs in Highly Protected Sectors in the USA and European Union, 1989 and 2001

	1989				*2001*			
	EU		*US*		*EU*		*US*	
Sector	Max.	Average	Max.	Average	Max.	Average	Max.	Average
Clothing	23	16	36	17	13	12	33	13
Food	180	25	25	14	75	17	350	28
Footwear	20	13	48	25	17	17	48	22
Misc. manufactures	28	12	38	14	22	13	38	14

Sources: United Nations, WITS Trade Database.
The average and maximum tariffs are unweighted averages of HS-8 digit tariff lines that make up the corresponding HS 4-digit categories listed in Appendix Table 3 and grouped under the 4 categories in this table.

Table 4. Core Regression. Panel, 1950 -2000

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
a	Log distance	-1.259**	-1.247**	-0.969**	-0.965**	-0.961**	-0.955**	-0.956**	-0.956**
		(0.020)	(0.019)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
b	Common language	0.302**	0.283**	0.153**	0.143**	0.140**	0.141**	0.143**	0.142**
		(0.037)	(0.036)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
c	Common border	0.103	0.131	0.015	0.024	0.021	0.019	0.02	0.019
		(0.085)	(0.081)	(0.066)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
d	Common colony	0.635**	0.609**	0.589**	0.576**	0.577**	0.567**	0.567**	0.567**
		(0.057)	(0.056)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
e	Current colony	0.608**	0.628**	0.749**	0.757**	0.771**	0.777**	0.774**	0.762**
		(0.185)	(0.187)	(0.145)	(0.145)	(0.144)	(0.144)	(0.143)	(0.143)
f	Ever colony	1.351**	1.331**	1.172**	1.164**	1.167**	1.168**	1.166**	1.168**
		(0.086)	(0.084)	(0.066)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
g	Common country	0.236	0.153	-0.49	-0.519	-0.55	-0.539	-0.535	-0.522
		(0.677)	(0.677)	(0.543)	(0.544)	(0.546)	(0.545)	(0.544)	(0.544)
h	Common currency	0.878**	0.880**	0.605**	0.614**	0.637**	0.637**	0.633**	0.636**
		(0.106)	(0.105)	(0.082)	(0.082)	(0.082)	(0.081)	(0.081)	(0.082)
i	Free trade area	0.661**	1.650**	0.672**	1.165**				
		(0.097)	(0.105)	(0.060)	(0.073)				
j	FTA and both in WTO					1.212**	1.204**	1.208**	1.210**
						(0.078)	(0.078)	(0.078)	(0.078)
k	FTA and at least one not in WTO					1.065**	1.067**	0.945**	0.975**
						(0.107)	(0.107)	(0.113)	(0.113)
l	Industrial country importer granting GSP	0.234**	2.149**	-0.055	0.806**				
		(0.075)	(0.146)	(0.059)	(0.096)				
m	Industrial country importer granting GSP and partner WTO member					0.841**	0.815**	0.823**	0.828**
						(0.100)	(0.101)	(0.101)	(0.101)
n	Industrial country importer granting GSP and partner not WTO member					0.831**	0.820**	0.619**	0.675**
						(0.115)	(0.115)	(0.132)	(0.134)
o	Importer WTO member	-0.252**		0.056					
		(0.044)		(0.036)					
p	Industrial country importer WTO member (ß3)		1.865**		1.010**				
			(0.144)		(0.092)				
q	Developing country importer WTO member (ß4)		-0.313**		0.017				
			(0.043)		(0.036)				
r	Industrial country importer and partner WTO member					1.082**			
						(0.096)			
s	Industrial country importer WTO member, but not partner (ß7)					0.905**	0.872**	0.679**	0.701**
						(0.107)	(0.108)	(0.125)	(0.125)
t	Developing country importer and partner WTO members (ß8)					-0.024	-0.046	-0.043	-0.037
						(0.036)	(0.036)	(0.036)	(0.036)
u	Developing country importer WTO member, but not partner (ß9)					0.103*	0.09	-0.117	-0.073
						(0.059)	(0.059)	(0.094)	(0.096)
v	Industrial country importer WTO member, partner industrial country and WTO member (ß5)						1.127**	1.134**	1.145**
							(0.097)	(0.097)	(0.097)
w	Industrial country importer WTO member, partner developing country and WTO member (ß6)						0.972**	0.980**	0.988**
							(0.103)	(0.103)	(0.103)
x	Developing country importer not WTO members and partner also not WTO member (ß10)							-0.237**	-15.751**
								(0.090)	(6.029)
y	Developing country importer not WTO members and partner also not WTO member, interacted with year (ß10*time)								0.008**
									(0.003)
	Time-varying importer and exporter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	76094	76094	55831	55831	55831	55831	55831	55831
	Sample		All imports			All Imports excluding values less than $500,000			
	R-squared	0.74	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	Root mean square error	1.679	1.673	1.113	1.110	1.110	1.109	1.109	1.109
	F-test [1/]		240	142,136, 7.3	125	10.1,5.5	7.7, 6.3, 17, 2.5	7.6, 0.7, 24, 11	7.9, 0.2, 23, 9.7
	Prob>F [1/]		0.00	0.00, 0.00, 0.01	0.00	0.00, 0.02	0.0, 0.0, 0.0, 0.1	0.0, 0.4, 0.0, 0.0	0.0, 0.7, 0.0, 0.0

1/ Column 2 & 4: H_0: p=q

Column 3: H_0 : i=l, i=o, l=o

Column 5: H_0: r=s, t=u.

Column 6, 7 & 8: H_0: v=w, t=u, s=v, s=w

Regressand: log real imports. Robust standard errors (clustered by country-pairs) reported below coefficient estimates. Coefficients β_3 and β_4 refer to equation 1, while coefficients β_5 *to* β_{10} refer to equation 2.

* Significant at 10%; ** significant at 5%.

Table 5. Robustness Checks: Panel, 1950-2000

Specification	*FTA*	*GSP*	*Industrial WTO member*	*Developing WTO member*
Rose definition of GSP and WTO dummies	0.755**	-0.097**	0.336**	0.017
(i.e. not defined mutually exclusively)	(0.046)	(0.032)	(0.058)	(0.025)
Country-pair random effects without importer and exporter fixed effects	1.076**	0.287**	0.401**	0.070**
	(0.036)	(0.028)	(0.024)	(0.015)
Country-pair random effects with importer and exporter fixed effects	0.945**	0.188**	0.306**	0.137**
	(0.039)	(0.038)	(0.032)	(0.016)
Country-pair fixed effects	0.894**	0.142**	0.271**	0.175**
	(0.059)	(0.063)	(0.054)	(0.027)
Excluding values of log imports 3 s.d. away from mean	1.162**	0.820**	1.022**	0.016
	(0.073)	(0.096)	(0.092)	(0.036)
Excluding values of log imports 2 s. d. away from mean	1.151**	0.721**	0.916**	0.02
	(0.074)	(0.098)	(0.094)	(0.036)
Helpman - Melitz - Rubinstein (2004) regression	1.693**	2.113**	1.808**	-0.349**
(correcting for non-zero trade selection and for firm heterogeneity)	(0.142)	(0.154)	(0.145)	(0.045)

Regressand: log real imports

Robust standard errors (clustered by country-pairs) reported below coefficient estimates. Intercepts and coefficients for standard covariates not reported for ease of presentation. All regressions include time effects and, with the exception of the regression with country-pair random effects, also include importer and exporter fixed effects. The specification in the last three rows include time-varying exporter and importer fixed effects.

* Significant at 10%; ** significant at 5%.

Table 6. Sectoral Results, Panel, 1990-2000

Seemingly (Unrelated Regressions)

	Liberalized manufacturing [1/]	Protected manufacturing [2/]	Clothing	Footwear	Food
Free trade area	0.958**	0.413**	0.534**	0.191	-0.13
	(0.150)	(0.149)	(0.172)	(0.225)	(0.240)
GSP, excluding FTA	1.012**	-0.109	0.539**	-0.988**	-0.543*
	(0.199)	(0.197)	(0.228)	(0.298)	(0.318)
Industrial country WTO member	1.065**	0.352**	0.095	-0.475*	-1.387**
	(0.176)	(0.174)	(0.201)	(0.263)	(0.281)
Developing country WTO member	0.277**	-0.277**	-0.14	-0.392**	-0.933**
	(0.103)	(0.101)	(0.117)	(0.154)	(0.164)
Time-varying importer and exporter fixed effects	Yes	Yes	Yes	Yes	Yes
Chi-sqaure test for equality of coefficients [3/]		13.2	18.34	32.42	66.46
Prob>Chi-square		0.00	0.00	0.00	0.00
Observations	4044	4044	4044	4044	4044
Root mean squared error	1.247	1.234	1.428	1.869	1.993
R-square	0.829	0.824	0.810	0.684	0.631

1/ Sectors with tariff rates higher than 5 percent in 1989, and zero in 2000 for both US and EU.

2/ Sectors with tariff rates higher than 5 percent in both 1989 and 2000, and tariff rates decreased by less than 2 percentage points between 1989-2000, excluding clothing and footware.

3/ Between industrial country dummy in unprotected manufacturing and that in each of the other sectors.

Regressand: log real imports. Robust standard errors (clustered by country-pairs) reported below coefficient estimates. Intercepts and coefficients for all the standard covariates listed in Table 4 are not reported for ease of presentation.

Table 7. New and Old Developing Country Members in the WTO [1/]

	2000						1995				
Free trade area	0.716**	0.704**	0.706**	0.708**	0.709**	0.712**	0.851**	0.854**	0.853**	0.853**	0.846**
	(0.085)	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)	(0.123)	(0.123)	(0.123)	(0.123)	(0.122)
Industrial country granting GSP	0.514**	0.502**	0.505**	0.508**	0.510**	0.514**	0.541**	0.543**	0.541**	0.542**	0.537**
	(0.114)	(0.115)	(0.114)	(0.114)	(0.115)	(0.115)	(0.153)	(0.153)	(0.153)	(0.153)	(0.153)
Industrial country WTO member	0.710**	0.697**	0.700**	0.702**	0.703**	0.706**	0.659**	0.662**	0.661**	0.661**	0.655**
	(0.104)	(0.104)	(0.104)	(0.104)	(0.104)	(0.104)	(0.146)	(0.146)	(0.146)	(0.146)	(0.145)
Old member (1990)	-0.012						-0.116**				
	(0.058)						(0.057)				
New member (1990)	0.295**						-0.024				
	(0.079)						(0.082)				
Old member (1991)		0.011						-0.114**			
		(0.058)						(0.056)			
New member (1991)		0.282**						0.002			
		(0.087)						(0.095)			
Old member (1992)			0.026						-0.116**		
			(0.057)						(0.055)		
New member (1992)			0.264**						0.034		
			(0.096)						(0.105)		
Old member (1993)				0.032						-0.114**	
				(0.057)						(0.055)	
New member (1993)				0.252**						0.028	
				(0.098)						(0.108)	
Old member (1994)					0.047						-0.104*
					(0.056)						(0.055)
New member (1994)					0.210**						-0.011
					(0.107)						(0.131)
Old member (1995)						0.061					
						(0.056)					
New member (1995)						0.171					
						(0.126)					
Importer and exporter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations with new members	712	595	531	512	360	217	568	433	388	374	204
F-test for equaility of coefficients [2/]	14.76	9.19	5.97	4.84	2.26	0.75	1.28	1.55	2.13	1.77	0.53
Prob>F	0.000	0.002	0.015	0.028	0.133	0.387	0.258	0.213	0.145	0.183	0.468
R-squared	0.81	0.81	0.81	0.81	0.81	0.81	0.78	0.78	0.78	0.78	0.78
Observations	6638	6638	6638	6638	6638	6638	7674	7674	7674	7674	7674
Root mean square error	1.062	1.062	1.062	1.062	1.062	1.093	1.093	1.093	1.093	1.093	1.093

1/ Old and new members refer to developing countries in the WTO; cut-off date for defining these in brackets.
2/ Between old and new members.
Regressand: log real imports. Robust standard errors reported below coefficient estimates. Intercepts and coefficients for standard covariates not reported for ease of presentation. * Significant at 10%; ** significant at 5%.

Table 8. Tariff Bindings and Reductions of Developing Countries in the Uruguay Round 1/

Percent of lines bound pre-Uruguay Round	30.1
Percent of lines bound post-Uruguay Round	80.8
Percent of lines unaffected by tariff reductions in Uruguay Round	72.3
Percentage tariff reduction on lines affected by tariff reductions	8.1
Post-Uruguay Round applied rate	13.3
Post-Uruguay Round bound rate	25.2

Source: Finger, Ingco, and Reincke (1996).
1/ Includes 21 countries for which data are available in the WTO's Integrated Data Base (see Table 1 in Finger, Ingco, and Reincke, 1996).