Estimating Trade Restrictiveness Indices*

Hiau Looi Kee†
Alessandro Nicita‡
Marcelo Olarreaga§

January 2008

Abstract

Studies of the impact of trade restrictiveness on growth, poverty or unemployment are frequent in the academic literature. Few authors, however, provide a precise definition of what they mean by trade restrictiveness. When they do, the definition is unlikely to have tight links with trade theory. The objective of this paper is to fill this gap by providing for 78 developing and developed countries clearly defined indicators of trade restrictiveness that are well grounded in trade theory. Results suggest that poor countries tend to have more restrictive trade policies, but they also face higher trade barriers on their exports.

JEL classification numbers: F10, F11, F13
Keywords: Trade restrictiveness indices, ad-valorem equivalents of non tariff barriers

*We are grateful to Olivier Cadot, William Cline, Alan Deardorff, Robert Feenstra, Michael Ferrantino, Bernard Hoekman, Jaime de Melo, Thierry Mayer, Peter Neary, Guido Porto, Zia Qureshi, Phil Schuler, Andrew Scott, Dustin Smith, Javier Suarez, Akiko Suwa-Eisenman, David Tarr, Dominique Van Der Mensbrugghe, Alan Winters, two referees, and participants at seminars at the Center of Global Development in Washington, Central Bank of Uruguay, FAO, IMF, Paris School of Economics, UNCTAD, University of Geneva, World Bank, and World Trade Organization for comments and suggestions. The views expressed here are those of the authors and do not necessarily reflect those of the institutions to which they are affiliated.

†Development Research Group, The World Bank, Washington, DC 20433, USA; Tel. (1-202)473-4155; Fax: (1-202)522-1159; e-mail: hlkee@worldbank.org

‡Development Research Group, The World Bank, Washington DC, 20433, USA; Tel. (1-202)473-4066; Fax: (1-202)522-1159; e-mail: anicita@worldbank.org

§University of Geneva, 40 bd Pont d'Arve, 1211 Geneva 4, Switzerland, and CEPR, London, UK; Tel. (41-22)379-8286; Fax: (41-22)379-8293; e-mail: marcelo.olarreaga@unige.ch

Analyses of the impact of trade restrictiveness on economic and social outcomes are quite common in academic literature and policy discussions. Indicators of trade restrictiveness are used to study the effects of trade policy on growth (e.g., Edwards, 1998, Frankel and Romer, 1999), poverty (Dollar and Kraay, 1998), or firm productivity (Melitz, 2003). Trade restrictiveness indicators are also an essential input to trade negotiators, and to any study attempting to understand the institutional and political determinants of trade protection (Grossman and Helpman, 1994). Indicators of trade restrictiveness are also needed when trade reforms are part of the conditionality associated with World Bank and IMF loans, or used as a determinant of aid allocation.

Unfortunately, measuring the restrictiveness of a trade policy regime is a difficult task. Most studies use simple indicators that are not well grounded in trade theory, and often, they only vaguely define the aspects of the restrictiveness of the trade regime they try to measure (as explained by Rodriguez and Rodrik, 2001). Without a theoretically sound measure of trade restrictiveness, any analysis of its impact on economic and social outcomes is likely to be inaccurate and lead to misinformed policy recommendations.

The objective of this paper is to provide a measure of trade restrictiveness that is well grounded in trade theory, and accounts for different forms of trade protection, while clearly defining what it measures. To do so, we build on the important work on trade restrictiveness by Anderson and Neary (1992, 1994, 1996, 2003 and 2007).[1] So far, the empirical implementation of their restrictiveness indices has been limited due to the important data requirements. This paper fills that gap.

[1] For an excellent survey of their work see Anderson and Neary, 2005.

To measure trade restrictiveness, one needs to overcome two important aggregation hurdles: the aggregation of different forms of trade policies, and the aggregation across goods with different economic importance. The first aggregation problem arises because trade policy can take many different forms: tariffs, quotas, non-automatic licensing, antidumping duties, technical regulations, monopolistic measures, subsidies, etc. How can one summarize in a single measure the trade restrictiveness of a 10% tariff, a 1000 ton quota, a complex non-automatic licensing procedure and a $1 million subsidy? Often the literature relies on outcome measures, e.g., import shares. The rationale is that import shares summarize the impact of all these trade policy instruments. The problem is that they also measure differences in tastes, macroeconomic shocks, and other factors which should not be attributed to trade policy. Another approach that is often followed is to simply rely on tariff data or collected customs duties, and assume that all other instruments are positively (and perfectly) correlated with tariffs.[2] These are obviously unsatisfactory solutions. A more adequate approach to solve the first problem is to bring all types of trade policy instruments into a common metric. We will do this by estimating ad-valorem equivalents (AVEs) of non tariff barriers (NTBs) for each country at the tariff line level.[3]

The second aggregation problem arises because trade policy is set at the tariff line level

[2]We will see later that tariffs and NTBs tend to be negatively correlated once we control for tariff line and country-specific effects.

[3]The literature has estimated the incidence of NTBs on imports using different methodologies and data (see Deardorff and Stern, 1997). These include frequency and coverage type measures (e.g., Nogues et al., 1986 or OECD, 1995), price comparison measures (e.g., Andriamananjara *et al.*, 2004 and Bradford, 2003), and quantity-impact measures (using NTB data as in Leamer, 1990 and Harrigan, 1993 or as residuals of gravity-type equations as in Mayer and Zignago, 2003). Not all of these measures can be directly compared to tariffs (which are measured in terms of the increase in domestic prices). More importantly, to our knowledge, there exists no attempt to estimate the incidence of NTBs in a consistent way for a wide variety of countries at the tariff line level.

and there are often more than 5000 tariff lines in a typical tariff schedule. How can one summarize all this information in one aggregate and economically meaningful measure? Commonly used aggregation procedures include simple averages, import-weighted averages and frequency or coverage ratios; none of which have a sound theoretical basis. For example, imports subject to high protection rates are likely to be small and therefore will be attributed small weights in an import-weighted aggregation, which would underestimate the restrictiveness of those tariffs. In the extreme case, goods subject to prohibitively high tariffs have the same weight as goods subject to zero tariffs: a zero weight. Similarly, when computing simple average tariffs, very low tariffs on economically meaningless goods would downward bias this measure of trade restrictiveness.

James Anderson and Peter Neary tackle these problems using a theoretically sound aggregation procedure that answers very clear and precise questions regarding the trade distortions imposed by each country's trade policies on itself and on its trading partners. One important conclusion emerging from their work is that one single indicator cannot provide a measure of the trade distortions a country imposes on itself while simultaneously capturing the trade distortions imposed on its trading partners. When interested in the welfare distortions that the country imposes on itself, the aggregation procedure answers the following question: *What is the uniform tariff that if applied to imports instead of the current structure of protection would leave home welfare at its current level?* This corresponds to Anderson and Neary's (1994, 1996) Trade Restrictiveness Index (TRI). While the TRI is an excellent indicator of the degree of domestic inefficiency caused by the domestic trade regime, it provides little information regarding the trade restrictiveness faced by exporters. Thus, when interested in the extent to which trade distortions limit imports, the aggregation procedure should answer the following question: *What is the uniform tariff that if imposed on home imports instead of the existing structure of protection would leave aggregate imports at their current level?* This second indicator is Anderson and Neary's (2003) MTRI, and it is here renamed Overall Trade Restrictiveness Index (OTRI) to account for the different methodology. Finally, if one is interested in the barriers faced by each country's exporters when selling in other countries, the relevant question is: *What is the uniform tariff that if imposed by all trading partners on exports of country c instead of their current structure of protection would leave exports of country c at their current level?* This can be seen as the mirror image (from the exporter's perspective) of the OTRI and it is labeled Market Access OTRI (MA-OTRI).

Anderson and Neary's main contribution is conceptual, but they also provide some applications of the their work using computable general equilibrium (CGE) models, which we will use as a benchmark for our results. Our contribution is empirical as we apply the concepts developed by Anderson and Neary to a vast multi-country data set on tariffs and NTBs. To do this, we move away from CGE models and follow a more econometric intensive approach within a simpler and empirically tractable trade model. The use of a partial equilibrium setup implies that we only study the direct impact of tariffs and NTBs on import demand. We ignore any income effects due to the redistribution of tariff revenue and any cross price substitution effects. However, the are clear benefits to the use of a partial equilibrium setup: simplicity is one of them. But probably, the main advantage is that it allows us to avoid biases associated with the necessary aggregation of tariff lines into a few industries which is necessary to fulfil CGE's data requirements. Given the heterogeneity of levels of protection within industries, not including some feedback mechanisms provided by the CGE approach seems a cost worth paying.

Feenstra (1995) shows that if one ignores the general equilibrium feedbacks, the TRI can be approximated by a weighted average of the squares of the level of protection at the tariff line level (which include AVEs of NTBs).[4] The weights increase with import demand elasticities and imports at the tariff line level. Following Feenstra's (1995) setup, we show in this paper that other measures of trade restrictiveness can also be constructed in a similar fashion. Until recently, the absence of estimates of import demand elasticities at the tariff line level would have made it impossible to implement Feenstra's setup. However, Kee, Nicita and Olarreaga (forthcoming) provide such estimates, allowing us to estimate different trade restrictiveness indices using the most detailed trade policy information available.

The remainder of the paper is organized as follows. Section 1 describes the methodology used to estimate AVEs of NTBs at the tariff line level. Section 2 presents the methodology used to estimate the trade restrictiveness indices. Section 3 describes the data, and section 4 describes the empirical results. Section 5 concludes.

[4]This is obtained by taking a conventional second-order approximation which involves summing the "deadweight loss" triangles associated with the loss due to trade restrictions and solving for the uniform tariff equivalent.

1 Estimating AVEs of NTBs

To obtain the AVEs of NTBs we first estimate the quantity-impact of NTBs on imports and then we turn to the transformation of quantity-impacts into price effects, using the import demand elasticities in Kee, Nicita and Olarreaga (forthcoming).[5]

1.1 Estimating the impact of NTBs on imports

The theoretical foundation for this kind of study is the n-good n-factor general equilibrium model with log-linear utilities and log-linear constant returns to scale technologies (see Leamer, 1988 and 1990). One of the specifications commonly used (e.g., Leamer, 1990, Harrigan, 1993, Trefler, 1993, and Lee and Swagel, 1997) and adopted in this study is the following:

$$\ln m_{n,c} = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c}^{\text{Core}} \text{Core}_{n,c} + \beta_{n,c}^{\text{DS}} \ln \text{DS}_{n,c} + \varepsilon_{n,c} \ln(1 + t_{n,c}) + \mu_{n,c} \qquad (1)$$

where $m_{n,c}$ is the import value of good n in country c evaluated at exogenous world prices, which are all normalized to unity so that imported quantities equal $m_{n,c}$;[6] α_n are tariff line dummies that capture any good-specific effect; C_c^k are k variables that provide country characteristics; more precisely as in Leamer's (1990) comparative advantage approach we

[5] One may wondered why we do not directly estimate the impact of NTBs on domestic prices. The reason is that data on domestic prices at the tariff line level only exists for a few products and a few countries, whereas data on imported quantities and import demand elasticities exists at the tariff line level for a large number of countries.

[6] Note that (1) is only defined for the strictly positive values of $m_{n,c}$. If $m_{n,c} = 0$, the $\ln(m_{n,c})$ is not defined. To avoid sample bias we added 1 to all $m_{n,c}$ values (which are measured in thousands of dollars).

used relative factor endowments (agricultural land over GDP, capital over GDP and labour over GDP), as well as GDP to capture economic size. We also introduced two gravity type variables: a dummy for islands and a measure of the average distance to world markets (i.e., the import-weighted distance to each trading partner); $\alpha_{n,k}$ are parameters in front of the variables that capture country characteristics; $Core_{n,c}$ is a dummy variable indicating the presence of a core NTB; $\ln\text{DS}_{n,c}$ is the log of agricultural domestic support, which is continuous and measured in dollars (for a description of NTB data, see subsection 2.1.1); $\beta_{n,c}^{\text{Core}}$ is the parameter that captures the impact that a core NTB imposed on good n in country c has on imports of good n in country c; similarly $\beta_{n,c}^{\text{DS}}$ is the parameter that captures the impact that agricultural domestic support granted to good n in country c has on imports of good n in country c; $t_{n,c}$ is the ad-valorem tariff on good n in country c; $\varepsilon_{n,c}$ is the import demand elasticity; and finally $\mu_{n,c}$ is an i.i.d. error term.

This model allows for both tariffs and NTBs to deter trade with effects that vary by importing country and good. Given that the impact of tariffs on imports depends exclusively on the import demand elasticities and that these have been estimated earlier for each Harmonized System (HS) six-digit tariff line in 149 countries (Kee, Nicita and Olarreaga, forthcoming), we can substitute these estimates into (1) instead of trying to estimate them again. Substituting previously estimated import demand elasticities into (1), and moving the term $\varepsilon_{n,c}\ln(1+t_{n,c})$ to the left-hand-side help us address the endogeneity of tariffs, as discussed in Trefler (1993) and Lee and Swagel (1997). This constrained specification may introduce additional errors in the regression given that import demand elasticities are estimated with error. We denote the new error term $\kappa_{n,c}$. Furthermore, $\kappa_{n,c}$ is likely to be heteroskedastic. A standard White correction is undertaken to obtain asymptotically robust standard errors.[7] After substituting the estimated elasticities and sending the tariff term to the left-hand-side, (1) becomes:

$$\ln m_{n,c} - \varepsilon_{n,c} \ln(1 + t_{n,c}) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c}^{\text{Core}} \text{Core}_{n,c} + \beta_{n,c}^{\text{DS}} \ln \text{DS}_{n,c} + \kappa_{n,c}. \quad (2)$$

According to (2), the impact of NTBs (core and domestic support) varies across countries and tariff lines (i.e., βs have subscripts n and c). Given that the international data on NTBs does not have adequate time variation, some structure would have to be imposed on the β parameters to allow them to vary across tariff lines and countries without running out of degrees of freedom. We will therefore allow them to have a product and a country-specific impact, where the latter will be captured by each country's factor endowments as in Leamer's (1988 and 1990) comparative-advantage approach:[8]

$$\beta_{n,c}^{\text{Core}} = \beta_n^{\text{Core}} + \sum_k \beta_{n,k}^{\text{Core}} C_c^k \quad (3)$$

$$\beta_{n,c}^{\text{DS}} = \beta_n^{\text{DS}} + \sum_k \beta_{n,k}^{\text{DS}} C_c^k \quad (4)$$

[7]However, note that this will only affect the variance-covariance matrices, which we do not use to estimate the standard error of AVEs and trade restrictiveness indices, which as explained later are bootstrapped.

[8]The idea is that the restrictiveness of a NTB on a particular product will vary across countries, and will depend on the determinants of each country's comparative advantage. For example, one could expect that a core NTB on agricultural products is likely to be less restrictive in countries with a comparative disadvantage in agricultural products (i.e., a country with a relatively low agricultural land over GDP ratio). Note that ultimately this is an empirical question and what matters is that if there is any heterogeneity along these lines our estimates will capture them.

where all $\beta_{n,k}$s are product (i.e., tariff line) specific parameters to be estimated. The country variation comes from the interaction with the comparative-advantage variables (agricultural land over GDP, capital over GDP, labour over GDP, and GDP). Substituting (3) and (4) into (2) we get:

$$\begin{aligned} \ln m_{n,c} - \varepsilon_{n,c} \ln(1 + t_{n,c}) &= \alpha_n + \sum_k \alpha_{n,k} C_c^k + (\beta_n^{\text{Core}} + \sum_k \beta_{n,k}^{\text{Core}} C_c^k) \text{Core}_{n,c} \\ &+ (\beta_n^{\text{DS}} + \sum_k \beta_{n,k}^{\text{DS}} C_c^k) \ln \text{DS}_{n,c} + \kappa_{n,c}. \end{aligned} \quad (5)$$

Given that there are: 4575 goods at the HS six-digit level on which at least one country in our sample has an NTB; two different types of NTBs and five coefficients by type of NTB (the product-specific dummy and then 4 variables that capture country characteristics), the estimation in (5) would involve estimating a maximum of 2 x 5 x 4575=45750 coefficients.[9] This is likely to be intractable if we try to estimate these coefficients in a single regression. We, therefore, opted for estimating these coefficients tariff line by tariff line. The only drawback is a loss in the efficiency of these estimates, but it is largely compensated by gains in programming and computing time. We essentially estimated 4575 equations (5) and retrieve the relevant parameters from each of these regressions to compute $\beta_{n,c}^{\text{Core}}$ and $\beta_{n,c}^{\text{DS}}$ according to (3) and (4).

An additional problem with the estimation of (5) is the endogeneity of NTBs, as suggested in the political economy literature. As shown in Trefler (1993) and Lee and Swagel (1997),

[9] And a minimum of 5 x 4575 = 18300 if core NTBs and agricultural domestic support are never present simultaneously.

such endogeneity may lead to a downward bias on the estimated impact of NTBs on imports, which will result in an underestimation of AVEs. Instrumental variables are needed to address this issue. Some of the traditionally used instruments in the literature such as firm concentration (on the buyer and seller side), or factor shares are not available at this level of aggregation. Instead, we use exports and the past change in imports as instruments which have also been used in the existing literature. However, these variables may still be correlated with imports and tariffs and therefore may not be adequate instruments. Thus, we use as an additional instrument for core NTB, the GDP-weighted average of the core NTB dummy variable at the product level of the 5 closest countries to each country c.[10] Similarly, as an additional instrument for domestic support of country c we use the GDP-weighted average of the domestic support by product of the 5 closest countries to each country c. The idea is simple. Historical, legal and cultural reasons may induce neighboring countries to impose similar types of NTBs on similar products. Thus, the existence of NTBs in neighboring countries are likely to explain the presence of NTBs in a given country, but they are unlikely to influence its imports.[11]

Because core NTB is a dummy variable that indicates the presence or absence of a particular type of NTB on a particular good in a given country, the estimation method follows a Heckman two-stage treatment effect procedure. In the first stage, we run a probit equation for each HS product explaining the presence of core NTBs with the instruments discussed above, to obtain the inverse Mills ratio (the ratio of the probability density function and the

[10]The 5 closest countries are determined by measuring geographic distance between capitals.

[11]Imports will not be influenced if we assume perfectly competitive world markets where individual countries cannot affect world prices.

cumulative density function of each observation). The second stage equation includes the inverse Mills ratio as a control variable. For 6-digit HS goods in which at least one country uses domestic support (around 158 HS six-digit tariff lines), the second stage involves an instrumental variable estimation where domestic support is instrumented using the GDP-weighted domestic support of the 5 closest neighbors for the given line, as well as exports and past changes in imports.

The two-stage estimation allows us to obtain estimates of $\beta_{n,c}^{\text{core}}$ and $\beta_{n,c}^{\text{core}}$. Note that theoretically one expects them to be non-positive. They can be zero if the NTB measure is not restrictive (e.g., tariffs are the binding measure). Because in 13% of the sample the unrestricted estimation provided positive estimates for $\beta_{n,c}^{\text{core}}$ and $\beta_{n,c}^{\text{DS}}$, which are economically meaningless, we actually constrained the estimation procedure so that $\beta_{n,c}^{\text{core}} \leq 0$ and $\beta_{n,c}^{\text{DS}} \leq 0$. This is done by replacing the expressions in equations (3) and (4) by:

$$\begin{aligned} \beta_{n,c}^{\text{Core}} &= -e^{\left(\beta_n^{\text{Core}} + \sum_k \beta_{n,k}^{\text{Core}} C_c^k\right)} && (6) \\ \beta_{n,c}^{\text{DS}} &= -e^{\left(\beta_n^{\text{DS}} + \sum_k \beta_{n,k}^{\text{DS}} C_c^k\right)}. && (7) \end{aligned}$$

Note that after replacing equations (6) and (7) into (5), equation (5) becomes non-linear in the parameters:

$$\begin{aligned} \ln m_{n,c} - \varepsilon_{n,c} \ln(1 + t_{n,c}) &= \alpha_n + \sum_k \alpha_{n,k} C_c^k + (-e^{\beta_n^{\text{Core}} + \sum_k \beta_{n,k}^{\text{Core}} C_c^k}) \text{Core}_{n,c} \\ &+ (-e^{\beta_n^{\text{DS}} + \sum_k \beta_{n,k}^{\text{DS}} C_c^k}) \ln \text{DS}_{n,c} + \kappa_{n,c}. && (8) \end{aligned}$$

Thus, our estimate of the impact of core NTBs and agricultural domestic support on imports ($\beta_{n,c}^{\text{Core}}$ and $\beta_{n,c}^{\text{Core}}$) are obtained by estimating (8) using non-linear least squares.

1.2 Estimating ad-valorem equivalents of NTBs

To make NTBs comparable with ad-valorem tariffs, one needs to transform the quantity impact into price-equivalents. This is referred to as an AVE of NTB, and is noted $ave = \partial \ln p^d / \partial NTB$, where p^d is the domestic price.[12]

To obtain our measure of AVE, differentiate equation (1) with respect to $\text{Core}_{n,c}$ and $\text{lnDS}_{n,c}$:

$$\frac{\partial \ln m_{n,c}}{\partial \text{Core}_{n,c}} = \frac{\partial \ln m_{n,c}}{\partial \ln p_{n,c}^d} \frac{\partial \ln p_{n,c}^d}{\partial \text{Core}_{n,c}} = \varepsilon_{n,c} ave_{n,c}^{\text{Core}} \tag{9}$$

$$\frac{\partial \ln m_{n,c}}{\partial \ln \text{DS}_{n,c}} = \frac{\partial \ln m_{n,c}}{\partial \ln p_{n,c}^d} \frac{\partial \ln p_{n,c}^d}{\partial \ln \text{DS}_{n,c}} = \varepsilon_{n,c} ave_{n,c}^{\text{DS}} \tag{10}$$

where $ave_{n,c}^{\text{Core}}$ and $ave_{n,c}^{\text{DS}}$ are respectively the ad-valorem equivalents of core NTBs and domestic support imposed on good n in country c. Solving (9) and (10) for $ave_{n,c}$s we obtain:

$$ave_{n,c}^{\text{Core}} = \frac{1}{\varepsilon_{n,c}} \frac{\partial \ln m_{n,c}}{\partial \text{Core}_{n,c}} = \frac{e^{\beta_{n,c}^{\text{Core}}} - 1}{\varepsilon_{n,c}} \tag{11}$$

$$ave_{n,c}^{\text{DS}} = \frac{1}{\varepsilon_{n,c}} \frac{\partial \ln m_{n,c}}{\partial \ln \text{DS}_{n,c}} = \frac{\beta_{n,c}^{\text{DS}}}{\varepsilon_{n,c}}. \tag{12}$$

AVEs are calculated in each country at the tariff line level (six digits of the HS). An overall AVE at the tariff line level is obtained by simply adding the two NTB components, and

[12] This assumes perfect competition.

is denoted $ave_{n,c}$. By construction the estimated AVEs is non-negative. They would be positive when the NTB is binding, and equal to zero when the NTB is not binding.

In section 4.1 we discuss at length the results obtained using the methodology described above, and their relation to results in other studies. These serve as external tests to the theoretical setup used to estimate the AVEs, as well as its implementation.

2 Estimating trade restrictiveness indices

The overall level of protection imposed by country c on imports of good n is given by:

$$T_{n,c} = ave_{n,c} + t_{n,c} \tag{13}$$

where $T_{n,c}$ is the overall level of protection that country c imposes on imports of good n; $ave_{n,c}$ is the AVE of NTBs that country c imposes on imports of good n, and $t_{n,c}$ is the tariff applied by country c on imports of good n. Adding the AVEs of NTBs and tariffs to obtain an overall level of protection on country c imports of good n assumes that all of the protection instruments are potentially binding (Anderson and Neary, 1992).[13] This is consistent with our AVE estimates, which should be interpreted as the impact that each NTB has on the volume of imported goods conditional on the presence of tariffs and other NTBs.

[13] Of course, tariffs and AVE estimates can be equal to zero.

2.1 Estimating TRIs

The TRI summarizes the distortions imposed by each country's trade policies on its own welfare. It answers the following question: What is the uniform tariff that if applied to imports instead of the current structure of protection would leave home welfare at its current level? More formally and following Feenstra (1995) the TRI is (implicitly) defined by:

$$\mathrm{TRI}_c : \sum_n W_{n,c}\left(\mathrm{TRI}_c\right) = \sum_n W_{n,c}\left(T_{n,c}\right) = W_c^0 \tag{14}$$

where $W_{n,c}$ is the welfare associated with imports of good n in country c and W_c^0 is the current level of aggregate welfare in country c given its protection structure. It is well known that in a partial equilibrium setup a second-order linear approximation to the welfare cost is given by:

$$\Delta W_{n,c} = \frac{1}{2} m_{n,c} \varepsilon_{n,c} T_{n,c}^2. \tag{15}$$

The right-hand-side linearly approximates the Harberger's Triangle. Thus, the extent of welfare loss increases with the elasticity of import demand, imports, and the squared of the level of protection. Totally differentiating (14), using (15) and solving for TRI_c yields:

$$\mathrm{TRI}_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}^2}{\sum_n m_{n,c} \varepsilon_{n,c}} \right)^{1/2}. \tag{16}$$

Thus, the partial equilibrium TRI is the weighted sum of squared protection levels, where weights are given by the elasticity of import demand and imports. Kee, Nicita and Olarreaga (forthcoming) shows that the squared of the partial equilibrium TRI can be decomposed into the squared of the import weighted average tariff, the tariff variance, and the covariance between tariff squared and import demand elasticities. Thus a higher tariff variance, and higher levels of protection on goods with large import demand elasticities lead to a higher TRI.

2.2 Estimating OTRIs

The OTRI summarizes the impact of each country's trade policies on its aggregate imports. It answers the following question: What is the uniform tariff that if imposed on home imports instead of the existing structure of protection would leave aggregate imports at their current level? More formally, the OTRI is implicitly defined by:

$$\mathrm{OTRI}_c : \sum_n m_{n,c} \left(\mathrm{OTRI}_c\right) = \sum_n m_{n,c} \left(T_{n,c}\right) = m_c^0 \tag{17}$$

where m_c^0 are current aggregate imports evaluated at world prices (again, we choose units so that all world prices equal unity). Totally differentiating (17) in a partial equilibrium setup, and solving for OTRI_c yields:

$$\mathrm{OTRI}_c = \frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}}{\sum_n m_{n,c} \varepsilon_{n,c}}. \tag{18}$$

Thus, the partial equilibrium OTRI is the weighted sum of protection levels, where weights are given by the elasticity of import demand and imports. Like the partial equilibrium TRI, the partial equilibrium OTRI can also be decomposed into the import weighted average level of protection and the covariance between the average protection level and the import demand elasticity. Unlike the TRI, the variance of protection does not affect the partial equilibrium OTRI. Indeed, as shown in Anderson and Neary (2003 and 2005), the OTRI is always smaller than the TRI, and tariff dispersion increases the difference between TRI and OTRI.[14]

2.3 Estimating MA-OTRIs

The MA-OTRI summarizes the impact of other countries' trade policies on each country's exports. The index answers the following question: What is the uniform tariff that if imposed by all trading partners on exports of country c instead of their current structure of protection would leave exports of country c at their current level? More formally, the MA-OTRI is implicitly given by:

$$\text{MA-OTRI}_c : \sum_n \sum_p x_{n,c,p} \left(\text{MA-OTRI}_c\right) = \sum_n \sum_p x_{n,c,p} \left(T_{n,c,p}\right) = x_c^0 \tag{19}$$

where $x_{n,c,p}$ are country c exports of good n to its trading partner p (and by definition is equal to $m_{n,p,c}$); $T_{n,c,p}$ is the level of protection faced in country p by country c exports of good n and x_c^0 are current aggregate exports of country c evaluated at world prices. Note that the change in exports from country c to country p is by definition equal to the change in imports of country p from country c. Thus if we totally differentiate (19) in a partial

[14] See also footnote 7 in Feenstra, 1995.

equilibrium setup, and solve for MA-OTRI_c we obtain:

$$\text{MA-OTRI}_c = \frac{\sum_p \sum_n m_{n,c,p} \varepsilon_{n,p} T_{n,c,p}}{\sum_p \sum_n m_{n,c,p} \varepsilon_{n,p}}. \tag{20}$$

Thus, the partial equilibrium MA-OTRI is the weighted sum of protection levels in other countries, where weights are given by the elasticities of import demand in other countries and their imports from c. Obviously MA-OTRI can be calculated bilaterally to obtain the level of trade restrictiveness that country p imposes on exports of country c. Instead of summing over n and p one would only sum over n to obtain $\text{MA-OTRI}_{c,p}$.

2.4 Estimating standard errors of trade restrictiveness indices

An important advantage of our econometric-intensive approach to construct trade restrictiveness indices is that we are able to estimate bootstrap standard errors for these indices, which take into account the sampling and estimation errors of the AVEs and import demand elasticities, as well as their covariances.

Our bootstrapping procedure is as follows. For each HS six-digit line, we pair a set of randomly drawn elasticities (one for each country) from the sample of bootstrap import demand elasticities in Kee, Nicita and Olarreaga (forthcoming) with a random sample from the data set used to estimate import equations. All draws are with repetition. We then estimate import equation (8) for every HS six-digit line, calculate the AVEs, and construct the TRIs, OTRIs, and MA-OTRIs using equations (16), (18) and (20). We perform this procedure 200 times. The bootstrap standard errors of TRIs, OTRIs and MA-OTRIs are the standard deviations of these 200 TRIs, OTRIs and MA-OTRIs. Note that this procedure also allows us to obtain the bootstrap standard errors of AVEs of core NTBs and agricultural domestic support from the standard deviations of the 200 AVEs for each tariff line and country.

3 Data

Tariff data comes from different sources. The main sources are the WTO's Integrated Database, and UNCTAD's TRAINS. For ad-valorem equivalents of specific tariffs, we use recent computations available through the MAcMap database, developed jointly by ITC (UNCTAD-WTO, Geneva) and CEPII, Paris (see Bouët et al., 2004 for a detailed description). The tariff data is for the most recent year for which there is data available between 2000 and 2004. In more than half the countries, the base year is 2003 or 2004 and in only three countries the data is 2000 (Peru, Kazakhstan and Egypt). MAcMap also provides a complete data set of unilateral, bilateral and regional preferences which is an important component when estimating MA-OTRIs.

The main source for NTB data is UNCTAD's TRAINS. This data set contains detailed information on various types of NTBs (more than 30 different types of NTBs are identified). We included in our measure of core NTBs: Price control measures (TRAINS codes 6100, 6200 and 6300), Quantity restrictions (TRAINS codes 3100, 3200 and 3300), Monopolistic measures (TRAINS code 7000) and Technical regulations (TRAINS code 8100). The data set was updated using information provided by the WTO's Trade Policy Reviews, and in the case of the European Union by the EU Standard's Database built by Shepherd (2004). The core NTB variable used in the estimation of equation (8) takes the value 1 when a given country imposes one of the core NTB measures in a six-digit tariff line, and zero otherwise.

The second type of NTB included is agricultural domestic support. This was obtained from WTO members' notifications during the period 1995-1998 (see Hoekman, Ng and Olarreaga, 2004, for a discussion of the construction of this variable). Domestic support is measured in dollars and is a continuous variable so it enters in log form in the estimation of (8). Only 158 tariff lines at the six-digit level of the HS are affected by domestic support in at least one WTO member.[15]

Import and export data come from United Nations' COMTRADE database. We took the average between 2001 and 2003 to smooth any year-specific shock. Elasticities of import demand elasticities are borrowed from Kee, Nicita and Olarreaga (forthcoming).

4 Empirical Results

We first discuss the estimates of AVEs of NTBs and then present the estimates of trade restrictiveness indices.

[15] One may wonder why we do not use existing estimates of producer subsidy equivalents (PSE). The reason is twofold. First, production data at this level of disaggregation is not available, which precludes calculating PSE. Second, PSE cannot be directly compared to tariffs as they only affect the production side, whereas tariffs affect both consumption and production. In other words, a 10% PSE can be much less restrictive than a 10% tariff (it would only be as restrictive as the tariff if the domestic demand is infinitely inelastic).

4.1 AVEs of NTBs

We run 4575 non-linear regressions (for each HS 6 digit category where at least one country imposes either core NTBs or domestic support) to estimate the impact of the two different types of NTBs on imports. The average and median R^2 is 0.58 and they range from 0.09 to 0.99.[16] Less than 1% of the regressions have an R^2 below 0.20, suggesting that the overall fit of the import equation is very good across different tariff lines.[17]

Each of these regressions provided us with 10 coefficients that measure the impact of NTBs (core and agricultural domestic support) on imports. These are the coefficients in front of the two NTB variables, interacted with a constant and four factor endowment variables that allow us to capture cross country variation in the estimates of the impact of NTBs on imports (these are GDP, labour force/GDP, capital/GDP, agricultural land/GDP). We then construct the country and product-specific effects of the two types of NTBs following (6) and (7).

Table 3 provides averages by country of the estimated values of $\beta_{n,c}^{\text{Core}}$, $\beta_{n,c}^{\text{DS}}$, AVEs of core NTB and agricultural domestic support across all tariff lines, and across only those products that are subject to either core NTBs or agricultural domestic support. The last two columns provide the share of NTBs that are binding (i.e., the share of tariff lines for which the AVEs

[16] The interpretation of R^2s in non-linear regressions has to be done with care, as they do not necessarily lie in the [0,1] interval and their value diminishes with the number of regressors (see Cameron and Windmeijer, 1997). However, in our case 99.9% of the R^2s lie in the [0,1] interval.

[17] Most variables in the regressions have the expected signs and are statistically significant, with the exception of the two gravity variables (island dummy and average distance to trading partners). These gravity variables have the right sign and are statistically significance in only 10% of the regressions. The disappointing performance of these variables could be because in our setup the dependent variable is aggregate imports, not bilateral imports as in the gravity model.

are statistically different from 0 at the 5% level).

The simple average ad-valorem equivalent in the entire sample for core NTBs is 12%; and it is 10% when import-weighted. If averages are calculated only over tariff lines affected by core NTBs, the numbers are much higher: 45% and 32%, respectively. The simple and import-weighted averages of AVEs of agricultural domestic support are much smaller (generally below 1%), but this simply reflects that a very small number of products are affected by domestic support in most countries (see the fourth column of Table 1). If one calculates the average only over those products affected by domestic support, the sample simple average is 48% and the import-weighted average is 21%. The differences between simple and import-weighted averages partly reflect some of the problems discussed in the introduction with this type of aggregation procedure.

Moreover, our regression results show that not all NTBs are binding.[18] In fact, core NTBs are present in 29% of our sample, of which only 21% are binding. When core NTBs are binding, the average AVE in the sample is 95% with an average t-statistic of 3.6. There are only 1312 tariff lines with positive domestic support in our sample, of which only 5% are binding. When domestic support is binding, the average AVE is 565% with an average t-statistic of 2.56. The share of NTBs that are estimated to be binding in each country are given in the last two columns of Table 3. For core NTB it varies between 4.1% in Mali and 28.3% in the European Union. For agricultural domestic support it varies between 0% in several countries and 13% in Poland.

Nevertheless, the importance of NTBs as a protectionist tool is substantial, especially

[18]Some AVEs have point estimates equal to zero or they are not statistically different from zero.

considering that in 55% of tariff lines subject to core NTBs, the AVE of core NTB is higher than the tariff. For products subject to agricultural domestic support, in 36% of these tariff lines the AVE of agricultural domestic support is higher than the tariff.[19]

The variation across goods (tariff lines) is very large. The average level of AVEs in agricultural products is 27% compared to 10% for manufacturing goods. The overall level of protection (including tariffs) is also much higher for agriculture (44% versus 19%).[20] The highest average AVE of NTBs at the 2 digit level of the HS is found for dairy products (HS 04) with an average of 46% (an average tariff of 29% brings the average level of protection for dairy products in the world to 75%). The lowest average AVE of NTB at the 2 digit level of the HS is found for tin and products thereof (HS 80) with an average of 3%, and an average level of overall protection of 9% once tariffs are included.

There is also significant variation across countries. The simple average AVE of core NTBs goes from virtually 0 to 51% (from 0 to 39% when import-weighted). Numbers for domestic support are generally below 1%. The countries with the highest average AVE of core NTBs are all low income African countries (Algeria, Cote d'Ivoire, Morocco, Nigeria, Tanzania, and Sudan). Several middle income countries also have relatively high AVEs of core NTBs. This includes Brazil, Malaysia, Mexico and Uruguay. The countries with the highest AVEs of domestic support are European Union members.

In order to disentangle the large variation in AVEs across countries, we undertook a series of simple correlation of our estimates with GDP per capita. Figure 1 plots the graph of the

[19] Note that because of our empirical methodology the AVEs should be interpreted as the marginal contribution of core NTBs and agricultural domestic support after controlling for tariff levels.

[20] The median is 6% for manufacturing and 20% for agriculture.

log of $(ave^{\mathrm{Core}} + ave^{\mathrm{DS}})$ on log of GDP per capita. It suggests that the average AVE of NTBs increases with GDP per capita (although some middle income countries seem to have the highest AVEs of NTBs).[21] Moreover, the contribution of core NTBs and agricultural domestic support to the overall level of protection (that includes tariffs) also increases with GDP per capita. Thus, as countries become richer the relative trade restrictiveness of NTBs becomes more visible. However, the overall level of protection $T_{n,c}$ still decreases with GDP per capita, mainly driven by average tariff levels that tend to be significantly lower as countries grow richer, as shown in Figure 2. This suggests that in general tariffs and AVEs of NTBs are substitutes rather than complements, as the incidence of NTBs tend to be higher when tariffs are low.

However the question of whether tariffs and NTBs are complements or substitutes needs to be answered at the tariff line level. We therefore run three simple regressions of tariffs on the AVE of core NTBs and the AVE of agricultural domestic support across countries and tariff lines. In the first specification we include tariff line (product) dummies to control for the fact that some products may simply have higher levels of both tariffs and AVEs of NTBs than others due to political economy reasons (for example dairy products versus oil). In the second specification we include country dummies to control for the fact that some countries may have higher levels of both tariffs and AVEs of NTBs than others due to their stronger participation in multilateral and bilateral trade agreements (for example Chile versus India). Finally, our preferred specification includes both country and tariff line dummies, so that the variation captured by the coefficient on AVEs of NTBs is not affected by the positive

[21] The same pattern is observed for core NTB and agricultural domestic support separately.

correlation that may exist at the aggregate product and country level between tariffs and AVEs of NTBs. The results are reported in Table 2. In the first two columns of Table 2 when controlling for either country *or* tariff line dummies, the coefficients on AVEs of NTBs are all positive and significant. However, if one focuses on the within industry *and* country variation for which results are reported in the third column, then tariffs are negatively correlated with AVEs of core NTBs. Thus, once we control for country and product fixed effects, tariffs and core NTBs are substitutes to each other. As sometimes anecdotally reported constraints imposed by international or bilateral trade agreements on governments ability to set tariffs may induce some countries to replace them by more restrictive NTBs (and *vice-versa*).

It is difficult to provide external tests for our estimates as exercises providing AVEs of NTBs at the tariff line level are nonexistent to our knowledge. However, we can compare the country averages provided by Bradford (2003) for Australia, Canada, Japan, United States and 5 European countries (Belgium, Germany, Italy, Netherlands and the United Kingdom). These AVEs are computed using price differentials between retail prices and import prices, after correcting for transport, taxes and other distributions costs. Because AVEs are taken as residuals, they include more policy restrictions than the ones we used in this paper (e.g., exchange rate controls). Also differences in taste and quality across countries can partly explain differences in prices. For these reasons one should expect these price differentials to be higher than our AVE estimates (and they generally are). Our estimates, and Bradford (2003, Table 2) given in parenthesis, compare as follows: 9% for Australia (compared to 15%), 5% for Canada (compared to 8%), 11% for Japan (compared with 58%), 10% for the United States (compared with 9%), 13% in the European Union (compared to 32% in Belgium, 18% in Germany, 12% in Italy, 31% in the Netherlands, and 38% in the United Kingdom). There are obvious reasons why these numbers may differ, but the orders of magnitude seem more or less in line, except perhaps for Japan and some European countries (Belgium, Netherlands, and United Kingdom), where Bradford's estimates are significantly higher.[22]

Andriamananjara *et al.* (2004) also provide estimates of AVEs of NTBs for 12 groups of products (that correspond to an aggregate of the GTAP product classification). They use price data from the Economist Intelligence Unit for 18 regions/countries and estimate the impact of NTBs on retail prices controlling for several variables capturing distribution costs (GDP per capita, distance, wages in the non-traded sector, etc..). The most complete exercise is undertaken for apparel. Andriamananjara *et al.* (2004) estimate a simple average AVE of NTBs in apparel across countries of 73% (it varies between 16 and 190%). Our simple average for apparel is 39% (it varies between 0 and 249%). Thus, the order of magnitude seems a bit higher in Andriamananjara *et al.* (2004). This difference could be explained by the fact that they only report the average AVE when it is binding (i.e., they exclude products for which they found a negative AVE). Our non-linear estimation avoids this problem and includes those products in which NTBs may have a very small impact on imports (or domestic

[22] One reason for this could be that the price comparisons in Bradford (2003) assume that domestically produced goods and import goods are perfect substitutes, and ignores product differentiation, which could be quite significant in Japan. Such large differences in tastes can lead to large NTB estimates. The precision with which distribution margins are calculated can also be questioned in this type of exercises. For example, all fresh, frozen or deep frozen fish is lumped together in one product category with a single distribution markup. Given that distribution and transport costs can vary significantly between fresh and deep frozen fish, the composition of this aggregate product matters when determining the markup cost.

prices). One could therefore expect lower AVEs than in Andriamananjara *et al.* (2004).

We also compared our results for apparel with those obtained using quota license price data under the Multi-Fiber Agreement (MFA).[23,24] Early studies suggest that Hong Kong exporters to the United States paid more than 20% of the value of apparel exports to obtain the right to sell to the United States under MFA.[25] More recent estimates by Andriamananjara, Dean and Spinanger (2005) for the year 2002 suggest that Hong Kong's Export Tax Equivalent (ETE) using quota price licenses for exports to the United States is 19%. Taking the import-weighted average across all exporters to the United States for which there was positive license price data in 2002 (China, Hong Kong, India and Pakistan), the ETE obtained by Andriamananjara, Dean and Spinanger is 15%. In our data set, the import-weighted average AVE for apparel (HS 61 and 62 which includes 213 HS six-digit tariff lines) is 37% in the United States; i.e., more than double the estimates obtained using quota license price data. There are several reasons for this. First, as estimated by Krishna, Erzan and Tan (1994) US importers have market power when facing rest-of-the-world exporters, and this leads to rent-sharing. Krishna, Erzan and Tan (1994) suggest that when taking this into account the restrictiveness of MFA quotas is 18 to 100% higher than suggested by ETE estimates. Thus, the trade restrictiveness of MFA quotas in the US is somewhere between 18 and 30% once we adjust ETE estimates for rent-sharing. Second, one should note that the

[23] We are grateful to an anonymous referee for suggesting this comparison.

[24] Until January 2005 imports of apparel by major developed countries were regulated by a set of bilateral quotas under the MFA (or the quota phase-out negotiated under the Agreement on Textiles and Clothing of the Uruguay Round).

[25] For a review of the early literature see Krishna and Tan (1998). Early studies focused exclusively on Hong Kong because it was the only country that in the 1980s had a public and open market for quota licenses.

our AVE estimates captured the restrictiveness of core NTBs, which includes not only MFA quotas, but also technical regulations, and other NTBs. Around 95% of apparel tariff lines in the US have either product characteristic requirements or labeling requirements. Thus, one should expect our estimates to be higher. Third, for the ETE to capture the rent kept by exporters, the quota license price needs to be determined in a perfectly competitive market. There is evidence that this may have been the case in Hong Kong, but less so in other major exporters such as China and India, where incumbents had preferences in the allocation of quotas. Thus, quota license prices may underestimate the value of the quota for exporters (see Krishna and Tan, 1998).

We also provide a test of our methodology to calculate the AVEs of NTBs.[26] Using the observed tariff information, we created a dummy that takes the value 1 when the tariff is positive and 0 otherwise. We then use this new dummy variable and calculated its impact on imports and proceed to transform the quantity impact into a price-equivalent as we did with the NTB information.[27] We then calculated the correlation between the ad-valorem equivalents for tariffs obtained using this methodology and the actual tariffs. The correlation is 0.31 and significant at the 1% level. The average actual tariff in the sample is 10.7% with a standard deviation of 23.0%, whereas the ad-valorem equivalent of the tariff dummy has an average of 11.3 with a standard deviation of 23.7%. Overall, this suggests that the methodology we used to estimate AVEs of border barriers performs well.

[26]We are grateful to Alan Deardorff for suggesting this.

[27]On the left hand side of (2) we only had log of imports, and the tariff dummy was now on the right-hand-side. To correct for endogeneity, we instrumented using the same method used on NTBs.

4.2 Trade restrictiveness indices

Table 4 provides our estimates of TRIs, OTRIs and MA-OTRIs for 78 countries (counting European Union members as 1 country).[28] The first three columns provide estimates of trade restrictiveness using tariff data only. The following three columns show estimates that include both tariffs and NTBs. Figures in parenthesis are the bootstrap standard errors.

One can make several important observations. First, NTBs have a significant contribution to the level of trade restrictiveness measured by the three indices. Indeed, according to OTRI estimates NTBs add on average an additional 87% to the level of trade restrictiveness imposed by tariffs. In 34 countries (out of 78) the contribution of NTBs to the overall level of restrictiveness is higher than the contribution of tariffs. Thus, neglecting the restrictiveness of NTBs can be very misleading.

Second, and as discussed earlier, the TRI which uses welfare as a reference is always higher than the OTRI. On average the TRI is around 84% higher than the OTRI (regardless of whether we include NTBs or not). The largest differences between OTRIs and TRIs are to be found in countries where the tariff variance is the highest (see Anderson and Neary, 2005 or 2007). High income countries tend to be predominantly among those with a much higher TRI (and therefore a higher tariff variance), and this partly explains why they appear to be relatively more restrictive.

In order to explore how trade barriers imposed and faced by each country are associated with income levels, we plot the correlation between log of GDP per capita and each of the

[28]Estimates for the European Union are for extra-EU trade.

three trade restrictiveness indices in Figures 3 to 5. In these figures, the precision with which the trade restrictiveness index of each country is estimated is also illustrated by a vertical line that shows the 95% confidence interval for each estimate. Apart from a few exceptions in the case of MA-OTRI (Gabon, Mali, Oman and South Africa), all indices are statistically different from zero.[29]

Figure 3 shows a negative association between OTRI and log of GDP per capita suggesting that richer countries tend to impose lower trade barriers on imports. However, Figure 4 also shows a negative correlation between MA-OTRI and log of GDP per capita which suggests that richer countries face lower trade restrictions on their export bundle than do poor countries. Thus poor countries impose and face more restrictive trade regimes. This may be explained by reciprocity forces in trade agreements: countries that keep high trade barriers on their imports are likely to face high trade barriers on their export bundles in other countries.

Perhaps surprisingly there does not seem to be any clear pattern between log of GDP per capita and TRI as depicted in Figure 5. The discrepancy between OTRI and TRI patterns can be partly explained by the variance of the protection structure in rich countries (see Anderson and Neary, 2005, or Kee, Nicita and Olarreaga, forthcoming) which tends to be much higher than in developing countries. Structural adjustment programs under the World Bank and the IMF may have helped to reduce the tariff variance (and levels) in many low income countries which may partly explain this absence of pattern between TRIs and log

[29]As can be derived from Table 4, OTRIs and TRIs have an average t-statistic around 12, and they are never smaller than 3. In the case of MA-OTRI, the average t-statistic is above 5.

of GDP per capita. Countries like Ethiopia, Madagascar, Malawi, Uganda, Rwanda, and Zambia all show low levels of trade restrictiveness and were all under a large number of structural adjustment programs in the 1990s.[30]

It is difficult to provide an external test of our estimates of TRIs and OTRIs as there are no comparable numbers available across a large number of countries, except for the work of Anderson (1998). However, Anderson's numbers are for protection levels in the early 1990s and focus exclusively on the TRI. Nevertheless, we calculated the correlation between Anderson's TRI numbers and our TRI indicators for the sub-sample of 27 countries in his sample (see Table A-1 on page 1125).[31] The correlation is 0.64 and significant at the 1% level. The average TRI in his sample is 0.20 whereas ours is 0.27. This may seem odd, given that most countries have liberalized over the period, but several explanations can be provided. First, Anderson (1998) did not include technical regulations as part of his NTB variable, whereas they are included here. Second, one would expect aggregation biases inherent to the CGE application to lead to downward biased TRIs, as the volatility of the protection structure is a determinant of TRI, and volatility declines as one aggregates tariff lines to fulfil the needs of the CGE application. Finally, the partial equilibrium assumptions of our approach may lead to over-estimating the degree of trade restrictiveness as the potential for substitution across markets is frozen in our setup, whereas it is present in Anderson (1998).[32]

[30]If the move towards lower levels of trade restrictiveness was successfully achieved, unfortunately these structural adjustment programs seemed to have been less successful in achieving their objectives of higher levels of income per capita, as this group of countries remain among the poorest countries in the world.

[31]Given that in Anderson (1998) the NTB data is only available for 19 of the 27 countries, we use the TRI calculated over tariffs only for those countries.

[32]For example, a very high level of protection for coffee will not be as damaging in a setup where consumers can substitute coffee for a product which enjoys a low level of protection, such as tea.

5 Concluding remarks

This paper offers an empirical implementation of the work of Anderson and Neary (1992, 1994, 1996, 2003, 2007) by providing three theory-based indicators of trade restrictiveness. The first index, the TRI, summarizes the distortions imposed by each country's trade policies on its own welfare. The second index, the OTRI, summarizes the impact of each country's trade policies on its own imports. The third index, the MA-OTRI, summarizes the impact of other countries' trade policies on each country's exports. All indices are constructed using tariff line level data on tariff protection and the AVEs of NTBs. Standard errors are estimated for each of these indices.

Results show that while poor countries have more restrictive trade regimes, they also face higher barriers on their exports. This may be explained by reciprocity in multilateral and bilateral trade agreements: what you get in terms of market access depends on what you are ready to give up in terms of protection at home.

Our results also show that NTBs contribute to a large share of trade restrictiveness across countries. On average, they add an additional 87% to the restrictiveness imposed by tariffs. Moreover, in 34 out of the 78 countries in our sample, the restrictiveness of NTBs is larger than the restrictiveness of tariffs. Thus, NTBs should be a priority for trade negotiators, particularly for those seeking better access to developed countries' markets, where the restrictiveness of NTBs is shown to be stronger.

References

[1] Anderson, J. (1998). 'Trade restrictiveness benchmarks', ECONOMIC JOURNAL, vol. 108(449) (July), pp. 1111-1125.

[2] Anderson, J. and Neary, P. (1992). 'Trade reforms with quotas, partial rent retention and tariffs', *Econometrica*, vol. 60(1), pp. 57-76.

[3] Anderson, J. and Neary, P. (1994). 'Measuring the restrictiveness of trade policy', *World Bank Economic Review*, vol. 8(2) (May), pp. 151-169.

[4] Anderson, J., Bannister, G. and Neary, P. (1995). 'Domestic distortions and international trade', *International Economic Review*, vol. 36(1) (February), pp. 139-157.

[5] Anderson, J. and Neary, P. (1996). 'A new approach to evaluating trade policy', *Review of Economic Studies*, vol. 63(1) (January), pp. 107-125.

[6] Anderson, J. and Neary, P. (2003). 'The Mercantilist index of trade policy', *International Economic Review*, vol. 44(2) (May), pp. 627-649.

[7] Anderson, J. and Neary, P. (2005). *Measuring the Restrictiveness of Trade Policy*, Boston: MIT Press.

[8] Anderson, J. and Neary, P. (2007). 'Welfare versus market access: the implications of tariff structure for tariff reform', *Journal of International Economics*, vol. 71 (2) (March), pp. 627-649.

[9] Andriamananjara, S., Dean, J.M and Spinanger, D. (2005). 'Trading Apparel: Developing Countries in 2005', mimeo, Kiel Institute of World Economics and USITC.

[10] Andriamananjara, S., Dean, J.M., Ferrantino, M.J., Feinberg, R.M., Ludema, R.T. and Tsigas, M.E. (2004). 'The Effects of Non-Tariff Measures on Prices, Trade, and Welfare: CGE Implementation of Policy-Based Price Comparisons', http://ssrn.com/abstract=539705.

[11] Bouët, A., Decreux, I., Fontaigné, L., Jean, S. and Laborde, D. (2004). 'Computing an exhaustive and consistent, ad-valorem equivalent measure of applied protection: a detailed description of MAcMap-HS6 methodology', mimeo, CEPII, Paris.

[12] Bradford, S. (2003). 'Paying the price: final goods protection in OECD countries', *Review of Economic and Statistics*, vol. 85(1) (February), pp. 24-37.

[13] Cameron, C. and Windmeijer, F. (1997). 'An R-squared measure of goodness of fit for some common nonlinear regression models', *Journal of Econometrics*, vol. 77(2), pp. 329-342.

[14] Deardorff, A. and Stern, R. (1997). 'Measurement of non-tariff barriers', Economic Department Working Papers # 179, OECD.

[15] Dollar, D. and Kraay, A. (2003). 'Trade, growth and poverty', ECONOMIC JOURNAL, vol. 114(493) (February), F22-F49.

[16] Edwards, S. (1998). 'Openness, productivity and growth: what do we really know?', ECONOMIC JOURNAL, vol. 108(447) (March), pp. 383-398.

[17] Feenstra, R. (1995). 'Estimating the effects of trade policy', in (G. Grossman and K. Rogoff, eds.), *Handbook of International Economics*, vol. 3, Amsterdam: Elsevier.

[18] Frankel, J. and Romer, D. (1999). 'Does trade cause growth?', *American Economic Review*, vol. 89(3) (June), pp. 379-399.

[19] Grossman, G. and Helpman, E. (1994). 'Protection for Sale', *The American Economic Review*, vol. 84(4) (September), pp. 833-850.

[20] Harrigan, J. (1993). 'OECD imports and trade barriers in 1983', *Journal of International Economics*, vol. 35(1) (August), pp. 91-111.

[21] Hoekman, B., Ng, F. and Olarreaga, M. (2004). 'Agricultural tariffs versus subsidies: what's more important for developing countries', *World Bank Economic Review*, vol. 18(2) (May), pp. 175-204.

[22] Kee, H.L., Nicita, A. and Olarreaga, M. (forthcoming). 'Import demand elasticities and trade distortions', *Review of Economics and Statistics*.

[23] Krishna, K., Erzan, R. and Tan, L.H. (1994). 'Rent Sharing In the Multi-Fibre Arrangement: Theory and Evidence From US Apparel Imports From Hong Kong', *Review of International Economics*, vol. 2(1) (February), pp. 62–73.

[24] Krishna, K. and Tan, L.H. (1998). *Rags and Riches*, Ann Arbor: University of Michigan Press.

[25] Leamer, E. (1988). 'Cross-section estimation of the effects of trade barriers', in (Robert Feenstra, ed.), *Empirical Methods for International Trade*, Boston: MIT Press.

[26] Leamer, E. (1990). 'Latin America as a target of trade barriers erected by the major developed countries in 1983', *Journal of Development Economics*, vol. 32(2) (April), pp. 337-368.

[27] Lee, J. and Swagel, P.. (1997). 'Trade barriers and trade flows across countries and industries', *Review of Economics and Statistics*, vol. 79(3) (August), pp. 372-382.

[28] Mayer, T. and Zignago, S. (2003). "Border effects of the Atlantic Triangle", mimeo, paper presented at the RIN conference in Punta del Este, December.

[29] Melitz, M. (2003). 'The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity', *Econometrica*, , vol. 71(6) (November), pp. 1695-1725.

[30] Nogues, J., Olechowski, A. and Winters, L.A. (1986). 'Extent of non-tariff barriers to industrial countries' imports', *World Bank Economic Review* (September), vol. 1(1), pp. 181-99.

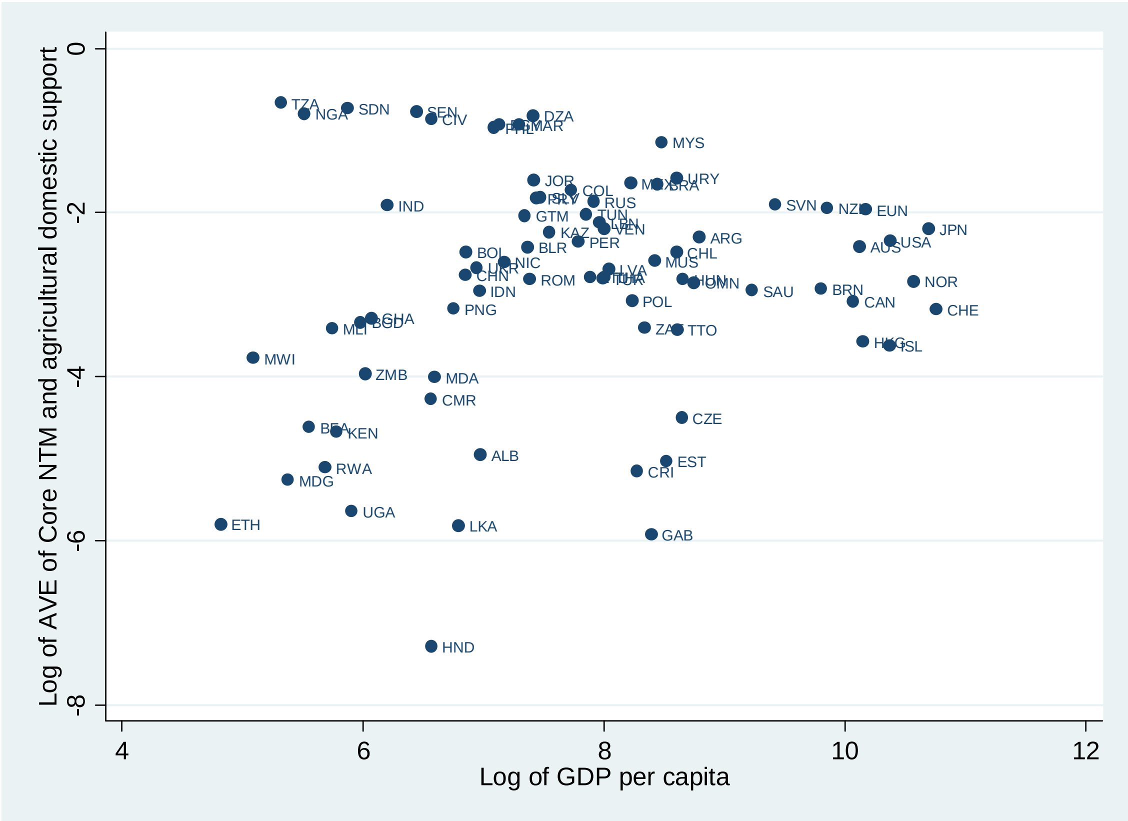
[31] OECD (1995). 'Patterns and pervasiveness of tariff and non-tariff barriers to trade in OECD member countries', ECO/CPE/WP1/GE(96)/3, Paris.

[32] Rodríguez, F. and Rodrik, D. (2001). 'Trade Policy and growth: a skeptic's guide to the cross national evidence', in (Ben Bernanke and Kenneth S. Rogoff, eds.), *Macroeconomics Annual 2000*, Cambridge: MIT Press for NBER.

[33] Shepherd, B. (2004). 'EU standards database', mimeo, Science Po, Paris.

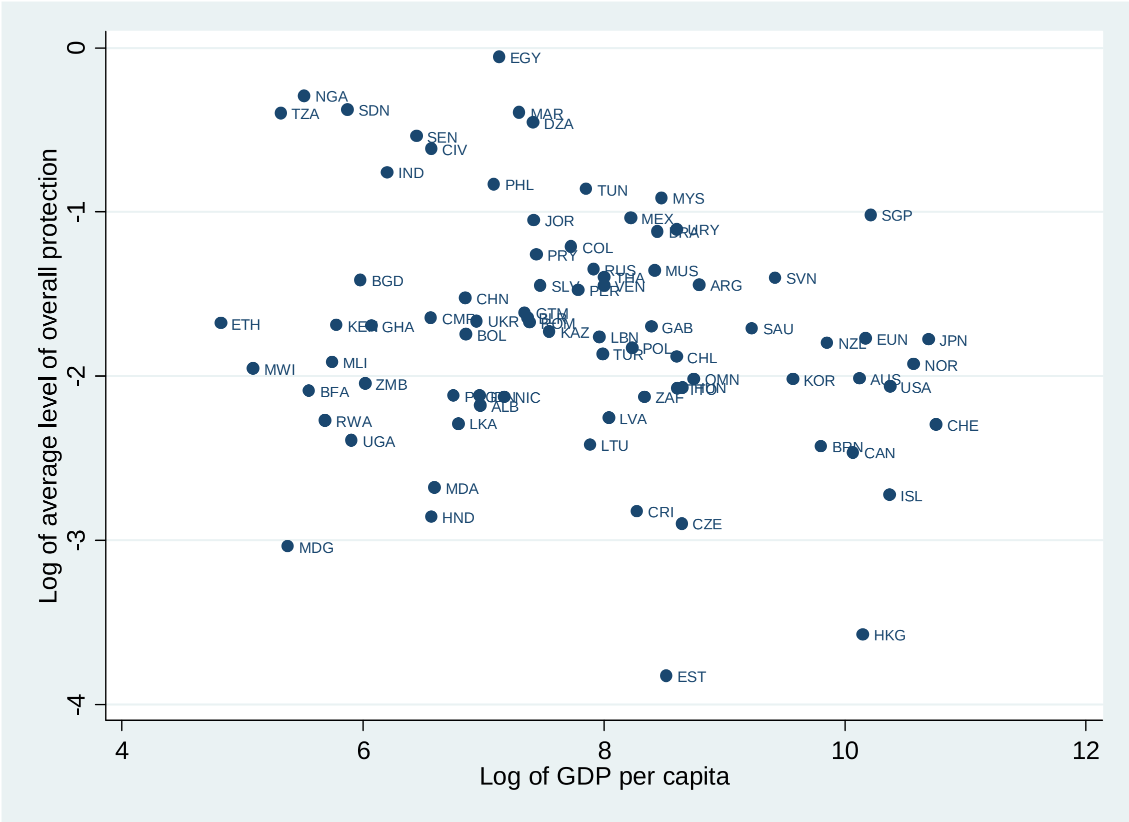
[34] Trefler, D. (1993). 'Trade Liberalization and the theory of endogenous protection: an econometric study of US import policy', *Journal of Political Economy*, vol. 101(1) (February), pp. 138-160.

Fig. 1: Ad-valorem equivalents of NTBs and economic development



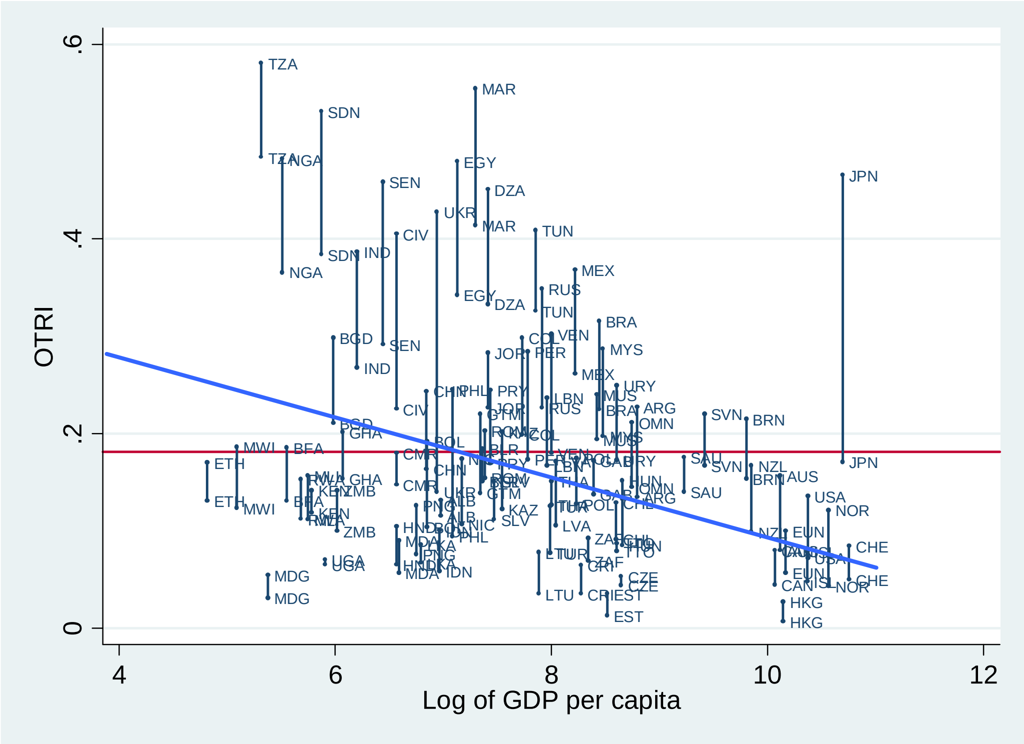
Note: NTBs include Core NTBs and agricultural domestic support

Fig. 2: Overall average level of protection and economic development



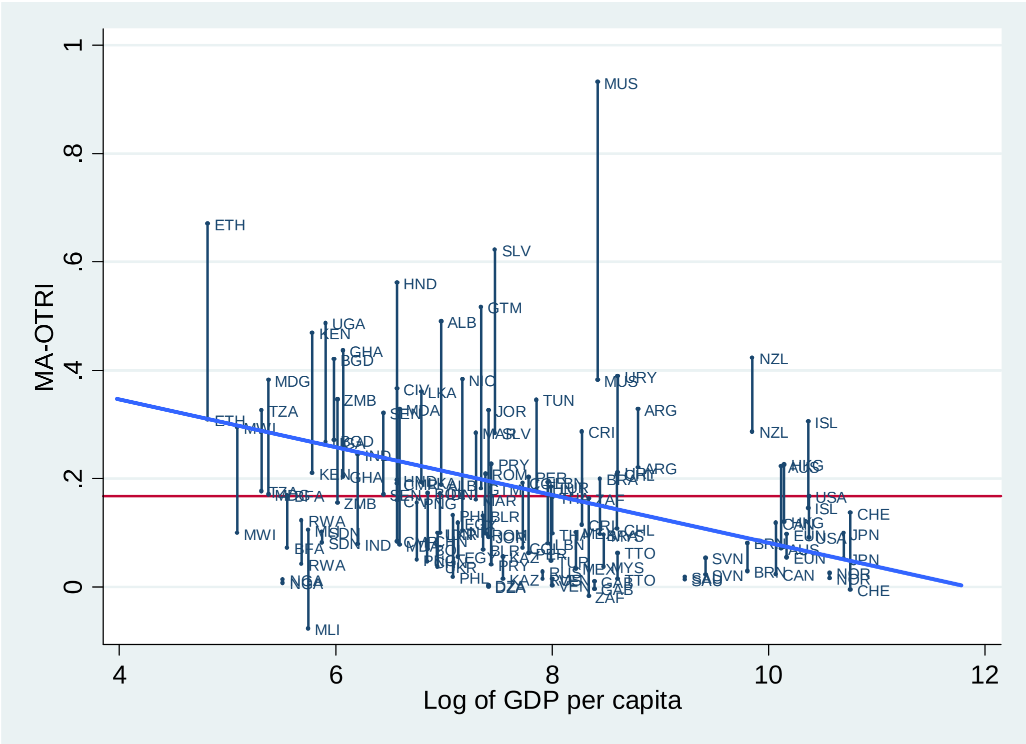
Note: The overall level of protection includes tariffs, and AVEs of Core NTBs and agricultural domestic support. The average level of overall protection is calculated as a simple average.

Fig. 3: OTRI and economic development



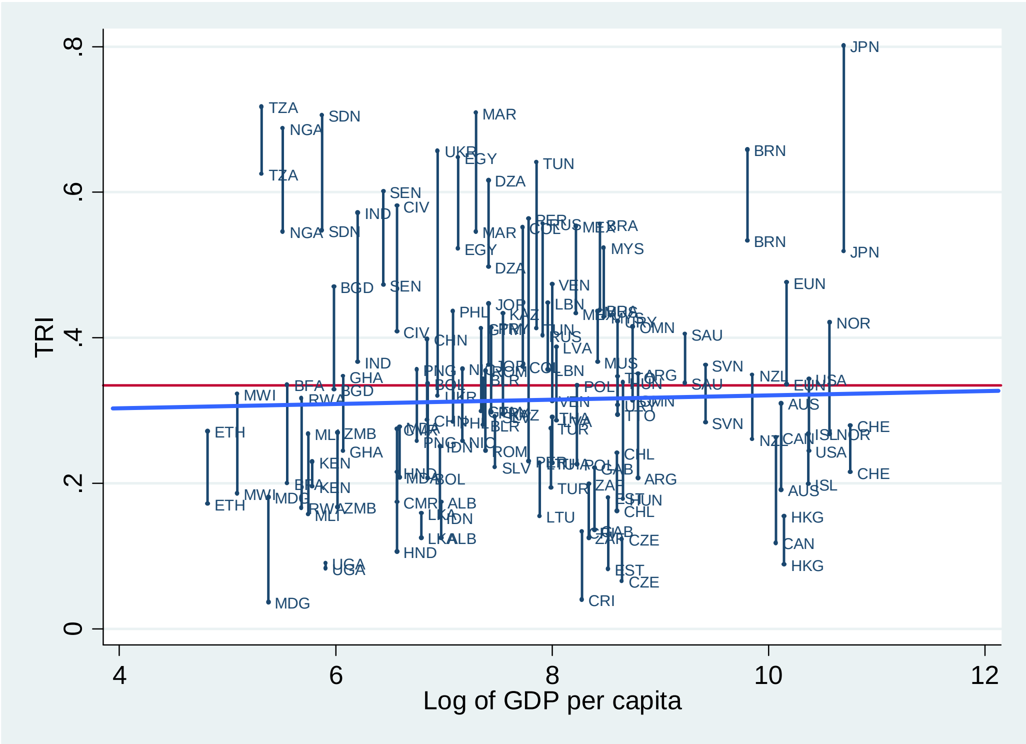
Note: Each line represents the 95% confidence interval for each country. The red line is the sample OTRI average. The blue line shows the regression line of Log of GDP per capita on OTRI. It has a slope equal to -0.021 which is statistically significant at the 1% level.

Fig. 4: MA-OTRI and economic development



Note: Each line represents the 95% confidence interval for each country. The red line is the sample MA-OTRI average. The blue line shows the regression line of Log of GDP per capita on MA-OTRI. It has a slope equal to -0.025 which is statistically significant at the 1% level.

Fig. 5: TRI and economic development



Note: Each line represents the 95% confidence interval for each country. The red line is the sample TRI average. The blue line shows the regression line of Log of GDP per capita on TRI. It has a slope equal to 0.001 which is not statistically significant.

Tables 1 to 4 of

Estimating Trade Restrictiveness Indices

by Kee, Nicita and Olarreaga

Table 1: *Frequency ratios*[a]

Country	Tariff Year	Core NTB Year	Simple Frequency ratio Non-Zero Tariffs	Simple Frequency ratio of of Domestic Support	Simple Frequency ratio of Core NTB	Import Weighted Frequency ratio of Non-zero Tariffs	Import Weighted Frequency ratio of Domestic Support	Import Weighted Frequency ratio of Core NTB
ALB	2002	1997	0.99	0.00	0.02	0.98	0.00	0.03
ARG	2002	2001	0.99	0.00	0.27	0.65	0.00	0.25
AUS	2002	1999	0.55	0.00	0.22	0.69	0.00	0.34
BFA	2003	1997	0.98	0.00	0.02	0.90	0.00	0.18
BGD	2001	2000	0.94	0.00	0.11	0.99	0.00	0.31
BLR	2002	1996	0.99	0.00	0.24	0.90	0.00	0.28
BOL	2002	2001	0.96	0.00	0.19	0.89	0.00	0.29
BRA	2002	2001	0.97	0.00	0.46	0.30	0.01	0.59
BRN	2002	2001	0.24	0.00	0.14	0.92	0.00	0.12
CAN	2002	2000	0.61	0.00	0.15	0.73	0.00	0.20
CHE	2004	1996	0.84	0.00	0.15	1.00	0.00	0.23
CHL	2003	2001	1.00	0.00	0.27	0.96	0.00	0.22
CHN	2002	2001	0.98	0.00	0.19	0.94	0.00	0.35
CIV	2002	2001	0.99	0.00	1.00	0.99	0.00	1.00
CMR	2002	1997	0.99	0.00	0.05	0.94	0.00	0.11
COL	2003	2001	0.99	0.01	0.51	0.58	0.03	0.53
CRI	2002	1998	0.52	0.00	0.02	0.80	0.00	0.05
CZE	2003	1999	0.81	0.00	0.06	0.72	0.00	0.08
DZA	2003	2001	0.99	0.00	1.00	0.90	0.00	1.00
EGY	2000	2001	0.99	0.00	1.00	0.71	0.00	1.00
EST	2003	1996	0.06	0.00	0.02	0.93	0.00	0.05
ETH	2003	1995	0.97	0.00	0.01	0.60	0.00	0.12
EUN	2004	1999	0.83	0.01	0.29	0.93	0.01	0.19
GAB	2002	1994	0.99	0.00	0.01	0.71	0.00	0.04
GHA	2004	1995	0.87	0.00	0.10	1.00	0.00	0.10
GTM	2001	1998	0.53	0.00	0.34	0.00	0.00	0.41
HKG	2003	1994	0.00	0.00	0.10	0.55	0.00	0.11
HND	2003	1998	0.53	0.00	0.00	0.84	0.00	0.05
HUN	2003	1999	0.90	0.00	0.20	0.63	0.00	0.16
IDN	2003	1999	0.80	0.00	0.13	0.99	0.00	0.14
IND	2003	1997	0.99	0.00	0.43	0.52	0.00	0.51
ISL	2002	1996	0.29	0.00	0.08	0.74	0.00	0.11
JOR	2002	2001	0.82	0.00	0.51	0.40	0.00	0.65
JPN	2003	2001	0.56	0.00	0.32	0.40	0.01	0.42
KAZ	2000	1999	0.75	0.00	0.26	0.72	0.00	0.36
KEN	2002	1993	0.93	0.00	0.02	0.79	0.00	0.04
LBN	2003	1999	0.63	0.00	0.31	0.57	0.00	0.44
LKA	2002	1994	0.81	0.00	0.01	0.28	0.00	0.01
LTU	2002	1999	0.26	0.00	0.17	0.50	0.00	0.21
LVA	2001	1996	0.70	0.00	0.18	1.00	0.00	0.31
MAR	2002	2001	1.00	0.00	1.00	0.40	0.02	1.00
MDA	2003	1995	0.59	0.00	0.05	0.65	0.00	0.09
MDG	2001	1995	0.62	0.00	0.01	0.96	0.00	0.06
MEX	2003	2001	0.99	0.00	0.60	0.95	0.01	0.58
MLI	2001	1995	0.99	0.00	0.07	0.98	0.00	0.15
MUS	2002	1995	0.45	0.00	0.19	0.84	0.00	0.23
MWI	2001	1996	0.90	0.00	0.05	0.29	0.00	0.03
MYS	2002	2001	0.47	0.00	1.00	1.00	0.00	1.00
NGA	2003	2001	1.00	0.00	1.00	0.61	0.00	1.00
NIC	2002	2001	0.51	0.00	0.15	0.64	0.00	0.33
NOR	2003	1996	0.25	0.00	0.15	0.98	0.00	0.13
NZL	2001	1999	0.45	0.00	0.39	0.92	0.00	0.53
OMN	2002	1999	0.96	0.00	0.14	1.00	0.00	0.14
PER	2000	2001	1.00	0.02	0.25	0.51	0.08	0.40
PHL	2003	2001	0.98	0.00	1.00	0.20	0.00	1.00
PNG	2001	1997	0.23	0.00	0.12	0.93	0.00	0.10
POL	2003	1999	0.96	0.00	0.14	0.80	0.00	0.22
PRY	2003	2001	0.99	0.00	0.35	0.91	0.00	0.40
ROM	2001	1999	0.94	0.00	0.20	0.99	0.00	0.17
RUS	2002	1997	0.99	0.00	0.39	0.90	0.00	0.63
RWA	2003	1994	0.93	0.00	0.01	0.91	0.00	0.07
SAU	2003	1999	0.97	0.00	0.16	0.99	0.00	0.16
SDN	2003	2001	0.99	0.00	1.00	0.95	0.00	1.00
SEN	2003	2001	0.99	0.00	1.00	0.00	0.00	1.00
SLV	2002	1997	0.54	0.00	0.39	0.92	0.00	0.32
SVN	2003	1999	0.91	0.00	0.41	0.77	0.00	0.41
THA	2001	2001	0.98	0.00	0.16	0.93	0.00	0.10
TTO	2004	1992	0.96	0.00	0.09	0.89	0.00	0.04
TUN	2004	1999	0.91	0.00	0.36	0.76	0.03	0.55
TUR	2002	1997	0.86	0.00	0.18	0.96	0.01	0.28
TZA	2004	2001	0.98	0.00	1.00	0.70	0.00	1.00
UGA	2002	1993	0.83	0.00	0.01	0.54	0.00	0.00
UKR	2003	1997	0.82	0.00	0.17	0.98	0.00	0.51
URY	2003	2001	0.98	0.00	0.51	0.86	0.02	0.54
USA	2003	1999	0.76	0.00	0.27	0.98	0.00	0.44
VEN	2003	2001	0.99	0.00	0.35	0.71	0.02	0.47
ZAF	2003	1999	0.49	0.00	0.10	0.68	0.01	0.06
ZMB	2002	1993	0.76	0.00	0.05	0.93	0.00	0.08

[a]All numbers are in %, except for years in the first two columns. The third to fifth columns are simple frequency ratio and the last three columns are import-weighted frequency ratios. For country names corresponding to the country codes, see Tables 3 or 4.

Table 2: *Tariffs and NTBs: complements or substitutes?* [a]

	ln (1+tariff)		
ln (1+ AVE of Core NTBs)	0.031***	0.037***	-0.003***
	(0.001)	(0.001)	(0.001)
ln (1+ AVE of Ag. Support)	0.110***	0.035**	0.067***
	(0.020)	(0.015)	(0.016)
Constant	0.085***	0.084***	0.145***
	(0.001)	0.001	0.001
Product dummies	Yes	No	Yes
Country dummies	No	Yes	Yes
R^2-adjusted	0.274	0.171	0.436
# observations	442773	442773	442773

[a] White robust standard errors are in parenthesis; *** stands for significance at the 1% level; ** stands for significance at the 5% level and * for significance at the 10% level.

Table 3: ***Summary Statistics of AVE estimates***[a]

Country code	Country name	$e^{\beta^{\text{Core}}}-1$	β^{DS}	AVE of core NTB all lines	AVE of core NTB if core NTB=1	AVE of ag. DS all lines	AVE of ag. DS if DS> 0	Share of binding core NTB	Share of binding ag. DS
ALB	Albania	-0.008	0.000	0.007	0.326	0.000		0.139	
ARG	Argentina	-0.112	-0.001	0.100	0.389	0.000	0.000	0.175	0.000
AUS	Australia	-0.105	-0.001	0.089	0.416	0.001	0.534	0.158	0.000
BFA	Burkina Faso	-0.010	0.000	0.010	0.448	0.000		0.171	
BGD	Bangladesh	-0.041	0.000	0.036	0.339	0.000		0.187	
BLR	Belarus	-0.094	0.000	0.089	0.389	0.000		0.205	
BOL	Bolivia	-0.093	0.000	0.084	0.458	0.000		0.168	
BRA	Brazil	-0.206	-0.002	0.188	0.428	0.002	0.498	0.190	0.045
BRN	Brunei	-0.059	0.000	0.053	0.399	0.000		0.208	
CAN	Canada	-0.060	-0.002	0.045	0.325	0.001	0.205	0.169	0.048
CHE	Switzerland	-0.049	-0.001	0.041	0.290	0.001	0.261	0.141	0.000
CHL	Chile	-0.090	0.000	0.083	0.325	0.000	0.229	0.114	0.000
CHN	China	-0.076	0.000	0.063	0.350	0.000		0.190	
CIV	Cote d'Ivoire	-0.462	0.000	0.423	0.423	0.000		0.171	
CMR	Cameroon	-0.021	0.000	0.014	0.299	0.000		0.061	
COL	Colombia	-0.190	-0.003	0.174	0.354	0.004	0.562	0.123	0.034
CRI	Costa Rica	-0.007	0.000	0.006	0.363	0.000		0.092	
CZE	Czech R.	-0.013	-0.001	0.011	0.191	0.000		0.107	
DZA	Algeria	-0.477	0.000	0.441	0.441	0.000		0.206	
EGY	Egypt	-0.447	0.000	0.395	0.395	0.000		0.189	
EST	Estonia	-0.009	0.000	0.007	0.288	0.000		0.120	
ETH	Ethiopia	-0.004	0.000	0.003	0.482	0.000		0.233	
EUN	European Union	-0.154	-0.008	0.134	0.450	0.006	0.327	0.283	0.081
GAB	Gabon	-0.003	0.000	0.003	0.283	0.000		0.133	
GHA	Ghana	-0.042	0.000	0.037	0.401	0.000		0.088	
GTM	Guatemala	-0.141	0.000	0.131	0.375	0.000		0.185	
HKG	Hong Kong	-0.031	0.000	0.028	0.292	0.000		0.150	
HND	Honduras	-0.001	0.000	0.001	0.543	0.000		0.167	
HUN	Hungary	-0.069	-0.001	0.059	0.309	0.001	0.289	0.137	0.071
IDN	Indonesia	-0.065	0.000	0.052	0.414	0.000		0.146	
IND	India	-0.185	0.000	0.147	0.357	0.000	2.004	0.093	0.000
ISL	Iceland	-0.033	0.000	0.026	0.361	0.000	0.204	0.127	0.100
JOR	Jordan	-0.214	0.000	0.202	0.413	0.000		0.259	
JPN	Japan	-0.139	0.000	0.111	0.346	0.000	0.100	0.120	0.071
KAZ	Kazakhstan	-0.117	0.000	0.107	0.425	0.000		0.113	
KEN	Kenya	-0.011	0.000	0.009	0.376	0.000		0.161	
LBN	Lebanon	-0.122	0.000	0.120	0.400	0.000		0.189	
LKA	Sri Lanka	-0.003	0.000	0.003	0.444	0.000		0.063	
LTU	Lithuania	-0.064	0.000	0.062	0.373	0.000		0.174	
LVA	Latvia	-0.079	0.000	0.068	0.398	0.000		0.222	
MAR	Morocco	-0.423	0.000	0.394	0.394	0.000	0.395	0.173	0.000
MDA	Moldova	-0.021	0.000	0.018	0.359	0.000		0.156	
MDG	Madagascar	-0.005	0.000	0.005	0.442	0.000		0.196	
MEX	Mexico	-0.219	0.000	0.193	0.336	0.001	0.306	0.155	0.000
MLI	Mali	-0.036	0.000	0.033	0.458	0.000		0.041	
MUS	Mauritius	-0.079	0.000	0.075	0.421	0.000		0.206	
MWI	Malawi	-0.026	0.000	0.023	0.429	0.000		0.094	
MYS	Malaysia	-0.355	0.000	0.319	0.319	0.000		0.186	
NGA	Nigeria	-0.500	0.000	0.453	0.453	0.000		0.206	
NIC	Nicaragua	-0.080	0.000	0.074	0.490	0.000		0.174	
NOR	Norway	-0.068	0.000	0.059	0.399	0.000	0.052	0.169	0.100
NZL	New Zealand	-0.155	0.000	0.143	0.383	0.000		0.185	
OMN	Oman	-0.066	0.000	0.058	0.431	0.000		0.206	
PER	Peru	-0.102	-0.008	0.089	0.367	0.005	0.277	0.120	0.082
PHL	Philippines	-0.431	0.000	0.382	0.382	0.000	0.024	0.199	0.000
PNG	Papua N. Guinea	-0.049	0.000	0.042	0.367	0.000		0.079	
POL	Poland	-0.054	-0.001	0.046	0.351	0.000	0.149	0.136	0.133
PRY	Paraguay	-0.169	0.000	0.162	0.482	0.000		0.219	
ROM	Romania	-0.066	0.000	0.060	0.317	0.000		0.142	
RUS	Russia	-0.183	0.000	0.155	0.417	0.000		0.201	
RWA	Rwanda	-0.006	0.000	0.006	0.478	0.000		0.233	
SAU	Saudi Arabia	-0.050	0.000	0.052	0.337	0.000		0.131	
SDN	Sudan	-0.528	0.000	0.481	0.481	0.000		0.172	
SEN	Senegal	-0.500	0.000	0.465	0.465	0.000		0.182	
SLV	El Salvador	-0.158	0.000	0.163	0.443	0.000		0.221	
SVN	Slovenia	-0.161	-0.001	0.148	0.374	0.001	0.183	0.212	0.111
THA	Thailand	-0.074	0.000	0.061	0.386	0.000	0.081	0.135	0.000
TTO	Trinidad and T.	-0.036	0.000	0.032	0.360	0.000	0.111		
TUN	Tunisia	-0.145	-0.001	0.132	0.390	0.000	0.194	0.191	0.000
TUR	Turkey	-0.068	0.000	0.060	0.347	0.001	0.340	0.226	0.125
TZA	Tanzania	-0.568	0.000	0.514	0.514	0.000		0.255	
UGA	Uganda	-0.004	0.000	0.004	0.482	0.000		0.086	
UKR	Ukraine	-0.075	0.000	0.069	0.421	0.000		0.233	
URY	Uruguay	-0.226	0.000	0.206	0.420	0.001	0.280	0.174	0.000
USA	United States	-0.108	-0.002	0.095	0.374	0.001	0.166	0.113	0.000
VEN	Venezuela	-0.123	-0.001	0.111	0.332	0.000	0.170	0.127	0.000
ZAF	South Africa	-0.040	-0.002	0.032	0.330	0.001	0.158	0.093	0.000
ZMB	Zambia	-0.021	0.000	0.019	0.443	0.000		0.120	

[a]The first column is the average impact of core NTB on imports, and the second column is the average impact of agricultural domestic support on imports (across all lines). The next two columns provide the average level of AVEs of core NTB across all lines (third column), and across lines for which there is a NTB in that country. Columns four and five provide similar AVE statistics, but for agricultural domestic support. The last two column provides the share of tariff lines where core NTBs and agricultural domestic support are binding (i.e., statistically different from zero at the 5% level).

Table 4: ***Trade Restrictiveness Indices***[a]

Country code	Country name	Tariffs only			Tariffs & NTBs		
		OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	TRI
ALB	Albania	0.118	0.022	0.134	0.124	0.340	0.150
		(0.002)	(0.005)	(0.001)	(0.004)	(0.076)	(0.013)
ARG	Argentina	0.130	0.064	0.142	0.181	0.275	0.279
		(0.002)	(0.004)	(0.002)	(0.024)	(0.029)	(0.037)
AUS	Australia	0.061	0.095	0.099	0.119	0.147	0.250
		(0.004)	(0.023)	(0.006)	(0.020)	(0.037)	(0.030)
BFA	Burkina Faso	0.107	0.029	0.123	0.158	0.121	0.268
		(0.000)	(0.009)	(0.000)	(0.014)	(0.024)	(0.035)
BGD	Bangladesh	0.179	0.028	0.227	0.255	0.346	0.399
		(0.005)	(0.000)	(0.005)	(0.022)	(0.036)	(0.036)
BLR	Belarus	0.086	0.051	0.109	0.168	0.101	0.312
		(0.001)	(0.004)	(0.001)	(0.008)	(0.017)	(0.016)
BOL	Bolivia	0.080	0.011	0.086	0.148	0.122	0.272
		(0.003)	(0.005)	(0.002)	(0.022)	(0.030)	(0.033)
BRA	Brazil	0.106	0.073	0.131	0.270	0.149	0.497
		(0.003)	(0.004)	(0.004)	(0.023)	(0.025)	(0.030)
BRN	Brunei	0.130	0.018	0.551	0.185	0.056	0.596
		(0.008)	(0.001)	(0.027)	(0.016)	(0.013)	(0.032)
CAN	Canada	0.029	0.028	0.076	0.063	0.072	0.191
		(0.001)	(0.007)	(0.003)	(0.009)	(0.023)	(0.037)
CHE	Switzerland	0.040	0.027	0.175	0.067	0.066	0.247
		(0.004)	(0.004)	(0.018)	(0.009)	(0.036)	(0.016)
CHL	Chile	0.069	0.022	0.069	0.110	0.158	0.202
		(0.000)	(0.001)	(0.000)	(0.010)	(0.026)	(0.020)
CHN	China	0.140	0.024	0.211	0.204	0.066	0.343
		(0.005)	(0.000)	(0.011)	(0.020)	(0.010)	(0.028)
CIV	Cote d'Ivoire	0.095	0.029	0.119	0.315	0.263	0.495
		(0.005)	(0.003)	(0.005)	(0.046)	(0.052)	(0.044)
CMR	Cameroon	0.140	0.032	0.161	0.164	0.138	0.224
		(0.005)	(0.002)	(0.006)	(0.008)	(0.027)	(0.026)
COL	Colombia	0.114	0.046	0.134	0.249	0.132	0.456
		(0.003)	(0.010)	(0.004)	(0.025)	(0.031)	(0.049)
CRI	Costa Rica	0.048	0.079	0.079	0.050	0.202	0.087
		(0.001)	(0.007)	(0.004)	(0.007)	(0.049)	(0.024)
CZE	Czech Rep.	0.043	0.012	0.064	0.049	0.027	0.094
		(0.001)	(0.002)	(0.001)	(0.002)	(0.005)	(0.015)
DZA	Algeria	0.131	0.002	0.161	0.392	0.002	0.557
		(0.002)	(0.000)	(0.002)	(0.030)	(0.001)	(0.030)
EGY	Egypt	0.129	0.026	0.224	0.411	0.088	0.586
		(0.003)	(0.003)	(0.006)	(0.035)	(0.015)	(0.032)
EST	Estonia	0.009	0.018	0.049	0.024	0.064	0.132
		(0.000)	(0.002)	(0.001)	(0.006)	(0.009)	0.025)

[a]Bootstrapped standard errors in parenthesis.

Country code	Country name	Tariffs only			Tariffs & NTBs		
		OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	TRI
ETH	Ethiopia	0.139	0.036	0.185	0.151	0.490	0.222
		(0.004)	(0.012)	(0.005)	(0.010)	(0.089)	(0.025)
EUN	European Union	0.017	0.028	0.078	0.079	0.086	0.406
		(0.001)	(0.002)	(0.006)	(0.011)	(0.014)	(0.036)
GAB	Gabon	0.155	0.002	0.178	0.155	0.003	0.178
		(0.001)	(0.000)	(0.001)	(0.009)	(0.003)	(0.022)
GHA	Ghana	0.145	0.017	0.247	0.178	0.321	0.296
		(0.003)	(0.007)	(0.004)	(0.012)	(0.062)	(0.026)
GTM	Guatemala	0.070	0.049	0.098	0.180	0.349	0.356
		(0.001)	(0.014)	(0.001)	(0.021)	(0.084)	(0.029)
HKG	Hong Kong	0.000	0.054	0.000	0.017	0.174	0.122
		(0.000)	(0.001)	(0.000)	(0.005)	(0.025)	(0.017)
HND	Honduras	0.068	0.074	0.092	0.085	0.379	0.161
		(0.005)	(0.003)	(0.003)	(0.010)	(0.087)	(0.028)
HUN	Hungary	0.063	0.020	0.090	0.119	0.055	0.259
		(0.001)	(0.003)	(0.002)	(0.017)	(0.012)	(0.041)
IDN	Indonesia	0.046	0.049	0.086	0.080	0.136	0.202
		(0.004)	(0.007)	(0.006)	(0.011)	(0.018)	(0.025)
IND	India	0.261	0.048	0.303	0.327	0.162	0.469
		(0.008)	(0.001)	(0.015)	(0.030)	(0.041)	(0.052)
ISL	Iceland	0.031	0.013	0.128	0.064	0.226	0.234
		(0.001)	(0.001)	(0.004)	(0.008)	(0.042)	(0.018)
JOR	Jordan	0.119	0.035	0.163	0.255	0.209	0.405
		(0.001)	(0.002)	(0.001)	(0.014)	(0.057)	(0.022)
JPN	Japan	0.091	0.047	0.418	0.319	0.076	0.660
		(0.021)	(0.002)	(0.056)	(0.075)	(0.011)	(0.072)
KAZ	Kazakhstan	0.044	0.006	0.074	0.162	0.036	0.364
		(0.001)	(0.000)	(0.001)	(0.020)	(0.011)	(0.035)
KEN	Kenya	0.122	0.031	0.189	0.131	0.340	0.213
		(0.007)	(0.003)	(0.006)	(0.006)	(0.062)	(0.009)
LBN	Lebanon	0.058	0.045	0.100	0.202	0.137	0.402
		(0.001)	(0.005)	(0.002)	(0.018)	(0.028)	(0.023)
LKA	Sri Lanka	0.076	0.072	0.141	0.076	0.277	0.142
		(0.004)	(0.003)	(0.005)	(0.005)	(0.038)	(0.009)
LTU	Lithuania	0.021	0.033	0.064	0.057	0.116	0.191
		(0.001)	(0.002)	(0.004)	(0.011)	(0.013)	(0.019)
LVA	Latvia	0.028	0.013	0.073	0.139	0.046	0.337
		(0.001)	(0.001)	(0.001)	(0.017)	(0.007)	(0.026)
MAR	Morocco	0.235	0.027	0.279	0.484	0.223	0.627
		(0.002)	(0.001)	(0.002)	(0.036)	(0.029)	(0.042)
MDA	Moldova	0.048	0.049	0.205	0.074	0.203	0.243
		(0.002)	(0.008)	(0.007)	(0.008)	(0.064)	(0.018)
MDG	Madagascar	0.031	0.031	0.050	0.043	0.277	0.109
		(0.003)	(0.012)	(0.003)	(0.006)	(0.053)	(0.037)

Country code	Country name	Tariffs only			Tariffs & NTBs		
		OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	TRI
MEX	Mexico	0.153	0.001	0.203	0.315	0.067	0.493
		(0.005)	(0.000)	(0.007)	(0.027)	(0.016)	(0.031)
MLI	Mali	0.097	0.012	0.112	0.135	0.015	0.213
		(0.003)	(0.001)	(0.003)	(0.011)	(0.047)	(0.028)
MUS	Mauritius	0.126	0.174	0.239	0.217	0.657	0.402
		(0.001)	(0.106)	(0.002)	(0.012)	(0.139)	(0.018)
MWI	Malawi	0.101	0.099	0.132	0.156	0.197	0.254
		(0.002)	(0.046)	(0.002)	(0.016)	(0.050)	(0.035)
MYS	Malaysia	0.058	0.018	0.263	0.242	0.067	0.476
		(0.003)	(0.002)	(0.024)	(0.023)	(0.015)	(0.024)
NGA	Nigeria	0.224	0.003	0.313	0.424	0.012	0.617
		(0.015)	(0.000)	(0.034)	(0.030)	(0.002)	(0.036)
NIC	Nicaragua	0.050	0.041	0.080	0.141	0.243	0.307
		(0.002)	(0.005)	(0.004)	(0.017)	(0.069)	(0.025)
NOR	Norway	0.049	0.004	0.267	0.083	0.022	0.345
		(0.011)	(0.001)	(0.035)	(0.020)	(0.003)	(0.039)
NZL	New Zealand	0.028	0.063	0.046	0.133	0.355	0.305
		(0.000)	(0.002)	(0.001)	(0.017)	(0.036)	(0.023)
OMN	Oman	0.119	0.009	0.261	0.178	0.010	0.365
		(0.008)	(0.000)	(0.015)	(0.017)	(0.006)	(0.026)
PER	Peru	0.127	0.018	0.129	0.229	0.133	0.397
		(0.001)	(0.001)	(0.001)	(0.028)	(0.034)	(0.085)
PHL	Philippines	0.030	0.015	0.061	0.170	0.076	0.361
		(0.001)	(0.004)	(0.003)	(0.038)	(0.028)	(0.039)
PNG	Papua N. Guinea	0.032	0.013	0.155	0.101	0.104	0.308
		(0.001)	(0.001)	(0.006)	(0.013)	(0.029)	(0.025)
POL	Poland	0.107	0.022	0.154	0.152	0.062	0.281
		(0.004)	(0.003)	(0.006)	(0.012)	(0.011)	(0.028)
PRY	Paraguay	0.108	0.032	0.124	0.207	0.135	0.356
		(0.001)	(0.014)	(0.001)	(0.019)	(0.050)	(0.030)
ROM	Romania	0.121	0.011	0.157	0.179	0.154	0.300
		(0.004)	(0.001)	(0.002)	(0.012)	(0.027)	(0.028)
RUS	Russia	0.103	0.012	0.126	0.288	0.022	0.480
		(0.003)	(0.001)	(0.004)	(0.031)	(0.003)	(0.039)
RWA	Rwanda	0.091	0.025	0.116	0.133	0.083	0.242
		(0.001)	(0.009)	(0.001)	(0.010)	(0.021)	(0.038)
SAU	Saudi Arabia	0.141	0.014	0.353	0.158	0.016	0.371
		(0.001)	(0.000)	(0.011)	(0.009)	(0.001)	(0.017)
SDN	Sudan	0.167	0.066	0.206	0.458	0.093	0.627
		(0.004)	(0.002)	(0.004)	(0.037)	(0.005)	(0.040)
SEN	Senegal	0.087	0.054	0.109	0.375	0.246	0.537
		(0.001)	(0.002)	(0.001)	(0.043)	(0.041)	(0.033)
SLV	El Salvador	0.061	0.079	0.095	0.132	0.454	0.257
		(0.002)	(0.011)	(0.003)	(0.010)	(0.080)	(0.018)

Country code	Country name	Tariffs only			Tariffs & NTBs		
		OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	TRI
SVN	Slovenia	0.104	0.013	0.123	0.194	0.038	0.323
		(0.001)	(0.001)	(0.001)	(0.014)	(0.008)	(0.020)
THA	Thailand	0.113	0.039	0.175	0.139	0.132	0.259
		(0.001)	(0.018)	(0.002)	(0.006)	(0.017)	(0.016)
TTO	Trinidad and T.	0.073	0.012	0.300	0.083	0.039	0.321
		(0.001)	(0.006)	(0.011)	(0.002)	(0.012)	(0.013)
TUN	Tunisia	0.233	0.057	0.306	0.368	0.264	0.527
		(0.003)	(0.004)	(0.004)	(0.021)	(0.041)	(0.058)
TUR	Turkey	0.042	0.019	0.096	0.102	0.117	0.235
		(0.002)	(0.002)	(0.005)	(0.012)	(0.033)	(0.021)
TZA	Tanzania	0.130	0.038	0.154	0.533	0.251	0.671
		(0.002)	(0.013)	(0.002)	(0.025)	(0.036)	(0.024)
UGA	Uganda	0.067	0.015	0.084	0.068	0.377	0.087
		(0.001)	(0.001)	(0.001)	(0.001)	(0.055)	(0.002)
UKR	Ukraine	0.064	0.023	0.160	0.285	0.069	0.489
		(0.006)	(0.001)	(0.023)	(0.073)	(0.015)	(0.086)
URY	Uruguay	0.097	0.057	0.118	0.211	0.300	0.365
		(0.002)	(0.004)	(0.003)	(0.019)	(0.045)	(0.029)
USA	United States	0.026	0.064	0.051	0.104	0.130	0.294
		(0.001)	(0.012)	(0.001)	(0.016)	(0.020)	(0.025)
VEN	Venezuela	0.136	0.005	0.159	0.242	0.009	0.393
		(0.007)	(0.000)	(0.007)	(0.031)	(0.003)	(0.041)
ZAF	South Africa	0.072	0.040	0.136	0.081	0.074	0.162
		(0.005)	(0.006)	(0.007)	(0.006)	(0.046)	(0.019)
ZMB	Zambia	0.087	0.016	0.115	0.121	0.252	0.219
		(0.001)	(0.027)	(0.001)	(0.011)	(0.052)	(0.026)