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Estimating Trade Restrictiveness Indices*

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Abstract

The objective of this paper is to provide indicators of trade restrictiveness that include both measures of tariff and non-tariff barriers for 91 developing and developed countries. For each country, we estimate three trade restrictiveness indices. The first one captures the extent to which trade policies at home affect domestic welfare. This follows the work of Anderson and Neary (1992, 1994 and 1996). The second index captures the impact of trade distortions on each country's import bundle. This follows the work of Anderson and Neary (2003). The last index focuses on market access and summarizes the trade distortions imposed by the rest of the world on each country's export bundle. All indices are estimated for the broad aggregates of manufacturing and agriculture products. Results suggest that poor countries (and those with the highest poverty headcount) tend to be more restrictive, but they also face the highest trade barriers on their export bundle. This is partly explained by the fact that agriculture protection is generally larger than manufacturing protection. NTBs contribute more than 70 percent on average to world protection, underlying their importance for any study on trade protection.

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1 Introduction

To measure the trade restrictiveness of a country's trade policy regime, one needs to overcome two important aggregation hurdles: aggregation of different forms of trade policies and aggregation across goods with very different economic importance.

Regarding the first aggregation problem, 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 percent tariff, a 1000 tons 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 also often followed is to simply rely on tariff data and hope that all other instruments are (perfectly) correlated with tariffs. These are obviously unsatisfactory solutions. A more adequate approach to solve this first problem is to bring all types of trade policy instruments into a common metric.[1]

Regarding the second aggregation problem, trade policy is set 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 average, import-weighted averages and frequency or coverage ratios; none of which has 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

[1] This is, for example, what the IMF's trade restrictiveness index does by implementing the following procedure. First, countries with an average tariff below a certain threshold are open and therefore score only 1 point, whereas countries with higher average tariffs score a higher number of points. Second, countries with a share of tariff lines affected by non-tariff barriers below a certain threshold are open and score 1 point, and countries with higher shares score a higher number of points. So for example, an average tariff of 3 percent scores 1 point and when only 5 percent of tariff lines are affected by NTBs the country also scores 1 point, for a total of 2 point on the TRI. Different types of trade policy instruments have been brought to a common metric. The problem is that it is not clear why a 3 percent average tariff should be equivalent to a 5 percent NTB coverage. These are ad-hoc criteria with no economic basis.

would downward bias this measure of trade restrictiveness.[2]

These two major hurdles are solved in the work of Anderson and Neary (1992, 1994, 1996, 2003 and 2004) on trade restrictiveness on which this paper is based. Their work, and ours, solves the first problem by transforming all the information on non-tariff barriers into a price equivalent, i.e., it answers the following question: what is the impact that these NTBs have on the domestic price of imported goods? This is called an Ad-Valorem Equivalent (AVE), and is directly comparable to a tariff. Adopting the framework of Anderson and Neary, we solve the second problem by using theoretically sound aggregation procedures that answer very specific questions regarding: a) the trade distortions imposed by each country's trade policies on itself, b) on its trading partners, and c) the trade restrictiveness imposed by the rest of the world on each country's export bundle. The questions are answered within a simple and empirically tractable model that allow us to measure the three trade restrictiveness indices for a large number of developing countries.

Thus, the trade restrictiveness indicators in this paper answer very specific questions.[3] When interested in the trade distortions that the country imposes on itself, the aggregation procedure answers the following question: *What is the equivalent uniform tariff that would keep real income (or welfare) constant?*. 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 among their trading partners. For example, if a particular tariff or NTB on beef imports in the European Union causes important domestic inefficiencies, this should not be a concern for EU trading partners if this does not significantly affect EU imports. When interested in the extent to which trade distortions limit imports from the rest of the world, the aggregation procedure answers the following question: *What is the equivalent uniform tariff of country M that would keep imports of country M at their observed levels?*. This second indicator is Anderson and Neary's (2003) MTRI. It is here labeled Overall Trade Restrictiveness Index (OTRI) to account for differences in methodologies. Finally, if one is interested in the barriers faced by exporters in the rest of the

[2] For example, assume that there are two tariff lines for cement: one for finished cement, which is very costly to transport internationally and one for clinker which represents 80 percent of cement's value added, but is cheap to transport. Finished cement has a 0 percent tariff and clinker a 100 percent tariff. The simple average tariff is 50 percent, whereas most of what is imported pays a 100 percent tariff.

[3] As will become clearer, 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.

world, the relevant question is: *What is the equivalent uniform tariff faced by exporters of country X in the rest of the world that would keep exports of country X at their observed levels?*. 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). The OTRI and MA-OTRI can be calculated bilaterally to capture the trade restrictiveness that countries impose on each other. By definition the MA-OTRI faced by country X on its exports to country M will be equal to the OTRI imposed by country M on its imports from country X.

Instead of using a Computable General Equilibrium (CGE) model to estimate the trade restrictiveness indices as in Anderson and Neary (1994, 2003), we follow a more econometric intensive approach, which allows us to avoid biases associated with the necessary aggregation of tariff lines into a few industries when building a CGE. 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 focuses on first order effects (and ignores some of the feedbacks), the TRI can be approximated by the squared root of a weighted average of the squares of the level of protection at the tariff line level (which include AVEs of NTBs). The weights are an increasing function of import shares, import demand elasticities and levels of protection. We show in this paper (following Feenstra, 1995) that the OTRI is also a weighted average of the applied levels of protection where the weights are functions of import shares and import demand elasticities. Finally, the MA-OTRI is also a weighted average of the applied levels of protection faced in the rest of the world (across tariff lines and trading partners). The weights are an increasing function of the exporter's export shares and importers' import demand elasticities. Note that the weights of the TRI, OTRI and MA-OTRI do not take the value of zero in the presence of prohibitive levels of protection, unless import demand is infinitely inelastic. This overcomes the problems of import-weighted averages mentioned above.

In order to compute the trade restrictiveness measures (TRI, OTRI and MA-OTRI), one needs information on tariffs, but more importantly AVEs of NTBs and elasticities of import demand at the tariff line level. The latter were estimated in Kee, Nicita and Olarreaga (2004).

For NTBs, several papers in the literature have estimated their incidence 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). However, to our knowledge, there exists no attempt to estimate those in a consistent way for a wide variety of countries at the tariff line level. Because trade policy is determined at the tariff line level (Men Shirts made of cotton) and not at the more aggregate industry level (Apparel), it is important to measure its restrictiveness at the most disaggregated level. Otherwise aggregation bias could lead to misleading conclusions.[4]

We estimate AVEs of NTBs as follows. Using data on two broad types of NTBs –Core NTBs (price and quantity control measures, technical regulations, as well as monopolistic measures, such as single channel for imports) and agricultural domestic support– at the tariff line level for each country, we estimate their impact on imports following Leamer's (1990) comparative advantage approach (see also Harrigan, 1993 and Trefler, 1993). The logic of this approach is to predict imports using factor endowments and observe its deviations in the presence of NTBs. This is done for each HS six-digit tariff line in which at least one country has some type of NTB (around 4800 tariff lines). The estimated impact of NTBs on imports varies by country (according to country specific factor endowments). We then convert the quantity impact of NTBs on imports into a price equivalent(or AVE) by simply moving along the import demand curve using import demand elasticities estimated earlier.

The reminder of the paper is organized as follows. Section 2 describes the methodology used to estimate ad-valorem equivalents of NTBs, whereas section 3 presents the methodology used to estimate the trade restrictiveness indices. Section 4 describes the data, whereas section 5 describes the empirical results. Section 6 concludes.

[4] For example, imagine that the Apparel industry is composed of two tariff lines: shirts made of cotton and shirts made of synthetic fabrics. Assume that country A imports an equal amount of both types of shirts. It has a tariff of 100 on cotton shirts, for which the import demand is perfectly inelastic and no tariffs on synthetic fabrics that had a fairly elastic import demand. Clearly, the tariff structure of country A does not impose any welfare cost. However if one were to aggregate cotton and synthetic fabrics into Apparel, one would find that the (average) 50 percent tariff on Apparel has a welfare cost, given that import demand for Apparel is not perfectly inelastic.

2 Estimating AVEs of NTBs

To obtain AVEs of NTBs we first estimate the quantity-impact of NTBs on imports and then we turn into the transformation of quantity effects into price effects.

2.1 Estimating the impact of NTBs on imports

The theoretical foundation for this kind of studies 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 Leamer, 1990). One of the specifications commonly used (e.g., Leamer, 1990, Harrigan, 1993, Trefler, 1993, Lee and Swagel, 1997 and Wang, 2001) and adopted in this study is the following:

$$\log(m_{n,c}) = \alpha_n + \sum_k \alpha_k C_c^k + \beta_{n,c}^{\text{Core}} \text{Core}_{n,c} + \beta_{n,c}^{\text{DS}} \text{logDS}_{n,c} + \varepsilon_{n,c} \log\left[(1 + t_{n,c})\right] + \mu_{n,c} \qquad (1)$$

where $m_{n,c}$ is import value of good n in country c;[5] α_n are product 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 used relative factor endowments (agricultural land over GDP, capital over GDP and labor 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 the world of each countries (i.e., the import-weighted distance to each trading partner); α_c^k are parameters in front of the variables that capture country characteristics; $Core_{n,c}$s is a dummy variable indicating the presence of a core NTB; $\text{logDS}_{n,c}$ is the log of agricultural domestic support, which is continuous and measured in dollars (for a description of NTB data, see subsection 3.1.1); $\beta_{n,c}^{\text{Core}}$ 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

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

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 HS 6 digit tariff line in 117 countries (see Kee, Nicita and Olarreaga, 2004), we can substitute these estimates into (1) instead of trying to estimate them again. This does not only allow us to avoid imposing any structure on the estimation of those parameters (to avoid running out of degrees of freedom), but also solves for the endogeneity of tariffs (and import demand elasticities) to tariffs as discussed in Trefler (1993) or Lee and Swagel (1997). This is achieved by sending the tariff variable (and the now "known" parameters) to the left-hand-side. This constrained specification may introduce heteroscedasticity in the error term $\kappa_{n,c}$ given that import demand elasticities have been estimated with error and this error in the measurement of the elasticities can be associated with measurement error in NTBs. A White correction could be undertaken to solve for this.[6] After substituting the estimated elasticities and sending the tariff term to the left-hand-side, Equation (1) becomes:

$$\log(m_{n,c}) - \varepsilon_{n,c}\log\left[(1+t_{n,c})\right] = \alpha_n + \sum_k \alpha_k C_c^k + \beta_{n,c}^{\text{Core}}\text{Core}_{n,c} + \beta_{n,c}^{\text{DS}}\log\text{DS}_{n,c} + \kappa_{n,c} \qquad (2)$$

According to equation (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, our sample is essentially a cross section of HS 6 digit tariff lines and products. Thus 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 specific impact and the country specific impact will depend on the variables that capture country characteristics; more precisely on endowments as in Leamer's (1990) comparative advantage approach:

[6] Alternatively, one could try to correct parametrically using the information on standard errors, but it is not clear that this would solve the heteroscedasticity problem. It will not if as asumed here, $\mu_{n,c}$ is independently and identically distributed.

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

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

where all β_n^ks are product (i.e., tariff line) specific parameters to be estimated. The country variations comes from the interaction with the comparative-advantage variables. Substituting (3) and (4) into (2) we get:

$$\begin{aligned} \log(m_{n,c}) - \varepsilon_{n,c}\log\left[(1+t_{n,c})\right] &= \alpha_n + \sum_k \alpha_k C_c^k + (\beta_n^{\text{Core}} + \sum_k \beta_n^{k,\text{Core}} C_c^k)\text{Core}_{n,c} \\ &+ (\beta_n^{\text{DS}} + \sum_k \beta_n^{k,\text{DS}} C_c^k)\log\text{DS}_{n,c} + \kappa_{n,c} \quad (5) \end{aligned}$$

Given that there are: 4545 goods at the HS 6 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 around 2 x 5 (4545)=45450 coefficients. This is likely to be intractable if we estimated these coefficients in a single regression. We therefore opted for estimating this 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. Thus we basically run 4545 equations (5) and retrieve the relevant parameters from each of these regressions that allow us 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 that NTBs are likely to be endogenous to imports (and tariffs, or import demand elasticities). Indeed the political economy literature suggests that all these may be determinants of NTBs. This endogeneity may bias the estimated impact of NTBs on imports, and as shown by Trefler (1993) and Lee and Swagel (1997), the endogeneity may actually lead to a downward bias in these estimates and therefore an underestimation of the ad-valorem equivalent. The traditionally used instruments such as firm concentration (on the buyer and seller side), or factor shares are not available at this level of disaggregation, so they will not provide a way out of the endogeneity problem. Other potential instruments for NTBs suggested in the literature are exports or the past change in imports. These however are likely to be correlated with imports and tariffs and therefore they may be not very good instrumental variables. An additional instrument for core NTB is the GDP-weighted share of the 5 closest countries that apply core NTB on product n; similarly the GDP-weighted share of domestic support provided to good n by the 5 closest countries is used to instrument for DS.[7] The idea is simple. Historical, legal and cultural reasons may induce neighboring countries to impose similar types of NTBs on similar products.[8]

Because core NTB is a dummy variable that just 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 5000 probit equation on Core NTBs (one for each product) explained by the instruments discussed above, to obtain the Mills ratio (the ratio of the probability density function and the cumulative density function of each observation). The second stage equation adds the Mills ratio of the probit model describing the Core NTB treatment decision as an explanatory variable. For 6-digit HS goods in which at least one country uses domestic support (around 158 HS 6 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 equal to zero if the NTB measure is not restrictive (e.g., tariffs are the binding measure –see Anderson and Neary, 1992). Because in 13 percent of the sample the unrestricted estimation provided positive estimates for $\beta_{n,c}^{\text{core}}$ and $\beta_{n,c}^{\text{core}}$, which are economically meaningless, we actually constrained the estimation procedure so that $\beta_{n,c}^{\text{core}} \leq 0$ $\beta_{n,c}^{\text{DS}} \leq 0$. This is done by replacing the expression given (3) and (4) by:

$$\beta_{n,c}^{\text{Core}} = -e^{\beta_n^{\text{Core}} + \sum_k \beta_n^{k,\text{Core}} C_c^k} \tag{6}$$

$$\beta_{n,c}^{\text{DS}} = -e^{\beta_n^{\text{DS}} + \sum_k \beta_n^{k,\text{DS}} C_c^k} \tag{7}$$

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

[8] A test of overidentifying restrictions is conducted on these instruments and discussed in section 4.

Note that after replacing (6) and (7) into (5) becomes non-linear both in the variables and the parameters:

$$\begin{aligned}\log(m_{n,c}) - \varepsilon_{n,c}\log\left[(1+t_{n,c})\right] &= \alpha_n + \sum_k \alpha_k C_c^k + (-e^{\beta_n^{\text{Core}}+\sum_k \beta_n^{k,\text{Core}} C_c^k})\text{Core}_{n,c} \\ &+ (-e^{\beta_n^{\text{DS}}+\sum_k \beta_n^{k,\text{DS}} C_c^k})\log\text{DS}_{n,c} + \kappa_{n,c} \qquad (8)\end{aligned}$$

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.[9]

2.2 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 as an AVE of NTB, and is noted $ave = d\log\left[p^d\right]/dNTB$, where p^d is the domestic price.[10]

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

$$\frac{d\log\left[q_{n,c}\right]}{d\text{Core}_{n,c}} = \frac{d\log q_{n,c}}{d\log\left[p_{n,c}^d\right]}\frac{d\log\left[p_{n,c}^d\right]}{d\text{Core}_{n,c}} = \varepsilon_{n,c}ave_{n,c}^{\text{Core}} \qquad (9)$$

$$\frac{d\log\left[q_{n,c}\right]}{d\text{Log DS}_{n,c}} = \frac{d\log q_{n,c}}{d\log\left[p_{n,c}^d\right]}\frac{d\log\left[p_{n,c}^d\right]}{d\text{Log DS}_{n,c}} = \varepsilon_{n,c}ave_{n,c}^{\text{DS}} \qquad (10)$$

where $q_{n,c}$ as before are imported quantities ($m_{n,c} = p_n^w q_{n,c}$), and $ave_{n,c,k}$ is the ad-valorem equivalent of NTB of type k imposed on good n in country c. Thus solving (9) and (10) for $ave_{n,c}$s we obtain:

[9] We also estimated these equations linearly using the specification in (5). The correlation between the linear and non-linear estimates of AVE is 0.86 for NTBs and 0.49 for domestic support, when the linear estimates provide positive AVEs. The correlation is 0 when the linear estimates of AVEs are negative. Note that the average non-linear AVE of core NTB point estimate is 15 percent for products that had a negative linear AVE, whereas it is 48 percent for observations where the linear AVE was positive. In the case of agricultural domestic support, the similar figures are 14 and 2 percent. Also, note that for those observations in which the estimated linear AVE is negative, the non-linear estimates are statistically significant in only 24 percent of these cases, which suggests that replacing the negative estimates by zero wouldn't be such a bad approximation.

[10] This assumes perfect competition.

$$ave^{\text{Core}}_{n,c} = \frac{1}{\varepsilon_{n,c}} \frac{d\log\left[q_{n,c}\right]}{d\text{Core}_{n,c}} \quad (11)$$

$$ave^{\text{DS}}_{n,c} = \frac{1}{\varepsilon_{n,c}} \frac{d\log\left[q_{n,c}\right]}{d\text{Log DS}_{n,c}} \quad (12)$$

Thus, the exact formula to calculate the ad-valorem equivalent will depend on whether the NTB is a continuous (domestic support) or a binary (Core NTBs) variable:

$$ave^{\text{DS}}_{n,c} = \frac{\beta^{\text{DS}}_{n,c}}{\varepsilon_{n,c}} \quad (13)$$

$$ave^{\text{Core}}_{n,c} = \frac{e^{\beta^{\text{Core}}_{n,c}} - 1}{\varepsilon_{n,c}} \quad (14)$$

Ad-valorem equivalents will be calculated for the two types of NTBs at the product level (six digit of the HS) in each country. An overall ad-valorem equivalent for the two types of NTBs at the product level can be easily obtained by simply adding the 2 NTB components, and will simply be denoted $ave_{n,c}$.

3 Estimating trade restrictiveness indices

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

$$T_{n,c} = \text{ave}_{n,c} + t_{n,c} \quad (15)$$

where $T_{n,c}$ is the overall level of protection that country c imposes on imports of good n; $\text{ave}_{n,c}$ is the AVE of NTBs that country c imposes on imports of good n, and $t_{n,c}$ is tariff applied by country c on imports of good n. Adding AVEs of NTBs and tariffs to obtain an overall level of protection on country c imports of good n in principle assumes that none of the protection instruments is binding (Anderson and Neary, 1992).[11] This is consistent with our AVE estimates, which need to be interpreted as the impact that each NTB has on the volume of imported goods conditional on

[11] Alternatively, if there is any reason to believe that one of the four policy instruments is binding, then one can define $T_{n,c}$ as $\max(\text{ave}_{n,c}, t_{n,c})$.

the presence of tariffs and other NTBs. This solves the first aggregation problem mentioned in the introduction; i.e., we have summarized in one indicator ($T_{n,c}$) the trade restrictiveness of different trade policy instruments applied on imports of a particular good (or tariff line).

The solution to the second aggregation problem, i.e., the aggregation of levels of protection across tariff lines, will depend on the trade restrictiveness index that is being considered. Below, we describe the methodologies to obtain the TRI, OTRI and MA-OTRI in turn.

3.1 Estimating TRIs

The TRI focuses on the trade distortions imposed by each country's trade policies on itself. It uses welfare as the relevant metric. It answers the following question: What is the uniform tariff that if applied to imports would leave home welfare unchanged? More formally, and assuming away second order effects (as in Feenstra, 1995), the TRI is (implicitly) defined by:

$$\mathrm{TRI}_c : \sum_n W_{n,c}\left(\mathrm{TRI}_c\right) = \sum_n W_{n,c}\left(T_{n,c}\right) = W_c^0 \tag{16}$$

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 this setup a linear approximation to the welfare cost associated with $T_{n,c}$ is given by:

$$\Delta W_{n,c} = \frac{1}{2}\frac{dm_{n,c}}{dp_{n,c}}T_{n,c}^2 = \frac{1}{2}\varepsilon_{n,c}m_{n,c}T_{n,c}^2 \tag{17}$$

where $m_{n,c}$ is the import demand function in country c, $p_{n,c}$ is the price of good n in country c, and $\varepsilon_{n,c}$ is the elasticity of import demand. The first equality linear approximate the Habergler triangle between the free trade and the protection driven domestic price. The second equality simply substitutes the slope of the import demand function by the more common notation where import elasticities are used (it normalizes world prices to unity). Totally differentiating (16), using (17) and solving for TRI_c yields:

$$\mathrm{TRI}_c = \left[\frac{\sum_n (dm_{n,c}/dp_{n,c})T_{n,c}^2}{\sum_n (dm_{n,c}/dp_{n,c})}\right]^{1/2} = \left[\frac{\sum_n m_{n,c}\varepsilon_{n,c}T_{n,c}^2}{\sum_n m_{n,c}\varepsilon_{n,c}}\right]^{1/2} \tag{18}$$

Thus, the TRI is defined as the weighted sum of squared protection levels, where weights are given by the slope of import demand functions in the first equality and elasticity of import demand and import levels in the second equality. These two are equal, except if imports are zero. The TRI after the second equality would give a zero weight to the protection level of a good that is not imported, whereas the TRI after the first equality would give that good a positive weight. In the empirical section we use the definition of TRI after the first equality in (18) to avoid the downward bias associated with the definition of TRI that uses imports and elasticities of import demand. The slope of the import demand functions were obtained from the estimation of import demand elasticities in Kee *et al.* (2004). Using the notation in Kee *et al.* (2004) it is easy to show that $dm_{n,c}/dp_{n,c} = -a_{nn}GDP_c - m_{n,c}^2/GDP_c - m_{n,c}$ where a_{nn} is a price parameter in a translog GDP function, and GDP_c is the Gross Domestic Product of country c. Thus with information on the slopes of import demand function and levels of protection at the tariff line level one can easily compute TRIs.

3.2 Estimating OTRIs

The OTRI focuses on the distortions imposed by each country's trade policies on its import bundle. It uses the aggregate import value as the relevant metric. It answers the following question: What is the uniform tariff that if imposed to home imports would leave aggregate imports unchanged? More formally, the OTRI is implicitly defined by:

$$\text{OTRI}_c : \sum_n m_{n,c}\left(\text{OTRI}_c\right) = \sum_n m_{n,c}\left(T_{n,c}\right) = m_c^0 \tag{19}$$

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 (19), and solving for OTRI_c yields:

$$\text{OTRI}_c = \frac{\sum_n (dm_{n,c}/dp_{n,c})T_{n,c}}{\sum_n (dm_{n,c}/dp_{n,c})} = \frac{\sum_n m_{n,c}\varepsilon_{n,c}T_{n,c}}{\sum_n m_{n,c}\varepsilon_{n,c}} \tag{20}$$

Thus, the OTRI is defined as the weighted sum of protection levels, where weights are given by the slope of import demand functions in the first equality and elasticity of import demand and import levels in the second equality. Again, in the empirical section we use the definition after the first equality to avoid the downward bias associated with the second definition in the presence of prohibitive tariff barriers.

As shown by Anderson and Neary (2003), the OTRI, which uses the volume of trade as the standard of reference, is always smaller than the TRI, that uses welfare as a metric. It is straightforward to show that OTRI_c in (20) is smaller than TRI_c in (18). Moreover as shown in Anderson and Neary (2003) and thoroughly discussed in Anderson and Neary (2004), the tariff dispersion is likely to increase the relative size of TRI with respect to the OTRI.[12]

3.3 Estimating MA-OTRIs

The MA-OTRI is the mirror image of the OTRI. It focuses on the distortions that the rest of the world imposes on each country's export bundle. It uses export value as the relevant metric. It answer the following question: What is the uniform tariff that if imposed by all trading partners on exports of country c would leave exports of country c unchanged? More formally, the MA-OTRI is implicitly given by:

$$\text{MA-OTRI}_c : \sum_n \sum_p x_{n,c,p} \left(\text{MA-OTRI}_c\right) = \sum_n \sum_p x_{n,c,p} \left(T_{n,c,p}\right) = x_c^0 \tag{21}$$

where $x_{n,c,p}$ are country c exports of good n to its trading partner p; $T_{n,c,p}$ is the level of protection faced by country c exports of good n in country p and x_c^0 are current aggregate exports of country c evaluated at world prices (again, we choose units so that all world prices equal unity). Totally differentiate (21), noting that noting that the change in exports of country c associated with the level of protection in country p has to be equal to the change in imports of country p from country c associated with the level of protection of country p. More formally, $dx_{n,c,p}/dp_{p,n,c} = dm_{p,n,c}/dp_{p,n,c}$. After differentiating and substituting, solving for MA-OTRI_cyields:

$$\text{MA-OTRI}_c = \frac{\sum_p \sum_n (dm_{p,n,c}/dp_{p,n}) T_{p,n,c}}{\sum_p \sum_n (dm_{p,n,c}/dp_{p,n})} = \frac{\sum_p \sum_n m_{p,n,c} \varepsilon_{p,n} T_{p,n,c}}{\sum_p \sum_n m_{p,n,c} \varepsilon_{p,n}} \tag{22}$$

Thus, the MA-OTRI is defined as the weighted sum of protection levels in the rest of the world. If one uses the definition after the first equality in (22) weights are given by the slope of import demand functions in the rest of the world for imports originating in country c. If one uses the second equality in (22), weights are given by the elasticities of import demand and import from c in the rest of the world. Again, in the empirical section we use the definition after the first equality to

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

avoid the downward bias associated with the second definition in the presence of prohibitive tariff barriers.

As before, the slope of the import demand functions were obtained from the estimation of import demand elasticities in Kee *et al.* (2004). Using the notation in Kee *et al.* (2004) it is easy to show that $dm_{p,n,c}/dp_{p,n} = -a_{nn}GDP_p - m^2_{p,n,c}/GDP_p - m_{p,n,c}$. If the formula in (22) were to be applied as such, it could be severely bias. Indeed, it would include in the MA-OTRI of country c levels of protection on products that c does not export at all. Thus in order to correct for this, the formula in (22) is calculated conditional on the particular product representing more than 0.1 percent of country c exports to the world. Obviously MA-OTRI can be calculated bilaterally to obtain the level of trade restrictiveness that country p imposes on exports of country c. Again the formula after the first equality in (22) can be used to answer this question. But instead of summing over n and p one would obviously only sum over p to obtain MA-OTRI$_{c,p}$. By definition MA-OTRI$_{c,p}$ = OTRI$_{p,c}$. To be economically meaningful, both would need to be estimated conditional on country c's export bundle to the world.

4 Data

Tariff data comes from different sources. The main sources are the WTO's IDB and UNCTAD's Trains. Because these sources rarely provide 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).[13] The tariff data is for the most recent year for which there is data available between 2000 and 2004. For more than half the countries the base year is 2003 or 2004 and for only three countries the data is 2000 (Peru, Kazakhstan and Egypt). MAcMap also provided us with a complete dataset of unilateral, bilateral and regional preferences which is an important component when estimating MA-OTRIs.

Calls for improving the quality of NTBs data collection are regularly done (see Deardorff and Stern, 1997). This paper is no exception. As can be seen from the first column of Table 1 the best international data available to us (UNCTAD's TRAINS) has quite an incomplete country coverage (e.g., tariff data is available for almost twice the number of countries for which NTB data

[13] See Bouët et al. (2004) for a detailed description.

is available). Moreover, the latest available year for which data is available varies significantly across countries (see second column of Table 1). To enhance country and time coverage would allow to improve upon the precision of the estimates.

We obtained the entire UNCTAD TRAINS dataset through the World Bank's WITS system. This dataset contains detailed information on various types of NTBs (more than 30 different types of NTBs are identified). As discussed earlier, we included in our measure of Core NTBs: Price control measures (UNCTAD Trains code 6100 6200 and 6300), Quantity restrictions (UNCTAD Trains code 3100 3200 3300), Monopolistic Measures (UNCTAD's Trains code 7000) and Technical Regulations (UNCTAD's Trains code 8100). The dataset 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 Groupe d'Economie Mondiale at Science Po (Paris).[14]

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. This obviously suffers from the drawback that we do not have a measure of the restrictiveness of a particular NTB in a particular country. However, instead of making ad-hoc assumptions regarding the restrictiveness of each NTB, we will rather rely on our estimation procedure to impute the restrictiveness of each measure in each country. Rather than the statistician deciding how restrictive is each measure we will let the data "decide" which type of NTB and in which country has the most restrictive impact on imports.

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 of the HS are affected by domestic support in at least one WTO member.[15] One may wonder why we do not use estimates of producer subsidy equivalents (PSE) as traditionally done in the literature rather than estimating the AVE of these subsidies. 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,

[14] See Shepherd (2004).

[15] One problem is that China's agriculture support is not included as it was not a WTO member during that period.

whereas tariffs affect both consumption and production. In other words a 10 percent PSE can be much less restrictive than a 10 percent tariff (it would only be as restrictive as the tariff if the domestic demand is infinitely inelastic). So even if we had production levels, one would need to transform the PSE into a tariff equivalent (or some sort of Trade Restrictiveness Index in the spirit of Anderson and Neary, 1996). In order to do so, we would need estimates of domestic supply and demand elasticities, which do not exist at this level of disaggregation.

Import and export data comes from United Nations' Comtrade (also available through WITS). We took the average between 2001 and 2003 to smooth any year specific shock. If data is missing for a particular country, then we use data for 2000 to calculate the average (Bhutan, Nigeria, Nepal and Gabon). If there was no trade data reported to Comtrade during the 2000-2003 period, then we mirror data from trading partners. This was the case for Cote d'Ivoire, Cameroon, Egypt, Lao, Mozambique, Chad and Vietnam.

Elasticities of import demand elasticities, or rather the slope of import demand functions (i.e., the price parameters a_{nn}) are borrowed from Kee, Nicita and Olarreaga (2004).

5 Empirical Results

We first discuss the estimates of AVEs of NTBs and we then turn into the calculation of trade restrictiveness indices.

5.1 AVEs of NTBs

We run 4545 non-linear regressions (for each 6 digit HS category where at least one country imposes either a core NTBs or domestic support) to estimate the impact that the two different types of Non-Tariff-Barriers (NTBs) have on imports. The average adjusted R^2 is 0.56; with a median at 0.58, a maximum at 0.88, and a minimum at -0.05. The Kernel density estimate of the R^2 estimates is given in Figure 1. There is less than 1 percent of the regression that had an R^2 below 0.10, suggesting that the fit of (8) was relatively good across the different tariff lines.

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, labor force/GDP, capital/GDP, agricultural land/GDP). For each six digit product in each country, we then interact the NTB variable with the sum of all these interacted coefficients to obtain the impact that NTBs have on imports following (6) and (7).

The simple average ad-valorem equivalent in the sample for core NTBs is 9.2 percent; it is 7.8 percent when import-weighted. If averages are calculated only over tariff lines affected by Core NTBs, the numbers are much higher: 39.8 and 22.7 percent, respectively. The simple and import-weighted averages of AVEs of domestic support are much smaller. Generally below 1 percent, but this simply reflects that a very small number of products are affected by domestic support in most countries (see fourth column of Table 1). If one calculates the average only over those products affected by domestic support, the sample simple average is 8.9 percent and the import-weighted average is 8.0 percent.

These results suggest that the importance of NTBs as a protectionist tool is substantial, especially considering that in 57 percent of tariff lines subject to core NTBs in our sample, the AVE of core NTB is higher than the tariff. Regarding products subject to agricultural domestic support, in 30 percent of these tariff lines the AVE of agricultural domestic support is higher than the tariff.[16]

There is also significant variation across countries. The simple average AVE of core NTBs goes from virtually 0 to 42 percent (from 0 to 39 percent when import weighted). Numbers for domestic support are generally below 1 percent. The countries with the highest average AVE of core NTBs are all low income African countries (Sudan, Algeria, Tanzania, Nigeria and Morocco). Several middle income countries also have relatively high AVEs of core NTBs. This includes Malaysia, Brazil, Mexico and Uruguay. The countries with the highest AVEs of domestic support are all European member countries and Peru.

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 2 plots the graph of the Log (ave^{Core}) on Log (GDP per capita). It suggests that the average AVE of core NTBs increases with GDP per capita (although some middle income countries seem to have the highest AVEs of core NTBs). Figure 3 provides the same plot but for the AVE of Domestic Support. There is

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

also an upward sloping curve, but it is more striking than in the case of core NTBs (the number of countries is also much smaller as notifications to the WTO of only 24 countries were used in Hoekman, Ng and Olarreaga (2004), which is our data source). 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 (see Figure 4). 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 than tend to be significantly lower as countries grow richer.

The variation across goods (tariff lines) is also very large. The average level of AVEs in agricultural products is 20 percent compared to 8 percent for manufacturing goods. The overall level of protection (including tariffs) is also much higher for agriculture (38 percent versus 17 percent). The highest average AVE of NTBs at the 2 digit level of the HS is found for dairy products (HS 4) with an average of 38 percent (an average tariff of 29 percent bring the average level of protection for dairy products in the world to 67 percent). 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 percent (and an average level of overall protection of 10 percent once tariffs are included). Also, the contribution of NTBs to the overall level of protection is higher in agriculture.

One question that one may ask is whether these different instruments of protection (tariffs, core NTBs and agricultural domestic support) are complements or substitutes in terms of their trade restrictiveness. In order to answer this question, we run a simple within country regression of tariffs on AVE of core NTBs and AVE of agricultural domestic support using country dummies. The results are reported in Table 2. They suggest that (within countries) tariffs do tend to increase with both AVE of core NTBs and agricultural domestic support, reinforcing each other, rather than substituting for each other.

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 country averages provided by Bradford (2003), which estimates AVE using price differentials for Australia, Canada, Japan, United States and 5 European countries (Belgium, Germany, Italy, Netherlands and the United Kingdom). These AVEs are computed using price differential between retail prices and import prices, after correcting for transport, taxes and other distributions costs. By definition they include more restrictions that the Core NTBs and agricultural domestic support we estimated because they include many other policies (e.g., exchange rate controls). Also differences in tastes and quality across countries can partly explain differences in prices. For these reasons one should expect them to be a bit higher (and they generally are). Our estimates compare to Bradford (2003, Table 2) as follows: 8 percent for Australia (compared to 15 percent), 5 percent for Canada (compared to 8 percent), 10 percent for Japan (compared with 58 percent), 8 percent for the United States (compared with 9 percent), 13 percent in Belgium (compared to 32 percent), 10 percent in Germany (compared to 18 percent), 10 percent in Italy (compared to 12 percent), 11 percent in the Netherlands compared to 31 percent, and 10 percent in the United Kingdom (compared to 38 percent). There are obvious reasons why these numbers may differ, but the order of magnitudes seem more or less on line, except perhaps for Belgium, Netherlands, United Kingdom and Japan, where Bradford's estimates are much larger.[17]

Andriamananjara *et al.* (2004) also provide estimates of AVEs of NTBs for 12 groups of product (that correspond to some aggregate of the GTAP product classification). They use price data from the Economist Intelligence Unit for 18 regions/countries and estimate the impact 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 AVEs of NTBs in apparel across countries of 73 percent (it varies between 16 and 190 percent). Our simple average for apparel is 20 percent (it varies between 0 and 95 percent). Thus, the order of magnitude seems a bit higher in Andriamananjara *et al.* 2004. This difference could be as before due to the assumption of perfect substitution between domestically-produced and imported goods or the fact that the averages are only reported for products for which their results were theoretically consistent ignoring other products. Our non-linear estimation avoids this problem and includes those products in which NTBs may have a very small impact on imports (or domestic prices). One could therefore expect lower AVEs than in Andriamananjara *et al.* (2004).

[17] 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. So large differences in taste can lead to large NTB estimates. The precision with which distribution margins are calculated can also be questioned in these type of exercise. 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 cost can vary significantly between fresh and deep frozen fish, the composition of this aggregate product matters when determining the markup cost.

We also provide a test of our methodology to calculate AVEs of NTBs.[18] Using the observed tariff information we created a dummy which takes the value 1 if the tariff is positive and zero otherwise. We then use this new dummy variable and calculated its impact on imports and proceeded to transform the quantity impact into a price-equivalent as we did with the NTB information.[19] 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 percent level The average actual tariff in the sample is 10.7 percent with a standard deviation of 23.0 percent, whereas the ad-valorem equivalent of the tariff dummy has an average of 11.3 with a standard deviation of 23.7 percent. Overall this suggests that the methodology we used to estimate ad-valorem equivalent of border barriers is doing a relatively good job.

5.2 Trade restrictiveness indices

Table 3 provides our estimates of TRIs, OTRIs and MA-OTRIs for 91 countries (counting European Union members as 1 country).[20] The first three columns provide estimates of trade restrictiveness using tariff data only. The following three columns show estimates that include both tariff and NTBs. The following two columns provide estimates of OTRI and MA-OTRI for agriculture products (HS 01 to 24) that include both tariffs and NTBs. The last two columns provide similar indices but for manufacturing products (HS 25 to 97).

One can make several important observations. First, NTBs have a significant contribution to the level of trade restrictiveness. Indeed, NTBs add on average an additional 70 percent to the level of trade restrictiveness imposed by tariffs. In 21 countries (out of 91) the contribution of NTBs to the overall level of restrictiveness is higher than the contribution of tariffs.[21] 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 70 percent higher than the OTRI (regardless of whether we include NTBs or not). The largest differences between OTRIs and TRIs are to be found in

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

[19] Obviously, 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 its endogeneity it was instrumented using the same method used on NTBs.

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

[21] It is also worth noting that on average the contribution of NTBs to the overall level of protection is 30 higher in agriculture than manufacturing.

countries where the tariff variance is the highest (see Anderson and Neary, 2003 or 2004). High income countries tend to be predominantly among those with a much higher TRI (and therefore a higher tariff variance). All high income countries in our sample are in the top 20 when ranked according to this criteria.

Third, agriculture protection is larger than manufacturing protection. It is on average twice as high. In only one country in the sample the OTRI for agriculture is lower than for manufacturing (Egypt). The MA-OTRI in agriculture, which captures the restrictiveness faced by each country on its agriculture export bundle is on average almost 4 times as high as the MA-OTRI for manufacturing. This suggests that countries which have an export bundle concentrated in agriculture products are likely to face much more important market access problems that countries specializing in manufacturing products.

Tables 4a to 4c provide estimates of bilateral OTRIs and MA-OTRIs (depending on whether we are focusing on the exporting or importing region) for groups of countries: QUAD, High, Middle and Low income countries, Least Developed Countries (LDCs) and Sub-Saharan African countries excluding South Africa (SSA). Table 4a provides estimates for the combined agriculture and manufacturing bundle; table 4b focuses on agriculture and table 4c on manufacturing. All indices include tariffs and NTBs. The last row and column give the trade restrictiveness imposed or faced by that region. The OTRI faced by the world on the world is 15 percent, but it reaches 41 percent for agriculture, again denoting the anti-agriculture biases of existing trade regimes. Focusing on the last rows and last column of each table suggests that the middle and low income countries impose and face the highest trade barriers in the world (this aggregates obviously hide quite a bit of heterogeneity which is captured in the numbers provided in Table 3). Table 4a suggests that all group of countries impose their highest trade barriers on low income countries, but low income countries also tend to impose the high barriers on their import bundle. If one focuses on agriculture products (Table 4b), then middle income countries face the highest barriers in the world, and the QUAD, high income and middle income countries impose the highest agricultural trade barriers on their import bundle. In the case of manufacturing (Table 4c), middle income and low income countries impose significantly higher barriers on their import bundle than high income countries.

In order to explore how trade barriers imposed and faced by each country are associated with income levels, we run a simple regression of GDP per capita on OTRI and MA-OTRI in our sample of 91 countries. The left quadrant of Figure 4 shows the partial correlation between Log of GDP per capita and the Log of OTRI. There is a negative and statistically significant association which suggest that rich countries tend to impose lower trade restrictions on their import bundle. The right quadrant of Figure 4 shows the partial correlation between Log of GDP per capita and the Log of MA-OTRI. There is again a negative and statistical significant correlation suggesting that richer countries face lower trade restrictions on their export bundle. Note that the relationship between the OTRI and GDP per capita seems to be non-linear in the first quadrant with the OTRI peaking for middle income countries.

It is difficult to provide an external test of these indicators of trade restrictiveness as there are no comparable numbers available across a large number of countries, except for the work of Anderson (1998). However, Anderson's number 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 sub-sample (see Table A-1 on page 1125).[22] The correlation is 0.65 and significant at the 1 percent level. The average TRI in his sample is 0.20 whereas ours is 0.26. This is somehow suspect, given that most countries have liberalized over the period, but it can be accounted by the fact that Anderson (1998) did not include technical regulations as part of his NTB variable, whereas they are included in the TRI measures in this paper.

Finally, all of the parameters used to estimate the trade restrictiveness indices were estimated and therefore have an error associated with them. In order to have an estimate of the precision of our trade restrictiveness indices we calculated the standard errors of the OTRI reported in the fourth column of Table 3 as follows. For each of the estimated variables needed to construct the OTRI (the βs of the NTB equation and the a_{nn} used to calculate the elasticities) we have a variance-covariance matrix.[23] Thus we first draw a sample of normally distributed variables with mean and variance-covariance equal to the point estimate and the variance-covariance matrix that was estimated. We then randomly take 50 draws (with repetition) from this sample and calculate the OTRI using (20). The standard error of the OTRI is then given by the standard deviation of

[22] 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.

[23] The covariance between the a_{nn} and the βs is assumed to be zero as we have estimated them separately.

the 50 OTRIs calculated from the different draws. Figure 5 reports the OTRI point estimates and their bootstrapped standard errors for each of the countries in the sample. Around 40 percent of the countries in the sample have an OTRI which is significant at the 1 percent level. An additional 10 percent are significant at the 5 percent level. Another 20 percent is significant at the 10 percent level (countries above the diagonal line). Thus, a third of our estimates are insignificant (those below the diagonal line), which suggests there is some room for improving the precision of the estimates.

6 Concluding remarks

The objective of this paper is to provide estimates of trade restrictiveness indices for 91 developing and developed countries. These restrictiveness indices include measures of both tariff and AVEs of NTBs at the tariff line level. Three trade restrictiveness indices are calculated that capture different aspects of countries' trade regimes. The first trade restrictiveness index, labeled TRI, captures the trade distortions that each country's trade policies impose on its own welfare. The second trade restrictiveness index captures the trade restrictiveness of each country's trade policies on its import bundle. The third trade restrictiveness index gives an indication of the level of trade restrictiveness faced by each country in the rest of the world on its export bundle. The latter are estimated bilaterally with the objective of measuring the restrictiveness of trade policy regimes *vis-a-vis* low-income and least-developed countries. They are also estimated for the broad disaggregates of manufacturing and agriculture products.

Results suggests that poor countries tend to have more restrictive trade regimes, but also face higher barriers on their export bundles. Interestingly, NTBs contribute for a large share of trade restrictiveness across countries: on average 70 percent. This indicates the importance of addressing NTBs in simulation exercises, but also in trade negotiations. This is particularly true for developed countries where the importance of NTBs is stronger.

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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
AUT	2004	1999	0.83	0.01	0.29	0.61	0.01	0.14
BEL	2004	1999	0.83	0.01	0.29	0.93	0.01	0.15
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
BHR	2003	1999	0.97	0.00	0.04	1.00	0.00	0.07
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
BTN	2003	1999	0.93	0.00	0.04	0.99	0.00	0.20
CAF	2003	1997	0.99	0.00	0.01	0.67	0.00	0.14
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
DEU	2004	1999	0.83	0.01	0.29	0.74	0.01	0.16
DNK	2004	1999	0.83	0.01	0.29	0.97	0.02	0.30
DZA	2003	2001	0.99	0.00	1.00	0.90	0.00	1.00
ECU	2003	2001	0.98	0.00	0.30	0.99	0.00	0.38
EGY	2000	2001	0.99	0.00	1.00	0.71	0.00	1.00
ESP	2004	1999	0.83	0.01	0.29	0.04	0.02	0.24
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
FIN	2004	1999	0.83	0.01	0.29	0.72	0.01	0.12
FRA	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
GBR	2004	1999	0.83	0.01	0.29	0.65	0.02	0.17
GHA	2004	1995	0.87	0.00	0.10	1.00	0.00	0.10
GNQ	2003	1998	0.99	0.00	0.02	0.77	0.00	0.02
GRC	2004	1999	0.83	0.01	0.29	0.64	0.02	0.16
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
IRL	2004	1999	0.83	0.01	0.29	0.36	0.01	0.08
ISL	2002	1996	0.29	0.00	0.08	0.74	0.00	0.11
ITA	2004	1999	0.83	0.01	0.29	0.82	0.01	0.22
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
KGZ	2002	1998	0.87	0.00	0.02	0.79	0.00	0.01
LAO	2002	2001	1.00	0.00	0.37	0.75	0.00	0.55
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
MOZ	2003	1994	0.97	0.00	0.05	0.39	0.00	0.07
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
NLD	2004	1999	0.83	0.01	0.29	0.19	0.03	0.19
NOR	2003	1996	0.25	0.00	0.15	0.98	0.00	0.13
NPL	2003	1998	0.99	0.00	0.00	0.63	0.00	0.00
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
PAK	2002	1998	1.00	0.00	0.17	1.00	0.00	0.29
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
PRT	2004	1999	0.83	0.01	0.29	1.00	0.03	0.26
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
SWE	2004	1999	0.83	0.01	0.29	0.96	0.01	0.17
TCD	2003	1997	0.99	0.00	0.01	0.85	0.00	0.11
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
VNM	2003	2001	0.69	0.00	1.00	0.43	0.00	1.00
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
ZWE	2003	1997	0.94	0.00	0.17	1.00	0.00	0.15

[a] All numbers are in percent, 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.

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

	Log(1+Tariff)
Log(1+ AVE of Core NTBs)	0.023***
	(0.004)
Log(1+ AVE of Ag. Support)	0.561***
	(0.113)
Constant	0.092***
	(0.001)
R^2-adjusted	0.274
# observations	469634

[a] The regression is estimated using a within estimator that takes the differences with respect to country means. Standard errors are in parenthesis and are corrected for within HS 6 digit tariff lines correlation across countries. *** stands for significance at the 1 percent level; ** stands for significance at the 5 percent level and * for significance at the 10 percent level.

Table 3: *Trade Restrictiveness Indices*

Country code	Country name	Tariffs only			Tariffs & NTBs			Tariffs & NTBs Agriculture		Tariffs & NTBs Manufacturing	
		OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	TRI	OTRI	MA-OTRI	OTRI	MA-OTRI
ALB	Albania	0.109	0.113	0.126	0.114	0.167	0.137	0.120	0.268	0.113	0.160
ARG	Argentina	0.132	0.100	0.143	0.204	0.221	0.314	0.220	0.438	0.202	0.135
AUS	Australia	0.047	0.119	0.081	0.116	0.218	0.270	0.353	0.569	0.087	0.095
BFA	Burkina Faso	0.110	0.128	0.128	0.149	0.191	0.245	0.362	0.485	0.107	0.076
BGD	Bangladesh	0.194	0.172	0.236	0.227	0.219	0.307	0.268	0.269	0.219	0.216
BHR	Bahrain	0.082	0.073	0.131	0.088	0.118	0.154	0.181	0.560	0.078	0.105
BLR	Belarus	0.091	0.098	0.111	0.159	0.154	0.273	0.312	0.338	0.137	0.147
BOL	Bolivia	0.087	0.102	0.091	0.147	0.220	0.247	0.355	0.436	0.114	0.144
BRA	Brazil	0.126	0.116	0.143	0.262	0.175	0.411	0.385	0.431	0.244	0.106
BRN	Brunei	0.095	0.081	0.461	0.139	0.126	0.497	0.410		0.097	0.126
BTN	Bhutan	0.158	0.134	0.205	0.194	0.249	0.282	0.216	0.702	0.190	0.151
CAF	Central Afr. Rep.	0.177	0.084	0.201	0.192	0.147	0.237	0.274	0.247	0.177	0.089
CAN	Canada	0.031	0.049	0.091	0.061	0.127	0.186	0.258	0.505	0.043	0.096
CHE	Switzerland	0.057	0.054	0.256	0.090	0.100	0.320	0.511	0.345	0.041	0.072
CHL	Chile	0.068	0.077	0.069	0.115	0.161	0.213	0.277	0.310	0.094	0.087
CHN	China	0.135	0.046	0.194	0.199	0.079	0.314	0.368	0.934	0.186	0.071
CIV	Cote d'Ivoire	0.110	0.127	0.129	0.377	0.220	0.521	0.533	0.379	0.343	0.092
CMR	Cameroon	0.167	0.064	0.192	0.182	0.109	0.221	0.249	0.183	0.171	0.084
COL	Colombia	0.116	0.122	0.133	0.228	0.186	0.354	0.427	0.371	0.197	0.116
CRI	Costa Rica	0.044	0.090	0.077	0.048	0.147	0.089	0.125	0.415	0.040	0.076
CZE	Czech Rep.	0.040	0.062	0.065	0.050	0.107	0.105	0.097	0.576	0.047	0.089
DZA	Algeria	0.163	0.021	0.192	0.465	0.130	0.612	0.549		0.447	0.130
ECU	Ecuador	0.104	0.201	0.122	0.157	0.301	0.241	0.346	0.471	0.133	0.106
EGY	Egypt	0.440	0.117	1.496	0.678	0.181	1.595	0.527	0.638	0.706	0.119
EST	Estonia	0.011	0.093	0.057	0.023	0.153	0.105	0.104	0.374	0.012	0.130
ETH	Ethiopia	0.157	0.084	0.203	0.162	0.159	0.217	0.174	0.405	0.160	0.075
EUN	European Union	0.030	0.084	0.100	0.126	0.151	0.331	0.453	0.343	0.075	0.122
GAB	Gabon	0.168	0.020	0.192	0.171	0.033	0.201	0.239	0.156	0.158	0.030
GHA	Ghana	0.143	0.072	0.185	0.174	0.132	0.258	0.373	0.266	0.140	0.079
GNQ	Equatorial Guinea	0.158	0.024	0.182	0.161	0.067	0.189	0.253	0.425	0.148	0.047
GTM	Guatemala	0.065	0.173	0.096	0.143	0.254	0.274	0.407	0.400	0.103	0.190
HKG	Hong Kong	0.000	0.085	0.000	0.014	0.124	0.097	0.131	0.322	0.006	0.105
HND	Honduras	0.068	0.162	0.094	0.079	0.236	0.132	0.159	0.332	0.062	0.168
HUN	Hungary	0.061	0.076	0.095	0.113	0.133	0.236	0.372	0.455	0.095	0.100
IDN	Indonesia	0.056	0.066	0.106	0.098	0.145	0.234	0.341	0.324	0.061	0.129
IND	India	0.300	0.139	0.336	0.399	0.213	0.508	0.650	0.540	0.368	0.149
ISL	Iceland	0.032	0.054	0.152	0.056	0.104	0.224	0.256	0.175	0.028	0.069
JOR	Jordan	0.127	0.107	0.179	0.244	0.153	0.387	0.240	1.009	0.244	0.103
JPN	Japan	0.058	0.050	0.344	0.143	0.081	0.474	0.580		0.073	0.081
KAZ	Kazkhstan	0.054	0.057	0.083	0.140	0.153	0.269	0.329	0.624	0.117	0.112
KEN	Kenya	0.137	0.103	0.188	0.144	0.179	0.206	0.225	0.390	0.132	0.087
KGZ	Kyrgyzstan	0.069	0.118	0.113	0.074	0.192	0.129	0.100	0.349	0.070	0.087
LAO	Lao People's DR	0.115	0.174	0.152	0.248	0.235	0.382	0.288	0.382	0.241	0.219
LBN	Lebanon	0.055	0.088	0.101	0.142	0.157	0.296	0.459	0.404	0.077	0.106
LKA	Sri Lanka	0.083	0.167	0.158	0.085	0.220	0.160	0.207	0.244	0.064	0.217
LTU	Lithuania	0.020	0.145	0.064	0.050	0.230	0.164	0.203	0.417	0.033	0.165
LVA	Latvia	0.030	0.108	0.075	0.098	0.200	0.247	0.366	0.364	0.058	0.153
MAR	Morocoo	0.254	0.092	0.316	0.509	0.144	0.642	0.710	0.294	0.478	0.115
MDA	Moldova	0.047	0.171	0.165	0.074	0.259	0.221	0.168	0.433	0.057	0.180
MDG	Madagascar	0.039	0.150	0.060	0.045	0.223	0.082	0.046	0.357	0.045	0.168
MEX	Mexico	0.148	0.045	0.205	0.287	0.084	0.440	0.550	0.251	0.261	0.077
MLI	Mali	0.108	0.036	0.125	0.140	0.075	0.207	0.282	0.251	0.115	0.052
MOZ	Mozambique	0.105	0.140	0.136	0.138	0.243	0.207	0.297	0.405	0.097	0.089
MUS	Mauritius	0.143	0.123	0.270	0.199	0.185	0.359	0.346	0.496	0.171	0.112
MWI	Malawi	0.107	0.171	0.139	0.142	0.263	0.214	0.281	0.418	0.114	0.200
MYS	Malaysia	0.061	0.041	0.262	0.260	0.079	0.476	0.553	0.341	0.236	0.067
NGA	Nigeria	0.253	0.028	0.350	0.550	0.054	0.700	0.786	0.159	0.502	0.044
NIC	Nicaragua	0.045	0.197	0.076	0.101	0.304	0.228	0.384	0.463	0.053	0.175
NOR	Norway	0.046	0.030	0.287	0.075	0.095	0.358	0.681	0.275	0.010	0.082
NPL	Nepal	0.157	0.103	0.389	0.157	0.171	0.390	0.240	0.304	0.144	0.152
NZL	New Zealand	0.024	0.117	0.054	0.127	0.226	0.295	0.313	0.405	0.104	0.119
OMN	Oman	0.101	0.061	0.214	0.156	0.094	0.316	0.586	0.321	0.067	0.080
PAK	Pakistan	0.171	0.183	0.229	0.210	0.276	0.313	0.470	0.659	0.174	0.196
PER	Peru	0.130	0.108	0.134	0.198	0.165	0.294	0.426	0.474	0.161	0.069
PHL	Philippines	0.040	0.062	0.073	0.240	0.094	0.410	0.477	0.649	0.212	0.060
PNG	Papua N. Guinea	0.062	0.106	0.256	0.103	0.176	0.318	0.349	0.387	0.058	0.039
POL	Poland	0.108	0.082	0.192	0.152	0.138	0.284	0.515	0.477	0.114	0.108
PRY	Paraguay	0.116	0.188	0.130	0.211	0.300	0.329	0.392	0.448	0.181	0.112
ROM	Romania	0.119	0.088	0.157	0.158	0.157	0.242	0.360	0.544	0.135	0.137
RUS	Russia	0.104	0.043	0.124	0.226	0.122	0.355	0.334	0.467	0.204	0.097
RWA	Rwanda	0.093	0.060	0.118	0.102	0.113	0.147	0.125	0.342	0.097	0.094
SAU	Saudi Arabia	0.067	0.026	0.112	0.108	0.035	0.221	0.153	0.550	0.100	0.032
SDN	Sudan	0.194	0.107	0.233	0.480	0.165	0.609	0.495	0.466	0.477	0.037
SEN	Senegal	0.097	0.092	0.118	0.360	0.167	0.506	0.573	0.231	0.305	0.090
SLV	El Salvador	0.065	0.175	0.103	0.150	0.237	0.270	0.154	0.527	0.150	0.175
SVN	Slovenia	0.098	0.080	0.118	0.182	0.139	0.298	0.483	0.664	0.152	0.138
TCD	Tchad	0.157	0.104	0.180	0.164	0.176	0.191	0.239	0.269	0.155	0.073
THA	Thailand	0.130	0.093	0.195	0.153	0.140	0.259	0.579	0.675	0.112	0.084
TTO	Trinidad and T.	0.075	0.061	0.281	0.086	0.158	0.301	0.380	0.504	0.054	0.117
TUN	Tunisia	0.249	0.096	0.345	0.367	0.136	0.523	0.941	0.342	0.293	0.129
TUR	Turkey	0.071	0.101	0.197	0.118	0.162	0.273	0.397	0.480	0.087	0.121
TZA	Tanzania	0.139	0.134	0.164	0.435	0.229	0.581	0.686	0.471	0.396	0.067
UGA	Uganda	0.079	0.070	0.095	0.080	0.139	0.099	0.119	0.268	0.074	0.093
UKR	Ukraine	0.093	0.071	0.299	0.216	0.152	0.454	0.464	0.492	0.184	0.114
URY	Uruguay	0.114	0.166	0.131	0.239	0.265	0.372	0.384	0.452	0.216	0.127
USA	United States	0.027	0.051	0.053	0.082	0.111	0.215	0.205	0.480	0.068	0.070
VEN	Venezuela	0.127	0.062	0.145	0.212	0.107	0.323	0.455	0.252	0.173	0.063
VNM	Vietnam	0.160	0.157	0.259	0.368	0.238	0.509	0.541	0.535	0.349	0.170
ZAF	South Africa	0.072	0.084	0.137	0.089	0.143	0.182	0.197	0.504	0.076	0.095
ZMB	Zambia	0.099	0.099	0.128	0.117	0.170	0.178	0.295	0.434	0.093	0.087
ZWE	Zimbabwe	0.164	0.131	0.226	0.191	0.216	0.283	0.414	0.372	0.161	0.099

Table 4a: ***Bilateral OTRI or MA-OTRI: Agriculture and Manufacturing***

	Importers						
Exporters	QUAD	High Inc.	Middle Inc.	Low Inc.	LDC	SSA	World
Quad	0.08	0.08	0.19	0.23	0.21	0.23	0.14
High Income	0.08	0.08	0.19	0.23	0.21	0.23	0.14
Middle Income	0.09	0.09	0.22	0.25	0.22	0.25	0.15
Low Income	0.14	0.14	0.25	0.26	0.22	0.26	0.20
LDC	0.12	0.12	0.24	0.25	0.22	0.26	0.18
SSA	0.11	0.11	0.23	0.24	0.21	0.24	0.17
World	0.10	0.09	0.22	0.24	0.22	0.25	0.15

Table 4b: ***Bilateral OTRI or MA-OTRI: Agriculture***

	Importers						
Exporters	QUAD	High Inc.	Middle Inc.	Low Inc.	LDC	SSA	World
Quad	0.30	0.31	0.46	0.37	0.29	0.34	0.37
High Income	0.34	0.29	0.46	0.36	0.28	0.34	0.38
Middle Income	0.49	0.47	0.42	0.36	0.28	0.33	0.43
Low Income	0.43	0.42	0.40	0.34	0.27	0.31	0.39
LDC	0.38	0.38	0.39	0.32	0.26	0.30	0.37
SSA	0.35	0.34	0.38	0.33	0.26	0.30	0.35
World	0.43	0.42	0.42	0.35	0.28	0.33	0.41

Table 4c: ***Bilateral OTRI or MA-OTRI: Manufacturing***

	Importers						
Exporters	QUAD	High Inc.	Middle Inc.	Low Inc.	LDC	SSA	World
Quad	0.06	0.06	0.15	0.21	0.20	0.21	0.11
High Income	0.05	0.06	0.15	0.21	0.20	0.21	0.10
Middle Income	0.04	0.04	0.19	0.23	0.21	0.24	0.11
Low Income	0.04	0.04	0.20	0.22	0.21	0.24	0.13
LDC	0.03	0.03	0.20	0.22	0.21	0.24	0.12
SSA	0.02	0.02	0.16	0.19	0.18	0.21	0.09
World	0.04	0.04	0.18	0.22	0.20	0.23	0.11

Figure 1: Distribution of R-squares of import equations (equation (5))

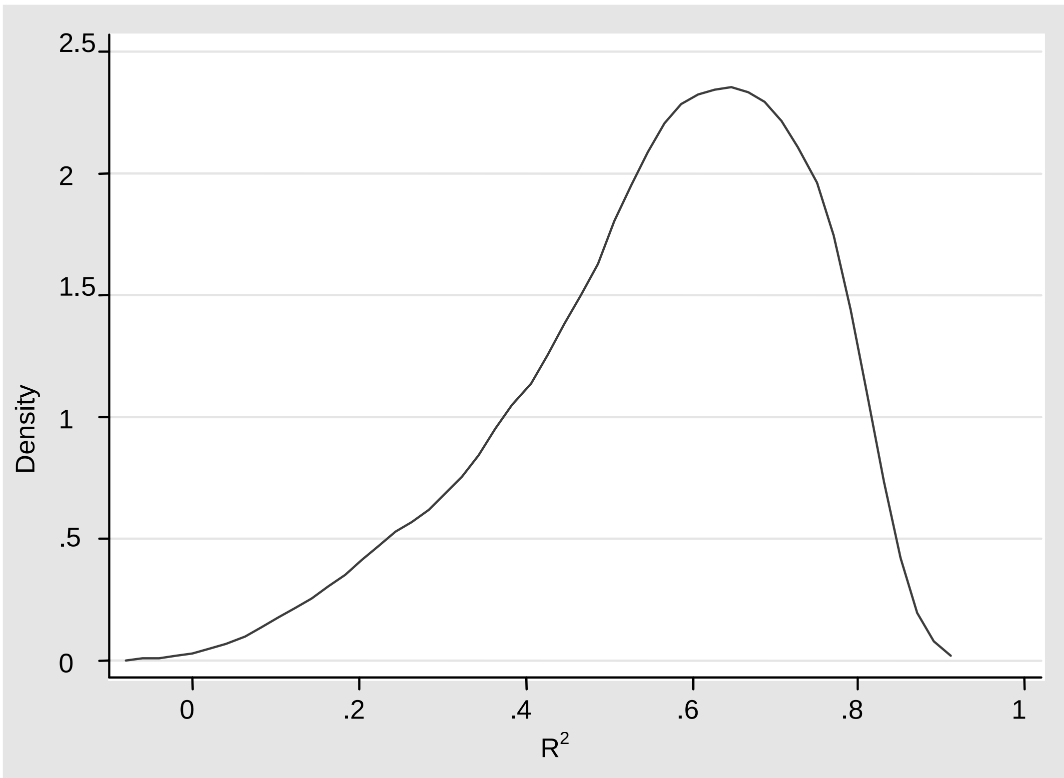

Figure 2: AVEs of Core NTBs and GDP per capita

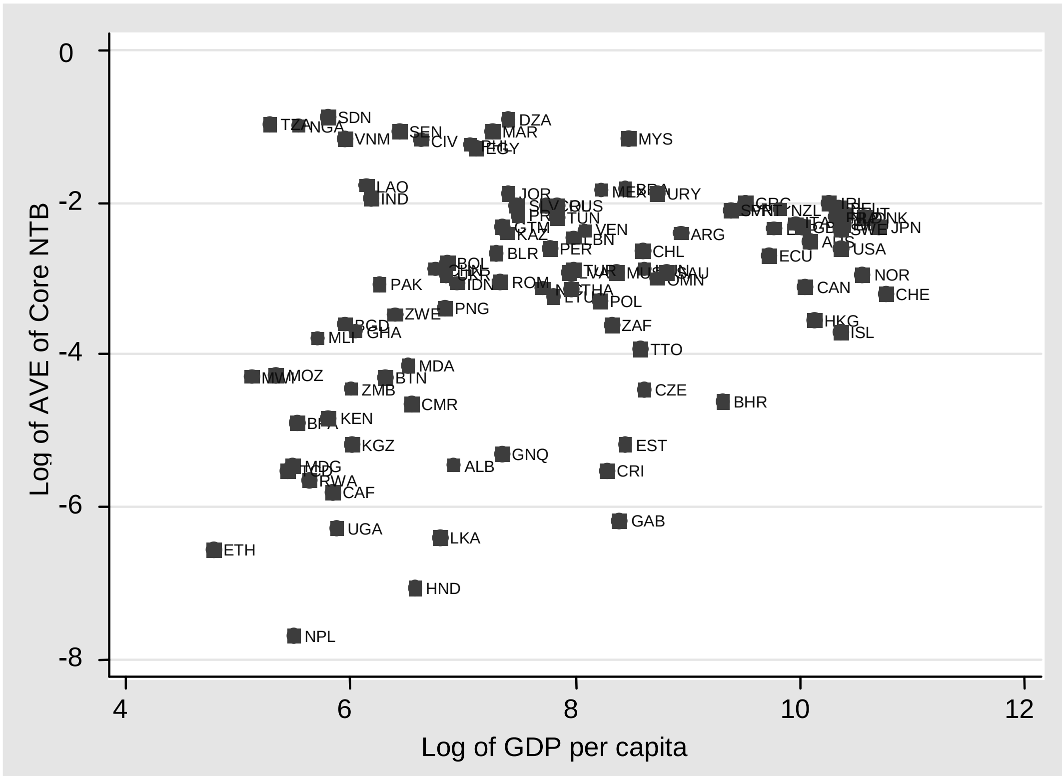

Figure 3: AVE of agricultural domestic support and GDP per capita

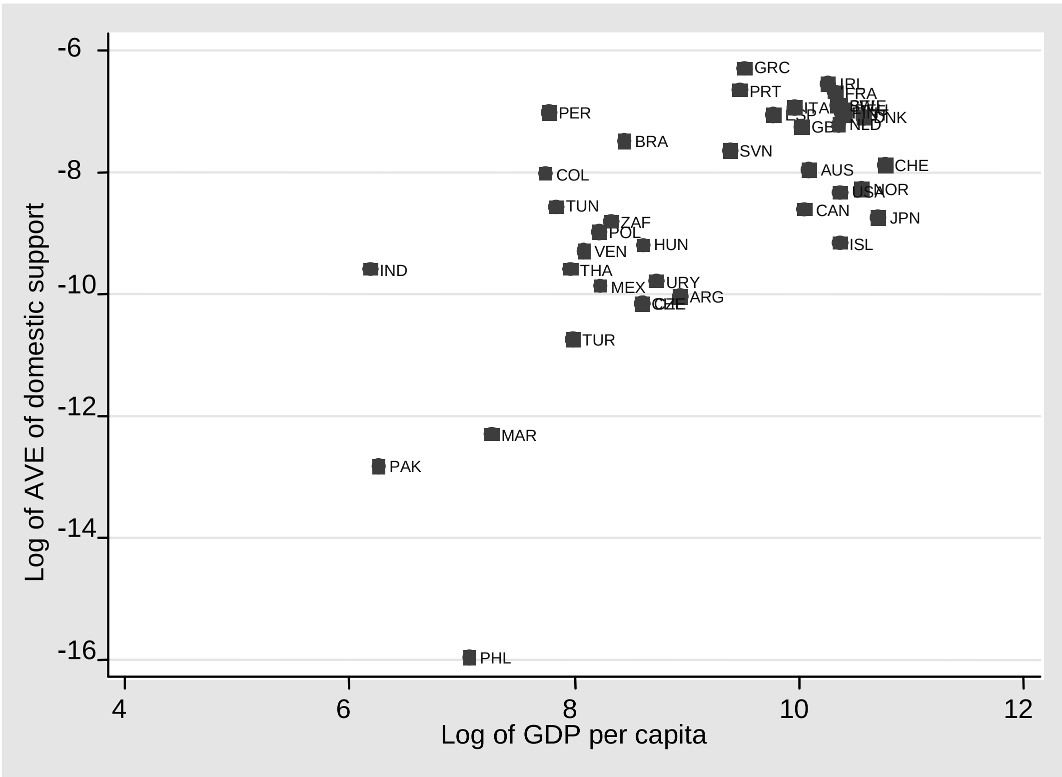

Figure 4: OTRI, MA-OTRI and GDP per capita

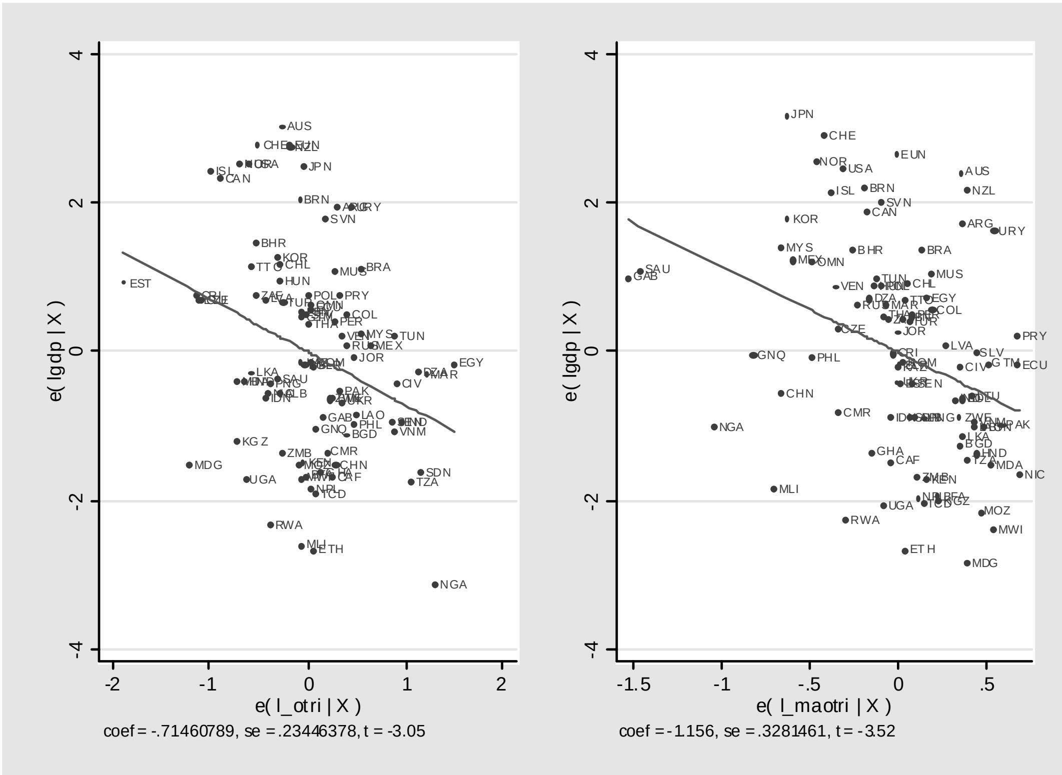

Figure 5: Precision of OTRI estimates