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Author(s)	Anderson, James E.; Neary, J. Peter
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THE MERCANTILIST INDEX OF TRADE POLICY*

James E. Anderson
Boston College and NBER

and

J. Peter Neary
University College Dublin and CEPR

July 11, 2001

Abstract

We introduce an index of trade policy restrictiveness defined as the uniform tariff which maintains the same trade volume as a given tariff/quota structure. Our index overcomes the problems of the trade-weighted average tariff: it avoids substitution bias, correctly accounts for general equilibrium transfers, and takes import volume rather than welfare as benchmark. Empirical applications to international cross-section and time-series comparisons of trade policy confirm our theoretical results: trade-weighted average tariffs generally underestimate the true height of tariffs as measured by the trade-volume-equivalent index; this in turn always underestimates the welfare-equivalent index.

JEL: F13

Keywords: International trade policy; tariffs; quotas; Trade Restrictiveness Index; trade liberalisation.

Addresses for Correspondence: James E. Anderson, Department of Economics, Boston College, Chestnut Hill, MA 02167-3806, USA; tel.: (+1) 617-552-3691; fax: (+1) 617-552-2308; e-mail: james.anderson@bc.edu. J. Peter Neary, Department of Economics, University College Dublin, Belfield, Dublin 4, Ireland; tel.: (+353) 1-716 8334; fax: (+353) 1-283 0068; e-mail: peter.neary@ucd.ie.

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We introduce an index of trade policy restrictiveness defined as the uniform tariff which maintains the same trade volume as a given tariff/quota structure. Our index overcomes the problems of the trade-weighted average tariff: it avoids substitution bias, correctly accounts for general equilibrium transfers, and takes import volume rather than welfare as benchmark. Empirical applications to international cross-section and time-series comparisons of trade policy confirm our theoretical results: trade-weighted average tariffs generally underestimate the true height of tariffs as measured by the trade-volume-equivalent index; this in turn always underestimates the welfare-equivalent index.

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International trade policies are often compared across countries and over time, using such measures as arithmetic or trade-weighted average tariffs, Non-Tariff Barrier (NTB) coverage ratios and measures of tariff dispersion.[1] But all such measures are without theoretical foundation. In this paper we develop and characterise a theoretically-based index number of trade policy which provides a true benchmark against which all these *ad hoc* measures can be evaluated. We also present a sample application which shows that our index can be operationalised and that it differs significantly from previously employed atheoretic indices. Our index is the uniform tariff which is equivalent in trade volume to the existing (usually highly nonuniform) tariff vector.

We call our index the Mercantilist Trade Restrictiveness Index (MTRI), since it takes as its starting point the Mercantilist preoccupation with the volume of trade. Modern avatars of Mercantilist thinking are everywhere, and their concern with trade volumes plays an important constraining role in policy formation. Successive GATT rounds have interpreted reciprocity in tariff negotiations to mean equivalent import volume expansion (defined as the value of imports at fixed world prices). The WTO goes further, sanctioning retaliation by the offended party to displace a volume of trade equal to that displaced by the original offending protection. (See Bagwell and Staiger (1999) for a rationalisation.) Each nation presumably faces domestic political pressure against tariff cuts and each pursues reciprocal strategies so that imports rise in step with the imports of others. Subject to the reciprocity constraint, which nation is cutting tariffs (against protectionist pressure) by more?

While concern with trade volume might suggest estimating the volume of trade in the distorted equilibrium relative to that in free trade, this ratio would not measure *policy*. Import volume could be much lower than in free trade either because tariffs are high on inelastic goods *or* because though low they are imposed on highly elastic goods. What is

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1 For overviews see Edwards (1993), Leamer (1988) and Pritchett (1996). Bordo, Eichengreen and

needed to guide multilateral negotiations is a conceptual framework within which the *level* and the *effects* of trade policy can be distinguished, and this is what our paper provides.

The MTRI should also be useful for bilateral negotiations. For example, interest group pleading and even U.S. government negotiators have focused in recent years on trade volumes in auto parts and in semiconductors, as well as on aggregate U.S.-Japanese bilateral trade volumes. The ubiquity of such examples shows that there is a latent demand on the part of practical trade policy makers for measures of trade restrictiveness which take the volume of trade as reference.

The volume equivalent uniform tariff measure has other significant uses in applied economics. One is in the measurement of implicit trade costs. Stimulated by McCallum's (1995) surprising revelation that the US-Canada border appeared to pose a big border barrier, a literature has grown up recently which examines trade barriers other than those associated with directly measurable trade costs. This work is primarily cross-sectional and uses the gravity model to answer the question: all else equal, by how much is trade reduced by the border (and similarly by language differences and so forth). The literature has yet to come to proper grips with measurable trade costs in the context of measuring the implicit ones. For this purpose it is necessary to have a trade policy index which holds volume constant.[2] Since this work is inevitably done with rather aggregated trade (most often on total trade) the appropriate measure of formal trade barriers is indeed the MTRI. A second possible use is in examining the link between open-ness and growth. If the underlying model features technology spillovers which are proportional to trade volume, as in Grossman and Helpman

Irwin (1999) is a recent example of the use of average tariffs to measure trade liberalisation.

2 The dependent variable is some trade volume, which in general depends on the vector of tariffs and a set of other independent variables. Using the full vector of tariffs as independent variables is impractical. The econometric analysis should ideally be based on aggregating the tariff vector such

(1995), a measure of policy open-ness which is trade-volume equivalent is indeed the appropriate index.[3]

In Anderson and Neary (1996), we addressed the policy index number problem in a different context, that of the welfare effect of trade restrictions. We provided a rigorous theoretical foundation for the Trade Restrictiveness Index (TRI), which operationalises the idea of finding a uniform tariff which yields the same *real income* as the original differentiated tariff structure. We advocated its use in studies of openness and growth and in other applications where it is desirable to have a measure of the restrictiveness of trade policy which takes real income as its reference. In the trade negotiations context, however, comparing levels of protection with an index which holds constant the level of real income is less appropriate.[4] Nations care about the effect of their partners' policies on their own interests, not their partners' interests. This need is addressed by the MTRI. We show below that the TRI and MTRI differ considerably in their measure of the restrictiveness of trade policy. Our working paper (2000) derives theoretical relations between the TRI and MTRI as well as other tariff indexes.

Similar indices have been proposed in the literature but none fulfils the same functions. Corden (1966) suggested calculating the uniform equivalent tariff and Leamer (1974) examined a quantity index variant. However, neither the Corden nor Leamer indices keeps track of the disposition of tariff revenue. Hence they are not full general-equilibrium indices.

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that the index does not change the implied trade volume.

3 The reasoning is similar to that of the preceding footnote.

4 An index of foreign country tariffs which holds constant the real income of the home country is appealing in a two-country world. In an n-country world (with n>2), this loses its appeal because an index of one country's trade distortions can hold constant only one of its trading partners' real incomes. Thus there would be n-1 different indices of each country's trade policies, differing from each other in complex and unintuitive ways. A single constant-volume index treats no one trading partner as special and is appealing as a summary of a country's restrictiveness relative to the rest of

Boorstein and Feenstra (1991) and Feenstra (1995) develop an index of the welfare effects of trade policy, but this is not appropriate for measuring its restrictiveness.

Because of the widespread use of the trade-weighted average tariff, we begin in Section 1 by outlining its practical and theoretical deficiencies and showing the difficulties in relating it to an index number of tariffs which holds real income constant, the TRI. Section 2 introduces the MTRI and shows how it relates to the trade-weighted average tariff and to the TRI. Section 3 extends the MTRI to cover the case of quotas. Section 4 presents the empirical analysis, which uses a 25-country cross-section of data from around 1990, and a 5-country panel of year-on-year changes from the late 1980's. We find that the MTRI differs from both standard indices and from the TRI, often dramatically.

1. Average Tariffs and Welfare

Calculating an average measure of tariffs is an index number problem. However, it is inherently more difficult than the usual index number problem, where data on prices and quantities at two distinct dates are available. In constructing a tariff index we typically cannot observe free-trade import volumes: at best we have observations only on current imports and on current and free-trade prices. This means that there are very few model-free measures available. One of the few that can be constructed, and so a natural starting point, is the trade-weighted average tariff. Section 1.1 reviews the difficulties with this index. and Section 1.2 sets out the TRI and relates it to the average tariff.

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the world.

1.1 The Trade-Weighted Average Tariff

Especially when data are particularly poor, it is not unknown for analysts to compute the simple (i.e., unweighted) average of tariff rates across different commodities. However, this measure has obvious disadvantages: it treats all commodities identically, and it is sensitive to changes in the classification of commodities in the tariff code. Clearly, tariffs should be weighted by their relative importance in some sense. The simplest and most commonly-used method of doing so is to use actual trade volumes as weights. This leads to the *trade-weighted average tariff*, $\boldsymbol{\tau}^a$:

$$(1) \qquad \boldsymbol{\tau}^a = \frac{\sum m_i t_i}{\sum m_i \boldsymbol{p}_i^*} = \sum \boldsymbol{w}_i \boldsymbol{\tau}_i; \quad \boldsymbol{w}_i \equiv (m_i \boldsymbol{p}_i^* / \sum m_i \boldsymbol{p}_i^*)$$

where t_i and $\boldsymbol{\tau}_i$ (equal to $t_i / \boldsymbol{p}_i^*$) are the specific and *ad valorem* tariffs on good i respectively, m_i is its import volume and $\boldsymbol{p}_i^*$ its world price. Note for later use that $\boldsymbol{\tau}^a$ equals the ratio of tariff revenue to the value of imports at world prices.

The difficulties with $\boldsymbol{\tau}^a$ are immediate. As the tariff on any one good rises, its imports fall, so the now higher tariff gets a *lower* weight in the index. For high tariffs this fall in the weight may be so large that the index is *decreasing* in the tariff rate. More subtly, tariffs have greater effects on both welfare and trade volume when they apply to imports in relatively elastic demand; but it is precisely these goods whose weights fall fastest.

Figures 1 and 2 illustrate these considerations in a linear two-good example. Each panel of Figure 1 gives the import demand function for one of the goods, with world prices normalised at unity for convenience. (Ignore point H and the associated dotted lines for the present.) As shown, the more elastic good 1 has the lower tariff. However, if this configuration were reversed, a high tariff would almost eliminate imports of good 1. As a result, the calculated trade-weighted average tariff would be lower than in Figure 1. Yet it seems intuitively obvious that trade would then be *more* rather than less restricted, since the volume of imports would be lower and the welfare cost of protection (measured by Marshallian triangles) would be higher. Figure 2, drawn for the same demand slopes as Figure 1, shows this from a different perspective: the trade-weighted average tariff is *declining* in t_1, the tariff rate on the high-elasticity good, when t_1 is relatively high.

In response to the difficulties caused by using current import volumes to construct the weights, some authors have suggested using instead the import volumes which *would* prevail in free trade.[5] This view is well expressed by Loveday (1931), quoted with approval by Leamer (1974): "The theoretically perfect weighting system would be the one under which each commodity were given a coefficient equivalent to the value which it would have in international trade of a free trade world." But is this indeed the "theoretically perfect weighting system"? Using free-trade weights avoids the most obvious defects of using current trade weights: the weights are not biased downwards by tariffs and the index is always increasing in each individual tariff rate. But otherwise the case for using it is not compelling, in the absence of an explicit theoretical basis for measuring trade policy restrictiveness. Moreover, the use of free-trade weights poses a major practical problem. Since the free-trade import volumes are not directly observable, the informational requirements of this index are just as great as those of the "true" indexes which we discuss below: a complete model of import demand must be specified and estimated.

5 Many other weighting schemes have been proposed, but none has a superior theoretical foundation and all suffer from practical disadvantages. Production shares give zero weight to tariffs on non-competing imports. Consumption shares, like import shares, may be low for high tariffs precisely because they restrict trade so much. Finally, world exports (suggested by Leamer (1974)) have the advantage that they are independent of domestic tariffs. However, this virtue reflects a basic problem with using any external variables as weights: they take no account of the special features of the

The choice between actual and free-trade import weights is identical in principle to that between Laspeyres (base-weighted) and Paasche (current-weighted) indexes in any branch of economics. In practice, some plausible compromise between the two (such as their geometric mean, the Fisher Ideal index) is often used. However, a central theme of the economic approach to index numbers (see, for example, Pollak (1971) and Diewert (1981)) is that the choice between alternative index-number formulae should primarily be based not on informal issues of plausibility but on how well they approximate some benchmark "true" index, which answers a well-defined economic question. Moreover, the use of free-trade weights poses a major practical problem. Since free-trade import volumes are not directly observable, the informational requirements of this index are just as great as those of the "true" indices which we discuss below: a complete model of import demand must be specified and estimated.

1.2 The TRI and the Trade-Weighted Average Tariff

We have already seen that an explicit behavioural model is needed to estimate an average tariff with any weights other than those based on the protected trade flows. The same applies when we come to specify a theory-consistent index. To define the TRI and to relate average tariffs to underlying resource constraints and real income, we now develop a general model of a tariff-distorted open economy.[6]

The economy is assumed to be in competitive equilibrium, with no distortions other than tariffs, and with a single representative consumer. Traded goods prices are fixed on world markets. (These assumptions can be relaxed at the cost of well-understood complications.[7])

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country being studied.

6 Further details on the specification of the model can be found in Dixit and Norman (1980). The trade expenditure function was introduced in Neary and Schweinberger (1986).

7 Relaxing the fixed world prices assumption is a topic for future work. We believe there is a rationale for a ceteris paribus trade restrictiveness index which fixes world prices even when these prices are in fact endogenous.

Private sector behaviour is described by the trade expenditure function $E(\boldsymbol{p},u)$. This gives the expenditure needed to attain the utility level u facing the price vector π of traded goods subject to tariffs, net of the income received from ownership of the factors of production. Spending and income in turn are represented by expenditure and GDP functions respectively:

(2) $$E(\boldsymbol{p},u) = e(\boldsymbol{p},u) - g(\boldsymbol{p}).$$

In the background are factor endowments, prices of non-traded goods and factors (which are endogenous given $\boldsymbol{p}$ and u), and prices of traded goods not subject to tariffs. Standard properties of the underlying functions (Shephard's and Hotelling's Lemmas) allow us to identify the price derivatives of the trade expenditure function as the economy's general-equilibrium utility-compensated (or Hicksian) import demand functions:

(3) $$E_{\pi}(\pi,u) \quad = \quad m^{c}(\pi,u).$$

The trade expenditure function describes private-sector behaviour. In the presence of tariffs, we must add to this the behaviour of the government, which collects tariff revenue and rebates it to the representative consumer in a lump sum. The outcome of both public and private behaviour can be summarised by the balance of trade function:[8]

(4) $$B(\boldsymbol{p},u) \equiv E(\boldsymbol{p},u) - (\boldsymbol{p} - \boldsymbol{p}^{*}) \cdot E_{p}(\boldsymbol{p},u)$$

This differs from the trade expenditure function by the tariff revenue term, where the vector $\boldsymbol{p} - \boldsymbol{p}^{*}$ denotes the tariff wedge between domestic and world prices. The economy is in equilibrium when the balance of trade constraint is satisfied. This requires that utility is at a level with equates the balance of trade function to any exogenous income, denoted by b:

8 All vectors are column vectors; a prime $(')$ denotes a transpose; and a dot $(\cdot)$ denotes a vector inner product. To economise on notation, wherever possible without compromising clarity we omit $\boldsymbol{p}^{*}$ from the arguments of B, along with the other exogenous variables.

(5) $$B(\boldsymbol{p},u)=b\,.$$

The balance of trade function thus allows us to summarise the equilibrium of an economy subject to tariffs in terms of a single compact equation.

We can now see why $\boldsymbol{t}^a$ is not a valid general-equilibrium measure of average tariffs. First, if a uniform tariff equal to $\boldsymbol{t}^a$ were imposed, with utility at u^0, private sector spending would not equal the level it has in the initial equilibrium: $E[(1+\boldsymbol{t}^a)\boldsymbol{p}^*,u^0]\neq E(\boldsymbol{p}^0,u^0)$.[9] Second, the economy would not be in equilibrium, since the balance of trade would not equal its initial level b^0: $B[(1+\boldsymbol{t}^a)\boldsymbol{p}^*,u^0]\neq b^0$. Hence $\boldsymbol{t}^a$ does not provide a valid benchmark for calculating a scalar equivalent to the initial tariff structure.[10]

Can we devise a true tariff index of this kind? Not only is the answer "yes" but it is already available. Anderson and Neary (1996) introduced the Trade Restrictiveness Index or TRI, which implies a uniform tariff index $\boldsymbol{t}^D$ defined implicitly as follows:

(6) $$\boldsymbol{t}^\Delta:\ B[(1+\boldsymbol{t}^\Delta)\boldsymbol{p}^*,u^0]=b^0\,.$$

[9] In contrast, equality could be preserved by defining a 'true' average tariff such that the expenditure with the uniform tariff is equal to initial expenditure, and it can be shown that the true average tariff exceeds the trade weighted average tariff due to the substitution effect (see Anderson and Neary, 2000).

10 The true average tariff defined in the preceding note has some legitimate uses. It is the appropriate index to use to aggregate tariffs across sub-sectors in order to construct an index of the average level of tariffs facing consumers or producers. It has been used in this way (usually operationalised under Törnqvist or Cobb-Douglas assumptions) both in partial equilibrium studies (e.g., Aw and Roberts (1986)) and in CGE models (e.g., Cox and Harris (1985)).

This has a similar interpretation to the true average tariff, except that it correctly accounts for tariff revenue as well as private-sector spending. The value of t^D is the uniform tariff which would ensure balance-of-payments equilibrium at the initial level of utility. Figure 3 illustrates t^D for the linear two-good case, and shows that it has much more satisfactory properties than the trade-weighted average tariff as the tariff schedule deviates from the uniform: it is always increasing in each individual tariff rate; and it responds more rapidly to higher tariffs on the high-elasticity good 1.[11]

2. The Mercantilist TRI

In the previous section we saw that the trade-weighted average tariff is a very imperfect approximation to a welfare equivalent measure of trade restrictiveness. But if our concern is with trade volume rather than welfare, the TRI is then not the appropriate concept. Instead we want a tariff index which takes the initial import volume as its reference point. Section 2.1 introduces this concept. Sections 2.2 and 2.3 compare it with the trade-weighted average tariff and the TRI, respectively, and Section 2.4 relates changes in the index to changes in the distribution of tariffs, all drawing on the results of Anderson and Neary (2000).

2.1 The MTRI

We wish to evaluate the restrictiveness of trade policy using trade volume as the reference standard. Let $M(\boldsymbol{p},b)$ denote the import volume function, giving the volume of imports valued at world prices when the vector of domestic prices of the distorted traded goods is equal to $\boldsymbol{p}$ and the trade balance equals b. Thus $M(\boldsymbol{p},b)$ is defined as $\boldsymbol{p}^* \cdot E_p(\boldsymbol{p},u)$, where the

11 With linear demands in partial equilibrium, the welfare loss from a tariff at rate t_i on good i equals $(t_i p_i^*)^2 g_i / 2$, where g_i is the price-responsiveness of imports of good i. Hence the welfare-equivalent uniform tariff t^Δ is defined implicitly by: $\sum (t^\Delta p_i^*)^2 g_i = \sum (t_i p_i^*)^2 g_i$.

level of u is compatible with balanced trade: $B(\mathbf{p},u)=b$. (The properties of this function are given in Anderson and Neary, 2000.) Then the Mercantilist Trade Restrictiveness Index (MTRI) gives the uniform tariff $\boldsymbol{t}^m$ which yields the same volume (at world prices) of tariff-restricted imports as the initial tariffs, M^0:

$$\text{(7)} \qquad \boldsymbol{t}^m\text{:}\ M[(1+\boldsymbol{t}^m)\mathbf{p}^*, b^0] = M^0.$$

Figure 4 illustrates the MTRI uniform tariff for the linear two-good example.[12] $\boldsymbol{t}^m$ behaves somewhat similarly to the welfare-equivalent uniform tariff (in particular, it increases more rapidly in $\boldsymbol{t}_1$, the tariff on the more elastic good) but very differently from the trade-weighted average tariff.

Obviously we get a different MTRI depending on which goods are included in the index. In international comparisons and multilateral negotiations it is natural to include all imports, irrespective of trading partner and whether or not they are subject to tariffs. (This is the convention adopted in the applications of Section 4.) Alternatively, in bilateral negotiations it makes more sense to define the index as the uniform tariff which would yield the same volume of bilateral trade. For example, in U.S.-Japan trade negotiations, the MTRI for Japan might include all Japanese imports and exports to the U.S., both distorted and undistorted. Separate indices could also be calculated for particular product groups (reflecting, for example, concerns with bilateral trade in electronics or motor vehicles). The only group of goods for which the index can *not* be defined is that of *all* traded goods, both exported and imported.[13]

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12 Denoting the import demand functions by $m_i = \boldsymbol{a}_i - \boldsymbol{g}_i \boldsymbol{p}_i$, the partial-equilibrium import-volume-equivalent uniform tariff $\boldsymbol{t}^m$ is defined implicitly by: $\sum \boldsymbol{p}_i^*[\boldsymbol{a}_i - \boldsymbol{g}_i(1+\boldsymbol{t}^m)\boldsymbol{p}_i^*] = \sum \boldsymbol{p}_i^*[\boldsymbol{a}_i - \boldsymbol{g}_i(1+\boldsymbol{t}_i)\boldsymbol{p}_i^*]$.

13 Heuristically, it does not make sense to define trade restrictiveness without selecting an untaxed

2.2 The MTRI and the Trade-Weighted Average Tariff

Next we want to rank the MTRI and the trade-weighted average tariff. In partial equilibrium it is easy to show that their relative size depends on the composite elasticity of import demand: the MTRI exceeds the trade-weighted average tariff if this elasticity exceeds one. To see this, return to Figure 1. To locate the MTRI uniform tariff in the diagram, draw the line *Ge* parallel to *Bb*, the import demand curve for good 1. By construction, the level of total imports *be* equals the initial level *BG*. Hence the MTRI uniform tariff equals the line *OH*. This also equals the level of tariff revenue generated by the MTRI uniform tariff, *abef*, divided by the value of imports at world prices (still, by construction, equal to *JAFK*). Now, recall from the discussion following equation (1) that the trade-weighted average tariff equals the ratio of *actual* tariff revenue to the value of imports at world prices. In Figure 1, this equals the ratio of *ABCO+ODEF* to *JAFK*. Hence, the MTRI uniform tariff exceeds the trade-weighted average tariff if and only if it leads to a higher level of tariff revenue. This is equivalent to requiring the composite elasticity of demand for imports to exceed one, which is what we wished to prove.

Of course, this argument is heuristic only, and needs to be extended to many goods and to general equilibrium. With many goods we need to be more careful in specifying the composite import demand elasticity; and in general equilibrium, the assumptions of no income effects and no cross effects need to be relaxed. In Anderson and Neary (2000) we prove:

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good or group of goods as reference. Technically, the index is not defined over all goods, since (from the standard assumption of no money illusion) when b equals zero the import volume function is homogeneous of degree zero in the prices of all traded goods. Neary (1998) shows how the failure to select a reference untaxed good leads to misleading results in the theory of trade policy.

Proposition 1: The MTRI uniform tariff $\boldsymbol{t}^m$ *exceeds the trade-weighted average tariff* $\boldsymbol{t}^a$ *if: (i) the compensated arc elasticity of demand for the composite tariffed good exceeds one; (ii) the composite tariffed good is normal; and (iii) the trade expenditure function is implicitly separable in tariffed and other goods.*

This proposition gives sufficient conditions only, and they are over-strong. The basic insight remains: the MTRI uniform tariff is more likely to be higher than the trade-weighted average tariff the more elastic is the demand for tariff-constrained imports.

2.3 The MTRI and the TRI

No such ambiguity arises when we come to compare the MTRI and the TRI. We show in Anderson and Neary (2000) that, under very general conditions, they can be ranked unambiguously:

Proposition 2: The MTRI uniform tariff cannot exceed the TRI uniform tariff: $\boldsymbol{t}^m \le \boldsymbol{t}^\Delta$.

This result can be explained intuitively as follows. Replacing the initial tariffs by the MTRI uniform tariff requires raising low tariffs and cutting high ones. Since the total volume of imports must remain fixed, this implies that the welfare cost of the tariff increases must be less (in absolute value) than the welfare gain from the tariff cuts. (For example, in Figure 1, moving to the MTRI uniform tariff *OH* means that the welfare cost of raising the low tariff (*AB*) on good 1 is *ABba*, which by similar triangles equals *FGef*. This is clearly less than *FEef*, the welfare gain from cutting the high tariff on good 2 (*FE*).) Hence, moving to the MTRI uniform tariff involves a rise in welfare; to keep welfare at its initial level would require a *higher* uniform tariff than OH.

This is an important result, since it means that the uniform tariff calculated according to the MTRI logic generally under-estimates the uniform tariff appropriate when welfare is the standard of reference. (Figures 3 and 4 illustrate in the linear two-good case.)

2.4 Tariff Dispersion and Changes in the MTRI and TRI

So far we have only considered alternative measures of *average* tariff levels. However, in practical applications it is also common to calculate measures of tariff *dispersion*. Once again, these have no theoretical foundation. Moreover, there is no obvious way of combining them with the trade-weighted average tariff to derive a composite measure of trade policy restrictiveness. Figure 5 illustrates the trade-weighted standard deviation of tariffs for the linear two-good example. It seems obvious that this conveys no information about trade restrictiveness.

Nonetheless, it is intuitively plausible that there should be some relationship between tariff dispersion and trade restrictiveness. The marginal welfare damage caused by a tariff is proportional to the height of the tariff, so large tariffs are more damaging than small ones, all else equal. Thus increases in dispersion which preserve the mean tariff in some appropriate sense should be welfare decreasing and thus should affect the TRI (and the MTRI through income effects). Figure 1 can be used to illustrate the effect of dispersion on the relation between the MTRI and TRI for the special case of no cross effects and no income effects. Start with a uniform tariff equal to OH (so $t^a = t^m = t^\Delta = OH$), then introduce dispersion by lowering t_1 to OC and raising t_2 to OD. By construction, the volume of trade and hence the MTRI uniform tariff are unchanged. However, reversing the reasoning of Section 2.3, welfare falls and so the TRI uniform tariff rises. Thus the increase in dispersion raises t^Δ relative to t^m. In Anderson and Neary (2000) we extend the approach of Anderson (1995) to generalise this result: under very general conditions, small changes in tariffs raise t^D by more than $\boldsymbol{t}^m$ if and only if the appropriately weighted coefficient of variation of tariffs rises.

3. Quotas and the MTRI

Quotas are an important form of trade intervention in many countries. Moreover, other kinds of non-tariff barriers may often be represented as quotas. The application of Section 4 includes many examples of non-tariff barriers treated in this way. Thus it is important to extend the definition of the MTRI to incorporate quotas. For simplicity, we continue to assume that all distortions are in trade only.

Let q denote the vector of quota-constrained imports, with domestic prices p and world prices p^*; while m, $\boldsymbol{p}$ and $\boldsymbol{p}^*$ continue to denote the quantity and prices of tariff-constrained imports. As before, we seek the uniform tariff which would yield the same import volume M^0 as the initial distortions $\{q^0,\boldsymbol{p}^0\}$. Of course, it would not make sense to deflate the quota vector directly. Instead, we apply the uniform tariff to the free-trade prices of the quota-constrained goods. (Anderson and Neary (2000) give a detailed justification for this procedure.) This leads directly to a generalisation of (7):

$$\text{(8)} \qquad \boldsymbol{t}^m: \; M[(1+\boldsymbol{t}^m)p^*,(1+\boldsymbol{t}^m)\boldsymbol{p}^*,b^0] = M^0.$$

With the quotas reduced to their price equivalents, the interpretation of the MTRI uniform tariff now proceeds in exactly the same way as in the case of tariffs only.

4. A Sample Application

The MTRI stands on its own as a theoretical benchmark against which the performance of any empirical index of trade restrictiveness can be evaluated. But, as with the true Konüs price index in consumer theory, it can also be made operational if a specific economic structure is assumed: in this case, an empirical specification of the economy's general equilibrium. In principle, the MTRI can be operationalised with only slight modifications of any standard Computable General Equilibrium (CGE) model. But, in practice, most CGE models are highly aggregated with respect to trade distortions and so are not ideally suitable for this purpose. It is also desirable to use the same CGE structure across economies. This will be highly aggregated in production both to meet data limitations for some countries and to focus on the detailed trade distortion structure. In this section, we draw on Anderson’s (1998) disaggregated application of the TRI, and use the same data and CGE model to calculate the MTRI and compare it with the TRI and the standard indices. The CGE model has a highly aggregated CES/CET industrial structure and a very disaggregated trade structure. The model's main virtue is that it requires relatively little information about domestic production structure, so a common model framework can be used across a large group of countries. At the same time, it permits the use of as detailed trade distortions data as the analyst can find. We briefly review the model in the Appendix to provide a self-contained treatment; see Anderson (1998) for details. We calculate the MTRI and TRI for both a cross section of countries and for a few cases of year-on-year changes.

Applications and their credibility are chiefly constrained by the paucity of detailed distortion data. Data on non-tariff barriers (NTBs) are notoriously poor, and there is also surprisingly little systematic detailed information on tariffs and associated import volumes across a broad spectrum of countries and years. The data were obtained by the World Bank from the TRAINS (TRade Analysis and INformation System) database (UNCTAD (1996)), supplemented by trade and trade distortions data supplied by country economists at the Bank. Non-Tariff Barriers (NTB's) are treated as binding quotas. This provides us with 6 digit or higher Harmonised System (HS) trade distortions: the GATT/WTO upper bounds on MFN ad valorem tariff rates and a binary variable indicating the presence or absence of a 'hard core' NTB. [14] To reach consistency in classification between trade distortion and trade flow classifications, we are forced to aggregate to the 4 digit HS level. We use atheoretic trade weighted average tariffs in this aggregation, losing considerable information in many cases (tariff variation within 4 digit trade categories is often considerable). To aggregate NTBs we assign an NTB if 75% of the sectors in a 4 digit HS aggregated sector have hardcore NTBs. By using the upper bound MFN tariff we neglect the important fact that many countries' actual tariffs are below their WTO binding level.[15] We also neglect the fact that many tariffs are specific rather than ad valorem, and hence have endogenous ad valorem equivalents. And we neglect trade preferences and other exemptions which cause tariffs to vary by country of origin. Errors are even more notorious for NTBs. Due to all these sources of error, we do not claim to have accurate measures of trade restrictiveness. Fortunately, our main purpose is to demonstrate the operationality of our theory and to show that different trade restrictiveness

14 A "hard-core" NTB includes some restrictions which are hardly quantitative, such as being under investigation for dumping. It excludes simple licensing requirements. See UNCTAD's description of their NTB database for details.

indexes give significantly different answers. Even inaccurate trade distortions data are adequate for this purpose.

A key practical issue is the treatment of quota rents, bearing in mind that information on domestic prices (and hence on quota premia) is not available. In comparisons with free trade (i.e., in Table 1 and Figure 6 below) we assume that rent-retaining tariffs capture all the quota rent, so all NTB's are non-binding at the margin in the initial equilibrium.[16] Hence the policy regime is assumed to be one of tariffs only, with quotas replaced by their tariff equivalents. In evaluating year-on-year changes (Table 3 below), we assume instead that binding quotas generate rents which are entirely lost to foreigners or to rent seeking, apart from the fraction which is retained by tariffs. Alternative expedients (discussed in Anderson (1998)) lead to similar qualitative results.

Table 1 presents the TRI and MTRI uniform tariffs, calculated using the CGE model for a cross-section of 25 countries, with the trade-weighted average tariff and the coefficient of variation of tariffs for reference. Table 2 presents the results of simple regressions and rank correlations between the columns in Table 1, and Figure 6 illustrates the data from Table 1, with countries ranked by their trade-weighted average tariff.

The first observation suggested by Tables 1 and 2 and Figure 6 is that the MTRI uniform tariff t^m and the trade-weighted average tariff t^a tend to move closely together on average. (The correlation and rank correlation coefficients between the two are 0.987 and 0.972 respectively.) However, this does not mean that the two measures are interchangeable for individual countries. On the contrary, t^a underpredicts t^m in all but three of the twenty-five cases. The effect is not statistically significant (as Table 2 shows) and the underprediction

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[15] See Pritchett and Sethi (1994).

$(t^m - t^a)/t^m$ is only 8.9% on average. However, it is important in a number of individual cases, exceeding 15% for Austria, Indonesia, Morocco and the U.S.A. This suggests that in trade negotiations, most countries would prefer to use t^a to evaluate their own trade policies but t^m to evaluate their partners'. On the other hand, for India, t^a *overpredicts* t^m by 7%. So the choice between the two measures is significant and of unpredictable sign in individual cases.

The second observation suggested by Table 1 and Figure 6 is that the TRI uniform tariff t^Δ exceeds the MTRI uniform tariff by a significant margin: $(t^\Delta - t^m)/t^m$ is equal to 48.7% on average. We know from Proposition 2 that t^Δ cannot be less than t^m (at least when both indices are generated by the same utility-consistent model, as here). This theoretical prediction is borne out for every case in the table.[17] The relationship between the two (with correlation and rank correlation coefficients of 0.886 and 0.799 respectively) is weaker than that between t^m and t^a. The percentage divergence also varies considerably, ranging from over 100% in three cases to less than 10% for Bolivia, Mexico and Peru. Here too the theoretical results of Section 2 provide some insight. Anderson and Neary (2000) show that, for small changes in tariffs, t^Δ rises by more than t^m if and only if the appropriately weighted coefficient of variation of tariffs rises. This suggests that the *actual* coefficient of variation of tariffs might help predict the divergence between the two indices (since the appropriately weighted coefficient is not available in practice). The final regression in Table 2 confirms this: the percentage excess of t^Δ over t^m is positively and significantly related to

16 Tariffs on NTB-constrained goods are in practice usually quite high.

17 The numbers in the table are given to only three significant digits, so in one case, Bolivia, the values shown for the two indices are equal to one another. From the raw data, the percentage excess of the TRI over the MTRI for Bolivia is 0.22%, while the next smallest differential (Peru) is 0.88%.

the coefficient of variation of tariffs (given by the last column in Table 1). Overall, it is clear that the two different purposes of evaluating tariff structures yield very different pictures of the relative restrictiveness of nations' trade policies.

Table 3 turns to consider a small sample of year-on-year changes. We now wish to measure the *change* in the tariff structure from $\boldsymbol{t}^0$ to $\boldsymbol{t}^1$, and (as is often true) it is convenient to avoid having to estimate the level of imports in free trade. This can be done by extending the definition of the MTRI given in (8) to allow for comparisons between the initial equilibrium (denoted as always by "0") and an *arbitrary* new equilibrium (denoted by "1") rather than just free trade. For convenience we present the MTRI *deflator* $\boldsymbol{m}$ rather than the MTRI uniform tariff (where $\boldsymbol{m}=1/(1+\boldsymbol{t}^m)$):

$$(9) \qquad \boldsymbol{m}: \ M(p^1/\boldsymbol{m}, \boldsymbol{p}^1/\boldsymbol{m}, b^0) = M^0 .$$

Thus $\boldsymbol{m}$ is the uniform price deflator or "uniform tariff factor *surcharge*" which, when applied to the prices in the new equilibrium, p^1 and $\boldsymbol{p}^1$, yields the same volume (at world prices) of tariff-restricted imports as the old equilibrium M^0.

Table 3 presents $\boldsymbol{m}$ along with comparable measures for the other indices: the TRI deflator $\boldsymbol{D}=1/(1+\boldsymbol{t}^D)$ instead of the TRI uniform tariff; and the ratio of average tariff factors, $(1+\boldsymbol{t}^{a1})/(1+\boldsymbol{t}^{a0})$, instead of the trade-weighted average tariff. Thus, a value greater than one in any of the first six numeric columns of the table indicates that, according to the measure in question, trade policy became *more* restrictive between the two years indicated. Because (from the tariff-imposing country's point of view) tariffs on NTB-constrained goods serve the positive function of retaining rent rather than the negative one of restricting trade, we report average tariffs for these separately. We also distinguish between average tariffs on intermediate and final goods categories. In addition, we give the (arithmetic) change in the coefficient of variation of tariffs, and three measures of NTB restrictiveness: the initial level of and the (arithmetic) change in the NTB coverage ratio, and the (percentage) change in the volume of NTB-constrained imports.

In dramatic contrast to the results of Table 1, the MTRI in Table 3 differs considerably from the standard indices. This echoes the finding of Anderson (1998), where the TRI was shown to differ dramatically from the average tariff and from all the other standard indicators in evaluating year-on-year changes in policy. There is a good reason for this. In the hypothetical leap to free trade, all standard indicators of trade policy move in the same direction. By contrast, in most real-world trade reforms there are conflicting tendencies which make it even more important to use a theoretically based rather than an *ad hoc* index number. In all cases except the disaggregated average tariff on intermediate goods, the tariff measures and the MTRI are negatively correlated. The MTRI is more closely related to the two measures of changes in NTB's (positively to the change in the NTB coverage ratio and negatively to the proportional change in the volume of NTB-constrained imports). Many of the countries analysed had a high initial incidence of NTB's and were liberalising NTB's in the years considered.

Comparing the changes in the MTRI and the TRI, the first columns of Table 3 show that they always have the same sign, but no consistent ranking emerges between them. In the year-on-year changes, the MTRI and TRI changes are quite highly correlated, with a correlation coefficient above 0.95. This is a surprise, since in levels they are not so closely correlated and since for changes as opposed to levels it is quite possible for mean and dispersion to move in opposite directions, amplifying differences between the two. Thus we see no reason to expect this pattern to persist with other data.

The results overall show that the MTRI is much different from standard measures in practice, enough to matter to practical policy-making. In future tariff negotiations it should be useful to come equipped with MTRI measures of proposed changes in policy. Our results also throw light on the appropriateness of using the trade-weighted average tariff as a measure of trade restrictiveness in empirical studies. Table 1 suggests that it may be appropriate in cross-section regressions (though not as we have seen for individual countries). However, Table 3 suggests that in panel data studies, such as the estimation of cross-country growth regressions, it is likely to be a very poor proxy for the two theoretically based indices of trade restrictiveness.

Of course, all our estimates of the TRI and the MTRI are dependent on the model used to calculate them. Anderson (1998) reports that results are not very sensitive to elasticity values, a finding which applies here as well since the same data and model are used. The insensitivity result is consistent with the folklore of CGE modelling --- elasticities do not matter much but specification of the model does matter. (For an illustration in the TRI context, see O'Rourke (1997).) It would be useful to have estimates based on different CGE models to understand better the effects of differences in specification. Despite these caveats, the case seems to be made that the standard measures are likely to be very seriously misleading in practice.

5. Conclusion

Most economists who work with index numbers are familiar with some of the problems they pose. However, it is not widely appreciated that these problems are even more acute in the context of international trade policy. In particular, the deficiencies of the trade-weighted average tariff go far beyond those of standard fixed-weight indices. First, the usual problem of substitution bias is accentuated: highly distorting tariffs get disproportionately low weights and the index may be a *decreasing* function of tariff rates. Second, while it is true that the trade-weighted average tariff yields a Laspeyres-type approximation to a true tariff index, that index itself is inappropriate for evaluating tariff structures in general equilibrium. The problem is that it ignores the redistribution of tariff revenue, implicitly assuming that compensating transfers are made to offset the loss of tariff revenue. Remedying this deficiency leads to the Trade Restrictiveness Index or TRI, which we introduced in another paper. But this brings up the third difficulty: while the TRI is the appropriate index when the welfare effects of tariffs are considered, it is not at all relevant to the concerns of policy makers and trade negotiators with trade volume.

This paper has introduced a new index number, the Mercantilist Trade Restrictiveness Index or MTRI, which deals satisfactorily with all these difficulties. It resembles the TRI in two respects: because it is based on optimising behaviour it avoids substitution bias; and because it is a general-equilibrium index it correctly accounts for tariff revenue. It differs from the TRI in taking trade volume rather than welfare as its reference. The MTRI is defined as the uniform tariff which yields the same volume of imports as a given tariff structure.[18] Since the MTRI is a true index number for tariffs, the performance of empirical measures should be evaluated in terms of how closely they approximate it.

Among our theoretical results, we show that the MTRI uniform tariff exceeds the trade-weighted average tariff if import demand is sufficiently elastic, and that it cannot exceed the

18 This definition is appropriate for comparisons of an arbitrary tariff structure with free trade. More generally, when two different tariff structures are compared, the MTRI is defined as the uniform deflator which, applied to the new set of distorted prices, yields the same trade volume as the initial tariffs. The cross-section and time-series applications in Section 4 illustrate these two alternative

TRI uniform tariff. We also show how changes in the MTRI can be related to changes in the tariff structure, summarised by two parameters, the generalised mean and variance of tariffs. Given the practical interest in measures of tariff dispersion, these techniques seem likely to prove useful in many other contexts. Finally, we show how the MTRI can be extended to allow for quotas as well as tariffs.

We also presented an empirical application which showed how the MTRI can be implemented using a computable general equilibrium model. We found that on average the MTRI is correlated with the trade-weighted average tariff in cross-section comparisons and with changes in NTB restrictiveness in time-series comparisons. However, it diverges significantly from both in individual cases, to an extent which makes standard atheoretic measures highly suspect in practice. The empirical calculations summarised in Figure 6 confirm our theoretical results: trade-weighted average tariffs generally underestimate the true height of tariffs, though less so from a Mercantilist than from a welfarist perspective.

We have concentrated on trade policy in this paper. However, it is clear that exactly the same problems arise in many other fields. Measures of average taxes in public economics or of average environmental distortions in environmental economics encounter similar conceptual difficulties to the trade-weighted average tariff. The theoretical techniques developed in this paper can be applied in these areas. We have made a start with our study of the trade restrictiveness of domestic distortions (Anderson, Bannister and Neary (1995)) and there is likely to be a huge pay-off to extending these techniques to derive appropriate indices of policy restrictiveness in many other contexts.

comparisons.

Appendix: The CGE Model

The economy produces two final composite goods, an exportable not consumed at home and a nontraded good; jointly produced with a Constant Elasticity of Transformation (CET) production function, given the level of activity. The inputs which produce the level of activity include a bundle of non-traded factors of production in fixed supply; a vector of imported inputs subject to binding quota constraints; and a vector of imported inputs subject to tariffs but not subject to quotas. A Constant Elasticity of Substitution (CES) production function relates the inputs to the level of activity. The technology exhibits constant returns to scale.

As for consumption, the representative consumer's tastes are represented by a CES expenditure function. The final goods consumed are a vector of final imports subject to tariffs but not quotas, a vector of final imports subject to binding quota constraints, and the nontraded good.

Trade distortions are modeled as follows. All tariff revenue is assumed to be redistributed to the representative consumer. This includes tariff revenue collected on quota-constrained goods, where it serves to secure a portion of the quota rents. The economy is assumed to lose all quota rent other than that retained by tariffs: either to rent-seeking or to foreigners via the bargaining power they may have in narrow product lines.[19] All nontariff barriers are assumed to be quotas (or ignored as nonbinding). The economy is assumed to be 'small', facing fixed international prices. Exports are not subject to distortions and form a natural numeraire. Any undistorted imports also enter the composite numeraire. In our application, all imports are treated as potentially distorted.

19 If domestic rent-seeking occurs, it uses factors in the same proportions as domestic value added.

In general equilibrium, the equilibrium level of real income (utility) of the consumer is determined by the balance of payments constraint, simultaneously with market clearance for nontraded goods and factors. In reconciling income and expenditure for the balance of payments constraint in our static model, net capital flows are made proportional to GDP. (An alternative treatment of capital flows as exogenous makes little difference to the trade restrictiveness calculations.)

The general distorted trade model set out above is operationalised as follows. Gross Domestic Product (GDP) is equal to the value of the nontraded good plus the export good (which is the numeraire) less the domestic value of imported inputs. Consumer expenditure is equal to the value of the nontraded good plus the domestic value of the final imports. The base expenditure on the vector of final imports divided by expenditure gives the vector of expenditure shares. In the CES structure, the expenditure shares are a function of own price relative to the CES price index. GDP is equal to the payment to the nontraded primary inputs; this plus the sum of imported inputs gives the total cost of production. The base expenditure on the vector of imported inputs divided by total cost gives the vector of imported input shares. With the CES structure, the imported input shares are a function of own price relative to a CES price index of input prices.

The quota-constrained imports have their domestic prices determined by market clearance. With a large number of such imports (given the desirability of disaggregation), this appears to present computational difficulties. Fortunately, the CES structure in combination with the inelastic supply of quota-constrained goods eases the difficulty greatly. For full details, see the user documentation on Anderson’s website (http://fmwww.bc.edu/EC-V/Anderson.fac.html).

The model is implemented by combining national accounts data published in the World Development report with the detailed trade and trade distortion data. In the base case we assume an elasticity of transformation equal to 5, an elasticity of substitution in imported inputs equal to 0.7 and an elasticity of substitution for final demand equal to 2.

References

Anderson, J.E. (1995): "Tariff index theory," *Review of International Economics*, 3, 156-73.

Anderson, J.E.(1998): "Trade restrictiveness benchmarks," *Economic Journal*, 108, 1111-25.

Anderson, J.E. and J.P. Neary (1996): "A new approach to evaluating trade policy," *Review of Economic Studies*, 63, 107-125.

Anderson, J.E. and J.P. Neary (2000), "The mercantilist index of trade policy", mimeo.

Anderson, J.E., G.E. Bannister and J.P. Neary (1995): "Domestic distortions and international trade," *International Economic Review*, 36, 139-157.

Aw, B.Y. and M.J. Roberts (1986): "Measuring quality changes in quota-constrained import markets: The case of U.S. footwear," *Journal of International Economics*, 21, 45-60.

Bagwell, K. and R. Staiger (1999): "An economic theory of GATT," *American Economic Review*, 89, 215-248.

Boorstein, R. and R.C. Feenstra (1991): "Quality upgrading and its welfare cost in U.S. steel imports, 1969-74," in E. Helpman and A. Razin (eds.): *International Trade and Trade Policy*, Cambridge, Mass.: MIT Press, 167-186.

Bordo, M.D., B. Eichengreen and D. Irwin (1999): "Is globalization today really different than globalization a hundred years ago?", NBER Working Paper No. 7195.

Corden, W.M. (1966): "The effective protective rate, the uniform tariff equivalent and the average tariff," *Economic Record*, 200-216.

Cox, D. and R. Harris (1985): "Trade liberalization and industrial organisation: Some estimates for Canada," *Journal of Political Economy*, 93, 115-145.

Diewert, W.E. (1981): "The economic theory of index numbers: A survey," in A. Deaton (ed.): *Essays in the Theory and Measurement of Consumer Behaviour in Honour of Sir*

Richard Stone, London: Cambridge University Press, 163-208.

Dixit, A.K. and V. Norman (1980): *Theory of International Trade: A Dual, General Equilibrium Approach*, London: Cambridge University Press.

Edwards, S. (1993): "Openness, trade liberalization and growth in developing countries," *Journal of Economic Literature*, 31, 1358-1393.

Feenstra, R. (1996): "Estimating the effects of trade policy", in G. Grossman and K. Rogoff (eds.): *Handbook of International Economics,Vol.3*, Amsterdam: North-Holland,1553-95.

Grossman, G. and E. Helpman (1995), "Technology and trade", in G. Grossman and K. Rogoff (eds.): *Handbook of International Economics,Vol.3*, Amsterdam: North-Holland,1279-1337.

Hatta, T. (1977): "A theory of piecemeal policy recommendations," *Review of Economic Studies*, 44, 1-21.

Leamer, E. (1974): "Nominal tariff averages with estimated weights," *Southern Economic Journal*, 41, 34-46.

Leamer, E.E. (1988): "Measures of openness," in R.E. Baldwin (ed.): *Trade Policy Issues and Empirical Analysis*, Chicago: University of Chicago Press, 147-200.

Loveday, A. (1931): *Britain and World Trade*, London: Longmans, Green and Co.

Neary, J.P. (1998): "Pitfalls in the theory of international trade policy: Concertina reforms of tariffs, and subsidies to high-technology industries", *Scandinavian Journal of Economics*, 100, 187-206.

Neary, J.P. and A.G. Schweinberger (1986): "Factor content functions and the theory of international trade," *Review of Economic Studies*, 53, 421-432.

O'Rourke, K. (1997): "Measuring protection: A cautionary tale," *Journal of Development*

Economics, 53, 169-183.

Pollak, R.A. (1971): "The theory of the cost-of-living index," U.S. Bureau of Labor Statistics Working Paper 11; revised version in W.E. Diewert (ed.) (1990): *Price Level Measurement*, Amsterdam: North-Holland, 5-77.

Pritchett, L. (1996): "Measuring outward orientation in developing countries: Can it be done?" *Journal of Development Economics*, 49, 307-335.

Pritchett, L and G. Sethi (1994): "Tariff rates, tariff revenue, and tariff reform: Some new facts," *World Bank Economic Review*, 8, 1-16.

UNCTAD (1996): *A User's Manual for TRAINS (TRade Analysis and INformation System),* New York and Geneva: United Nations.

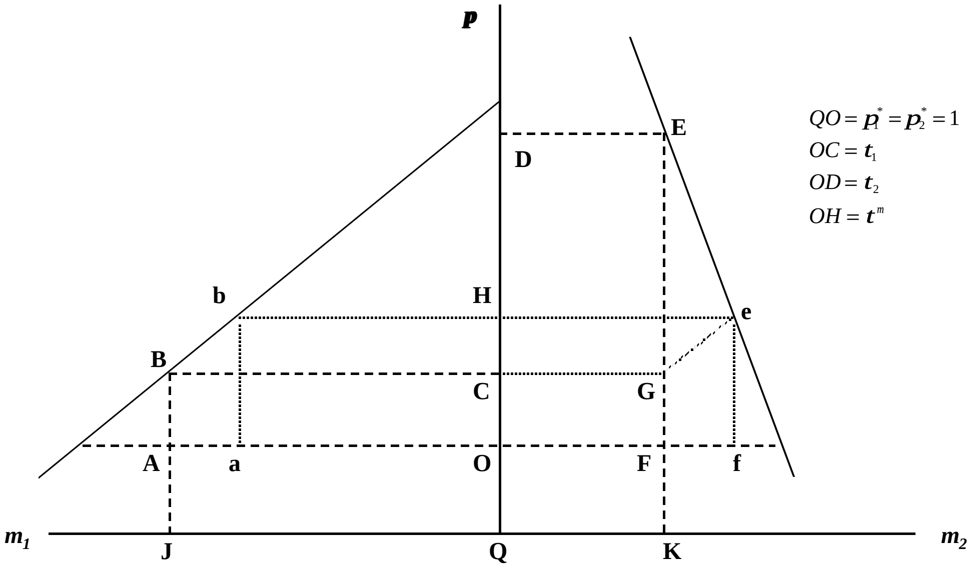

Figure 1: Measuring Trade Restrictiveness:
Tariff Rates and Import Demand Elasticities Negatively Correlated

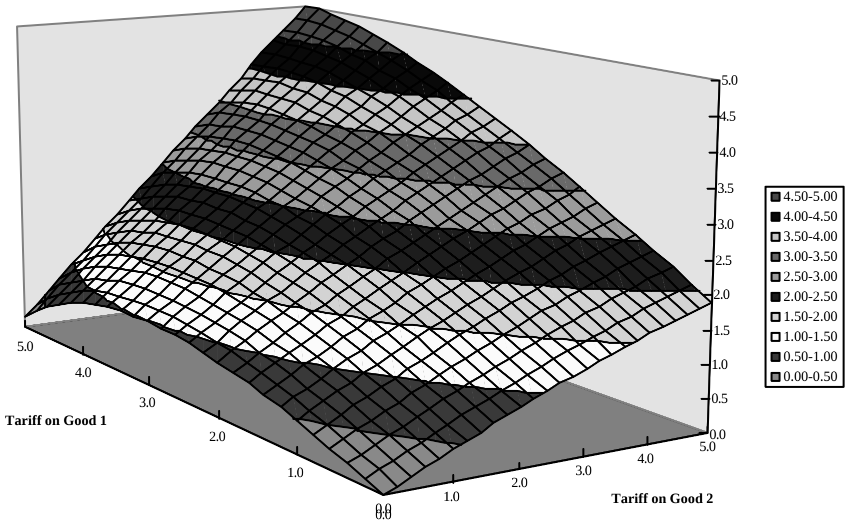

Figure 2: The Trade-Weighted Average Tariff

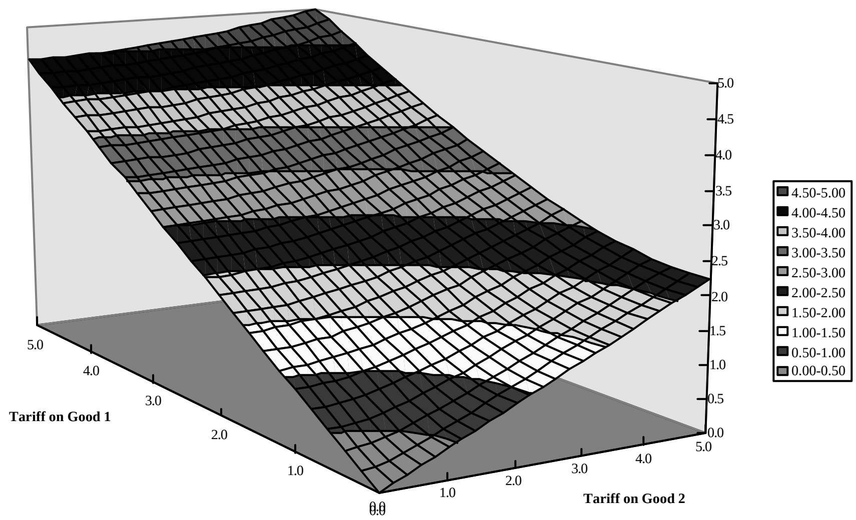

Figure 3: The TRI or Welfare-Equivalent Uniform Tariff

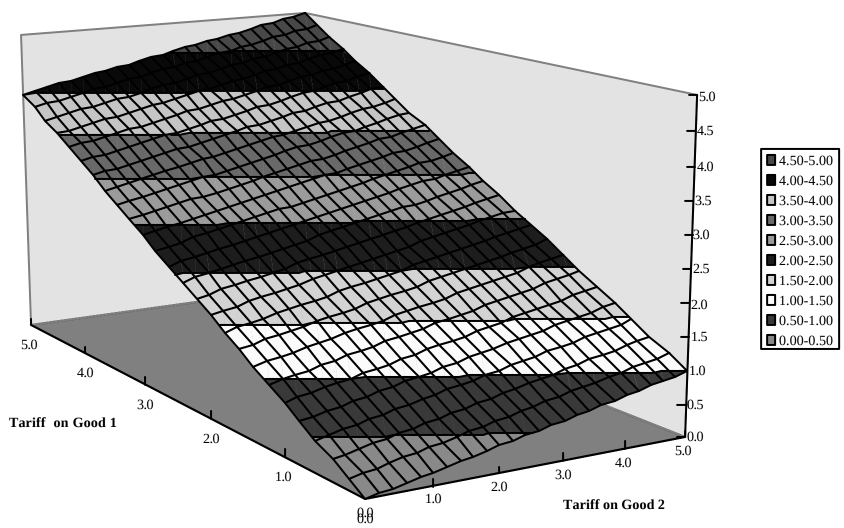

Figure 4: The MTRI or Import-Volume-Equivalent Uniform Tariff

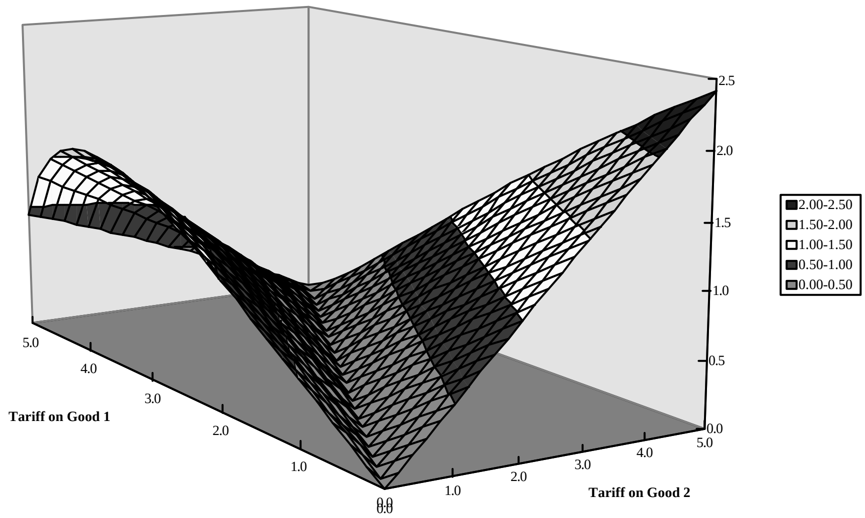

Figure 5: The Trade-Weighted Standard Deviation of Tariffs

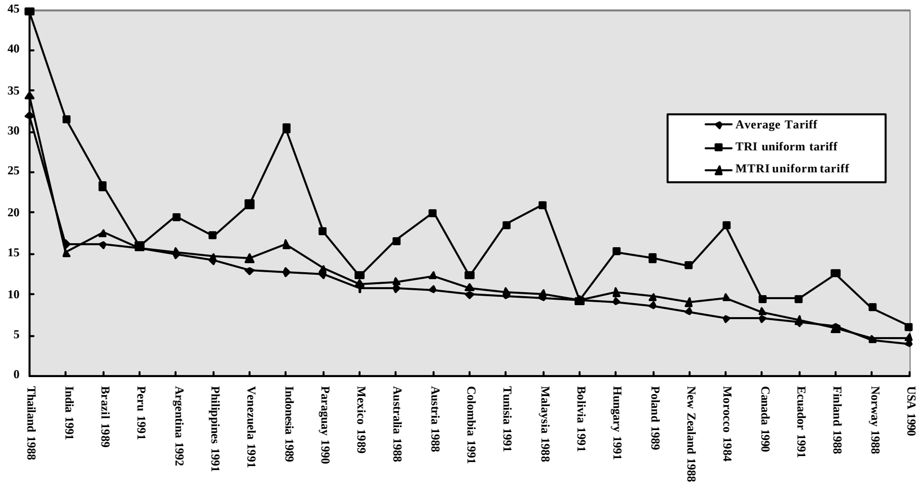

Figure 6: Measures of Trade Restrictiveness for 25 Countries (%)

Source: All data from Table 1

Table 1: Alternative Indices of Trade Restrictiveness

Country and Year	Trade-Weighted Average Tariff (%)	τ^{Δ} : TRI Uniform Tariff (%)	τ^{μ} : MTRI Uniform Tariff (%)	Coefficient of Variation of Tariffs
Argentina 1992	14.9	19.6	15.3	0.792
Australia 1988	10.8	16.6	11.6	1.004
Austria 1988	10.6	20.0	12.4	0.928
Bolivia 1991	9.4	9.3	9.3	0.140
Brazil 1989	16.1	23.3	17.6	0.816
Canada 1990	7.0	9.5	7.9	0.732
Colombia 1991	10.0	12.4	10.9	0.523
Ecuador 1991	6.5	9.5	6.9	0.759
Finland 1988	6.0	12.6	5.9	1.355
Hungary 1991	9.1	15.3	10.3	1.001
India 1991	16.2	31.6	15.1	1.495
Indonesia 1989	12.8	30.4	16.2	1.385
Malaysia 1988	9.7	21.0	10.2	1.106
Mexico 1989	10.8	12.4	11.4	0.469
Morocco 1984	7.1	18.5	9.7	1.676
New Zealand 1988	7.9	13.6	9.1	0.985
Norway 1988	4.5	8.4	4.6	1.340
Paraguay 1990	12.5	17.8	13.2	0.795
Peru 1991	15.8	16.0	15.8	0.149
Philippines 1991	14.2	17.3	14.6	0.506
Poland 1989	8.7	14.5	9.8	1.035
Thailand 1988	32.0	44.7	34.4	0.672
Tunisia 1991	9.9	18.6	10.4	1.294
USA 1990	4.0	6.1	4.8	1.035
Venezuela 1991	12.9	21.1	14.5	0.814

Notes: All three tariff indices compare the actual tariff structure with free trade.
See text for details.

Table 2: Regression Equations Based on Columns in Table 1

Regression Equation	*a*	*b*	*r*	Rank
τ^{μ} on Average Tariff	0.4354 (0.4395)	1.0409 (0.0353)	0.987	0.972
τ^{μ} on τ^{Δ}	1.1993 (1.3096)	0.6179 (0.0674)	0.886	0.799
τ^{Δ} on Average Tariff	3.0238 (1.9880)	1.3038 (0.1599)	0.862	0.761
$(\tau^{\Delta}-\tau^{\mu})/\tau^{\mu}$ on CV	-0.2283 (0.0801)	0.7838 (0.0811)	0.896	0.626

Notes: *a* is the intercept and *b* the slope coefficient; standard errors are in parentheses;
r is the correlation coefficient; and "Rank" is the rank correlation coefficent.

Table 3: Year-on-Year Comparisons of the MTRI, the TRI, Standard Tariff Measures and Two Measures of NTB Restrictiveness

Country	MTRI	TRI	Average Tariff on Final Goods		Av. Tariff on Intermed. Goods		CV of Tariffs		Initial NTB Coverage Ratio		Change in NTB Coverage Ratio		% Change in NTBC Imports	
			No NTB	NTB	No NTB	NTB	Final	Intermed.	Final	Intermed.	Final	Intermed.	Final	Intermed.
Argentina 1985-88	0.783	0.783	1.113	1.059	1.048	0.956	0.200	0.035	0.779	0.574	-0.567	-0.411	66.1	35.5
Morocco 1984-85	1.044	1.098	0.993	1.011	0.997	0.999	-0.327	-0.138	0.157	0.037	0.000	0.000	-13.8	-2.2
Morocco 1986-88	1.044	1.028	0.961	1.053	1.142	1.142	-0.086	-0.742	0.164	0.030	-0.091	-0.005	1.9	15.9
Tunisia 1987-88	0.877	0.913	0.989	0.982	1.033	0.989	0.030	-0.137	0.914	0.714	-0.320	-0.717	24.3	23.2
Tunisia 1988-89	0.903	0.862	1.045	0.991	0.981	1.039	0.039	0.006	0.851	0.649	-0.101	-0.411	21.5	13.2
Correlations with MTRI		0.955	-0.828	-0.012	0.264	0.679	-0.895	-0.687			0.897	0.789	-0.953	-0.841

Notes: MTRI and TRI are in deflator form: values greater than one indicate an increase in trade policy restrictiveness
Average tariff measures are in the form: $(1+\tau^{a1})/(1+\tau^{a0})$.
CV: Coefficient of variation of tariffs is the arithmetic year-on-year change.
NTBC: % Change in Volume of NTB-Constrained Imports
See text for further details.