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The IMF's Trade Restrictiveness Index

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Abstract

This paper reviews the IMF's Trade Restrictiveness Index (TRI) and possible alternatives. The first part describes the TRI, the data needed to compute it, and the history of its use. The second part asks what a good measure should be. The third part suggests that the IMF use an approach based on work by Anderson, Neary, and Feenstra (ANF-TRI). The ANF-TRI approach is relatively flexible and can be used to construct various measures of trade restrictiveness. This approach has been implemented by the World Bank and the relevant indices are reported in the Global Monitoring Report.

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ABBREVIATIONS

AN-TRI	Anderson-Neary trade restrictiveness index
ANF-TRI	Anderson-Neary-Feenstra trade restrictiveness index
AVE	Ad valorem (tariff) equivalent
FDMD	First Deputy Managing Director (IMF)
GMR	<i>Global Monitoring Report</i> (IMF/World Bank)
LDC	Least developed country
MAcMaps	Market Access Maps
MA-OTRI	Market Access Overall Trade Restrictiveness Index (World Bank)
NTB	Nontariff barrier
OECD	Organization for Economic Cooperation and Development
OTRI	Overall Trade Restrictiveness Index (World Bank)
PDR	Policy Development and Review Department (IMF)
PSE	Producer Support Estimate
PTA	Preferential trade agreement
SPR	Strategy, Policy, and Review Department (IMF)
TRI	Trade Restrictiveness Index (IMF)
TTE	Total Tariff Equivalent
UNCTAD	United Nations Conference on Trade and Development
WTO	World Trade Organization

SUMMARY

This paper reviews the IMF's Trade Restrictiveness Index (TRI). It has three parts.

The first part describes the TRI, the data needed to compute it, and the history of its use. It also discusses the key studies of the TRI that the IMF has produced internally and commissioned from external sources.

The second part asks what a good measure should be. There is no one-size-fits-all measure, as trade restrictiveness is multidimensional. However, there is no reason to rely on a single measure of trade restrictiveness to capture all these dimensions. Depending on how comprehensive a picture is needed, one measure or a variety of measures may be deemed appropriate in assessing trade restrictiveness. The strengths and weaknesses of the TRI are highlighted and existing measures briefly surveyed.

The third part suggests that the IMF use an approach based on work by James Anderson, Peter Neary, and Robert Feenstra (ANF-TRI), together with other indicators. The ANF-TRI approach is relatively flexible and can be used to construct a basic measure of trade restrictiveness or a variety of more comprehensive ones described. This approach has been implemented by a group of economists currently or formerly at the World Bank. The relevant indices are available online. They are reported in the *Global Monitoring Report (GMR)* which is put out under the joint auspices of the World Bank and the IMF and has presumably been vetted by both institutions. This provides additional legitimacy for the Fund's use of these indices. Moreover, the World Bank is committed to updating these indices annually for the *GMR*.

I. THE IMF'S TRI

1. Many measures of trade restrictiveness have been proposed in the literature. The IMF has used one such measure in its policy work. This paper will evaluate the IMF's Trade Restrictiveness Index (TRI) and the case for and feasibility of using the TRI or alternative frameworks to guide the Fund's work on trade.

A. Construction of the TRI

2. The TRI is a 10-point index of overall trade restrictiveness, with 10 denoting the most restrictive and 1 the least restrictive trade regime. The computation of the 10-point TRI is via the following formula:

$$TRI = 1 + (t - 1) + 3(N - 1)$$

where t is the tariff index and N is the NTB index.

3. The tariff index, t , takes integral values from 1 to 5, based on the simple unweighted average of most-favored-nation applied tariff rates for the country in question plus any additional surcharges/fees that are applied only to imports. Average tariffs below 10 percent are assigned a value of 1, average tariffs of 10–15 percent are assigned a value of 2, average tariffs of 15–20 percent are assigned a value of 3, average tariffs of 20–25 percent are assigned a value of 4, and average tariffs above 25 percent are assigned a value of 5. The NTB index, N , takes integral values from 1 to 3 depending on the extent of the country's usage of NTBs such as import/export quotas, restrictive licensing requirements, import/export bans, state trading, or exchange restrictions. N is assigned a value of 1 if the coverage of NTBs in trade or production is less than 1 percent, 2 if the coverage of NTBs is 1–25 percent, and 3 if the coverage of NTBs is greater than 25 percent. The resultant combination of the tariff index and NTB index into a single measure via the aforementioned formula yields the 10-point classification scheme.

4. The dispersion of tariffs is not captured by the TRI. This is unfortunate, as greater tariff dispersion increases the adverse impact of trade policy on welfare. Small tariffs have very small adverse effects when the equilibrium is close to first-best (because the welfare function peaks at the first-best tariff and thus it is relatively flat in this neighborhood), while larger tariffs result in disproportionately larger welfare losses.

B. History of the Usage of the TRI

5. The TRI has its roots in an older index created in the IMF's then Policy Development and Review Department (PDR) by Calika and Corsepilus (1994) to measure trade reforms in IMF-supported programs. That index combined two sub-indices—one for tariffs and one for quantitative restrictions—each of which had three categories (open, moderate, and

restrictive), as did the overall index. The TRI, by contrast, has five tariff categories and three categories for nontariff barriers (NTBs) which are combined to form a 10-point overall index.

6. The TRI was developed by the IMF's PDR in 1997 for use in a Board paper evaluating trade reform in program countries during the 1990s. In that paper (IMF, 1997a), the base year of the TRI was 1990 and the evolution of the index until 1997 was tracked for 27 countries. Subsequently, the TRI started to be calculated annually for all IMF member countries. Overall, the Executive Board took a positive view of the development of the TRI, which was seen as a valuable tool for classifying the relative restrictiveness of trade regimes. Even at that time the TRI's limitations were noted, and some IMF Directors cautioned against placing undue emphasis on the index. Other Directors felt that the TRI should be used as an input in designing and monitoring trade liberalization components in ongoing IMF-supported programs (IMF, 1997b).

7. In April 1998, IMF management authorized the use of the TRI in staff reports on new IMF medium-term adjustment programs (i.e., programs lasting two or more years) (IMF, 1998). The TRI was meant to be used for evaluating changes in a country's trade restrictiveness over the program period. However, IMF staff began using it regularly also in the surveillance context, and the TRI thus appeared regularly in Article IV staff reports and background papers.

8. In 2003, PDR's Trade Policy Division engaged an external consultant, William Cline (from the Center for Global Development and Institute for International Economics), to produce a review of the TRI. The review was to outline the state of knowledge, highlighting the methodology and its pros and cons, and provide at least two operationally viable alternatives. Cline (2003) made a number of important observations. First, he pointed out that the TRI does not capture tariffs in agriculture effectively. Tariff-rate quotas, which replaced quotas as a consequence of the Uruguay Round Agreement on Agriculture negotiations, are classified as NTBs in calculating the TRI. As the intensity of NTBs is not well differentiated in the TRI, he argued, the TRI tends to underestimate agricultural protection levels. Second, the TRI does not account for subsidies.¹ This point had also been made by Subramanian (2000) in the context of African trade policies.

9. Cline (2003) provided a useful discussion of some alternative indices, including the International Trade Center's Market Access maps (MAcMaps) measure, the Heritage Foundation-Wall Street Journal index of trade freedom (which is a part of their overall Index of Economic Freedom), the Oxfam Index of Double Standards (which measures developed country protection against exports from developing countries), and the Center for Global

¹ In general equilibrium, a tariff on the imported good (which encourages domestic production and discourages consumption of the good) is equivalent to a production subsidy and a consumption tax on the good. Thus, a subsidy on production does what a tariff would do on the production side. As a result, the protective effects of subsidies may need to be considered.

Development's Aggregate Measure of Protection (which is meant to do the same thing as the Oxfam index). Cline pointed out the well known problems involved with using trade shares as weights in aggregating tariffs, namely that tariffs reduce trade and so trade-weighted average tariffs tend to understate protection. He also pointed out that tariff equivalents of NTBs are hard to estimate and suggested some rules of thumb for converting various NTBs into tariff equivalents. He recognized that the average and the variance of tariffs both matter in the calculation of the welfare costs of tariffs, and suggested a formula based on the assumption of a given world price and no domestic production. He also discussed the Anderson-Neary Trade Restrictiveness Index (AN-TRI) and argued that the AN-TRI required intensive data and modeling inputs and had less success in incorporating NTBs. He concluded that "It seems unlikely that any of the recent indices reviewed above could (or in some cases, should) replace the IMF's index of trade restrictiveness any time soon" (Cline, 2003).

10. Instead, Cline suggested a measure called the Total Tariff Equivalent (TTE) as a potential replacement for the TRI. The TTE involves calculating an average tariff and a tariff-equivalent of NTBs and summing the two. But Cline did not clearly define the weights to be used at each stage, and the suggested procedure seems a bit ad hoc.

11. In June 2003, PDR sent a memorandum to management summarizing Cline's paper, outlining the pros and cons of his suggestions, and suggesting some options for future action that could be presented to the Board, namely, moving away from the TRI toward a more judgmental approach; keeping the TRI as it stood; formulating an alternative index for the advanced economies; and investigating a TTE-based index with other multilateral institutions. Management responded in favor of the fourth option.

12. Cline's paper was subsequently circulated for comments to experts inside and outside the Fund, including Will Martin (World Bank), James Anderson (Boston College), and Peter Neary (University of Oxford). Anderson and Neary, in particular, responded to Cline's view that the data requirements for implementing the AN-TRI were excessive. They pointed out that their indices could be implemented at less detailed levels and thereby require basically the same data as Cline's proposed TTE index. Moreover, making the same kinds of assumptions that Cline suggested (for example converting NTBs into tariffs at some fixed rate) would even further reduce the data requirements for their indices. Their points seem well thought out and fair. In the end, Cline's paper was not released even within the Fund.

13. In December 2004, the First Deputy Managing Director (FDMD)—after receiving complaints from Nigeria that the TRI presented an overly negative picture of Nigeria's trade regime relative to South Africa's—decided that the TRI needed to be reformed. She asked staff to work on a price-wedge-based alternative. An inter-departmental working group was constituted with staff from PDR, the Research Department, the Statistics Department, and the African Department to assess the feasibility of calculating price gaps as a way to measure the restrictiveness of trade policies across countries. Meanwhile, the TRI was no longer to be

used in country staff reports (although it could continue to be provided to missions to be used as a basis for their discussions with the authorities).

14. In February 2005, the Executive Board discussed the TRI as part of its review of IMF work on trade. A background paper for the discussion outlined the TRI, its uses and shortcomings, the TTE approach, and other alternatives (IMF, 2005a). The paper concluded that the TRI was still “a valuable quantitative indicator of trade policy” but recommended that country-specific TRIs no longer be published “to avoid unnecessary confusion” (IMF, 2005a). The Board reaffirmed this view, noting that the TRI “balance[d] reasonably well the requirements of accuracy, country coverage, timeliness, and methodological soundness” but was not suited to cross-country comparisons and therefore, “to avoid a false sense of precision” should be used mainly as a starting point in discussions with national authorities, and not be included in individual country staff reports (IMF, 2005b). Directors also called on the staff to consider ways to improve the TRI and to explore the development of alternative indices.

15. Shortly after the Board discussion on the TRI, the inter-departmental working group submitted a thoughtful and useful report on the price-gap measure to management. This report advised against a price-wedge approach because other factors than trade policy affected price gaps and there was no way to purge the data of these effects (Tokarick and Wei, 2005). Moreover, the paucity of internationally comparable price data was cited as making this approach impractical. The working group was clearly aware of work by World Bank researchers on computing trade restrictiveness indices. The report summarized the work of Kee, Nicita, and Olarreaga (2004, 2006), noting that it represented “a clear advance towards the calculation of trade restrictiveness indices.” The report also outlined the shortcomings of that approach, including the fact that subsidies (both export and production) were not incorporated and that the NTB data used for most of the countries were out of date.

16. Following the 2005 Board discussion, staff were instructed not to use the TRI in staff reports (IMF, 2005c), and the TRI has not appeared in any staff report since that year. The TRI continues to be compiled but there is little evidence that staff still use it as a basis for discussion. No follow-up took place in PDR on improving the TRI or developing alternative indices. According to (former) Trade Policy Division staff, this was largely due to the lack of consensus on how to improve the data on NTBs. In 2006, the IMF was invited to participate in a multi-agency effort to improve the measurement of NTBs that was coordinated by the United Nations Conference on Trade and Development (UNCTAD), but IMF staff attended only the initial meeting held in Washington. However, one Research Department staff member has continued to work independently on a new TRI along the lines of the AN-TRI as part of a project on measuring structural reforms.

II. A GOOD INDEX?

17. Trade restrictiveness (or its opposite, trade openness) sounds as if it should be easy enough to define and measure. Yet, how it should be defined is controversial. A good index of trade restrictiveness should be conceptually based, implementable, and comparable. It should be objectively defined in terms of what it is measuring by means of a model, even if the model is relatively simple: thus, if what the index is measuring is continuous, the index should be continuous, or it loses information content.² The index should be relatively easy to calculate using available information. It should permit comparability over time and space.

18. The literature contains many definitions of trade restrictiveness, and their meanings and relationships to one another are not clear to the uninitiated. Pritchett (1996) shows that existing measures of trade openness are by and large uncorrelated. This is not surprising, for two reasons. First, none of the definitions he considers is conceptually well based, so it is not quite clear what they are measuring. Second, the different measures try to capture different aspects of trade restrictiveness (with different degrees of accuracy). This may well be why different studies reach different conclusions about the relationship between openness and economic performance.³

19. It is also far from clear how to calculate such an index, especially when time and available resources are as limited as they are in practice. Assuming the objective is to measure barriers to trade, how can/should these be measured?

20. Two broad approaches can be taken. The first is an indirect, i.e., outcome-based, approach. (This is analogous to the output approach in R&D, where innovation is measured in terms of patents.) This approach takes the view that restrictive trade policy should be reflected in outcomes such as the country's trade flows or deviations of the domestic prices of tradables from world prices. Thus, an import quota on shoes, for example, should reduce the import value (at world prices) and raise the domestic price of shoes relative to what it would have been without the quota. Alternatively, one may take a more direct, i.e., input-based, approach. (This is analogous to the input approach in R&D, whereby innovation is

² Attempting to dichotomize the continuum is counterproductive for two more reasons. First, it leads to the permeation of ideology into analysis: outward orientation is perceived as good and inward orientation as bad on a priori grounds while both (or neither) may be universally so. Second, it prevents researchers from trying to develop conceptual measures and permits reliance on ad hoc definitions.

³ Some, such as Dollar (1992), and Edwards (1992, 1993), and Frankel and Romer (1999) conclude that openness is good for growth, while others, like Rodriguez and Rodrik (2001) cast doubt on this conclusion. In much of this work, trade restrictiveness is measured by the value of trade relative to national income. There may be good reason to expect a link between growth and trade value. For example, more trade may allow greater specialization and lower costs in industries with dynamic scale effects. If this is the motivation, the value of trade in these industries should be considered, not the total value of trade. Alternatively, more trade may help fill the "foreign exchange gap," thereby relieving growth-retarding bottlenecks as suggested, for example, in Krueger (1983).

measured in terms of R&D expenditures). This approach takes the view that trade policy can be measured directly in terms of how it is implemented—namely through tariffs, quotas, and other NTBs. The measurement is clearly easier for tariffs (though even the question of appropriate weights for the tariffs is an issue) than for quotas, since quotas need to be identified and transformed into their ad valorem equivalents, which is not trivial.

21. Both approaches have their problems. Estimating trade-flow gaps or price gaps is problematic as trade flows are not well explained by trade models. The most empirically successful model, the gravity model, is loosely based on theories that explain trade flows. Thus, taking the view that deviations from predicted trade flows must be due to trade policy is a bold step.⁴ Nevertheless, it may be the only viable option in some cases (as explained in Section IV below). Using price-gap measures is also problematic as differences in prices can occur without trade restrictions being in place. The most obvious issue is that the quality of imports could differ across countries and this could result in NTBs being mistakenly inferred.

22. The input-based approach has equally vexing problems. For example, as is well known, in general equilibrium all taxes and subsidies need to be considered. In particular, one of the results in international trade is that trade policies in competitive markets are equivalent to a combination of domestic policies—as explained by the Lerner Symmetry Theorem. Thus, even if one could aggregate meaningfully over tariffs on different commodities, trade restrictiveness cannot be defined solely in terms of trade policy. For example, if a good is imported, a production subsidy on the good is equivalent to an import tariff and a consumption subsidy at the same rate. Thus, Japan’s production subsidies on rice can be thought of as an import tariff on rice combined with a consumption subsidy. The treatment of subsidies in calculating trade barriers could completely change the estimated levels and rankings of trade restrictiveness across countries. An agricultural developing country might for this reason take exception to leaving agricultural subsidies (such as those of the European Union, Japan, and the United States) out of the calculations. While this is certainly a valid point of view, it is worth emphasizing that if we take this stand, then other domestic policies may also become candidates for inclusion in trade restrictiveness measures. Subsidies have not traditionally been included in trade restrictiveness measures, though they clearly could be. (For more on this issue see Section IV below.)

23. An additional complication arises from the prevalence of NTBs and the recent proliferation of preferential trade agreements (PTAs). Over the many rounds of multilateral negotiations, tariff barriers have fallen considerably but NTBs remain, often disguised in

⁴ If imports in a sector fall short of what is predicted, the extent of the shortfall, together with the import demand elasticity, yields an implicit tariff that would result in the observed import level. However, this is usually a one-sided exercise: if a country imports more than predicted by the regression, the implicit tariff is set to be zero.

creative ways and creating difficult measurement issues.⁵ To estimate a tariff equivalent of NTBs is difficult, requiring detailed knowledge and modeling (Deardorff and Stern, 1998).

24. PTAs further complicate the measurement of NTBs. Tariffs among PTA members are not really zero, as restrictive rules of origin may have to be met to obtain preferential status (Krishna and Krueger, 1995; Krishna, 2006). These rules raise the cost of production and have real costs associated with them. Moreover, as PTAs increase trade among PTA partners while reducing trade with nonmembers, they make tariff equivalents harder to estimate. Preferences given to the least developed countries (LDCs) such as free market access under the European Union's Everything But Arms initiative, would reduce the tariffs levied on trade. However, to the extent that the market access is conditional on costly rules of origin being met, the preferences both restrict and distort trade patterns.

25. As a result of all these problems, outcome-based approaches may be the only option for measuring trade restrictiveness, especially when NTBs and PTAs are prevalent.

26. Even assuming we can measure the component parts of trade barriers, how do we put them together in a meaningful way? How should trade barriers be weighted? Is only their level relevant or are higher moments important as well? This is where the need for a model is greatest. A simple or trade-weighted average (or variance) of trade barriers is relatively easy to construct but without a model it is far from clear what such a number means. Suppose, for example, that the tariff is prohibitive: a trade-weighted average will clearly underestimate the extent of protection in this case.

27. In this context, the strengths and weaknesses of the TRI are obvious:

- *Strengths:* The TRI is easily computed because it has low data requirements. Hence it can be calculated often and for a wide range of countries. It is based on a (deceptively) simple formula.
- *Weaknesses:* The TRI's simplicity—a strength—leaves it open to a range of criticisms. The most profound is that it is ad hoc: because the TRI is not conceptually well based, it is not clear what it is measuring; the uninformed user is lulled into thinking that s/he understands it but only because the lack of underlying logic is not clear to those who have not thought through it rigorously. Other criticisms are that the TRI has a narrow policy coverage,⁶ does not weight the data appropriately,⁷ and does

⁵ For example, Cline (2003) points out that if we replace quotas with tariff-rate quotas, then the out-of-quota penalty tariff (converted into ad valorem terms) should be used as the tariff equivalent if there are imports out of quota. But if there are no such imports then the tariff equivalent is harder to pin down.

⁶ It does not account for subsidies of any form and so cannot capture the implicit protective effect of agricultural production subsidies.

not accurately reflect the policies of countries in PTAs. The TRI is also said to be biased against LDCs, which tend to rely more on tariff barriers than on the opaque technical or phytosanitary barriers favored by advanced countries.⁸ Furthermore, the TRI's NTB sub-index is insufficiently differentiated in its ratings (about 60 percent of countries are assigned an NTB rating of 2)—as was pointed out in Cline (2003).⁹

28. The IMF's TRI seems to have served its purpose for a general evaluation of program countries' trade policies over time, but its limitations have become more and more of an issue as data availability and technology have improved. It is clear that the TRI should not be used alone for policy advice but must be used in conjunction with qualitative analysis and supplemental indicators to allow a more detailed analysis of a country's trade policies. Certainly, no single measure of trade restrictiveness can be expected to capture all the elements of a country's trade policy. But better approaches than the TRI are now feasible.

29. How do the alternative measures fare on the three criteria—conceptual basis, implementability, and comparability? There is little point in making an exhaustive list of measures and shooting them down. The interested reader can find comprehensive discussions of older measures in Baldwin (1991), Dearnorff and Stern (1998), Edwards (1989), and Krishna (1991). Cline (2003) contains a discussion of more recent alternatives. Of the newer measures, the only conceptually well based ones are the original index proposed by Anderson and Neary (1990, 2003, 2005), and its implementation in a computable general equilibrium model or the simplified partial equilibrium analogue proposed by Feenstra (1995) and implemented by Kee, Nicita, and Olarreaga (2006).

III. A CONCEPTUALLY WELL BASED MEASURE: THE AN-TRI

30. Anderson and Neary (1990, 2003, 2005) develop a distance function-based measure of openness that can be used for both tariffs and quotas, separately and together, and which allows for differences in rent retention.¹⁰ This measure is called the AN-TRI. The Anderson-Neary measure is quite analytically complex, but its basic idea is to calculate how much all tariffs have to be increased and quotas decreased to keep utility unchanged. This equation is

⁷ Average tariffs tend to underestimate the extent of protection (as explained earlier) and no attention is paid to the dispersion of tariffs.

⁸ Australia, for example, has very strict phytosanitary standards for agricultural imports—these can translate into very high implicit trade policies. However, the incorporation of such technical barriers is not without controversy—see Section V below.

⁹ This is largely due to the overall reduction in protection that has occurred over time which has reduced the dispersion in the NTB sub-index. When the TRI was originally constructed, an equal share of countries fell in each category.

¹⁰ Rent retention is an issue both because of the current practice of not selling quotas and because of evidence in Krishna and Tan (1996) that not all quota rent goes to those who get the quota licenses.

then totally differentiated to get new and interesting results for piecemeal policy reform. The relevant comparative statics terms turn out to be quite easy to sign and calculate if further technical assumptions on the trade balance function are made.¹¹

31. Though conceptually well based, the AN-TRI has some disadvantages in practice. First, because it is calculated by taking derivatives, it is reliable only for assessing small changes in trade policies. Second, and much a more severe limitation, it is not well suited to making inter-temporal and cross-country comparisons. A given percentage change in the AN-TRI does not correspond to the same percentage change in welfare across time or space when the economies are different. As the same country's economy differs over time, and different countries have different economies, the AN-TRI has some serious comparability problems. (Of course, the inter-temporal differences within a given country emerge quite slowly and are less pronounced than the differences across countries.) Anderson (1998) argues that using average tariffs or even trade-weighted tariffs gives very different rankings over time compared to the AN-TRI.

IV. A SIMPLER VERSION: THE ANF-TRI AND RELATED INDICES

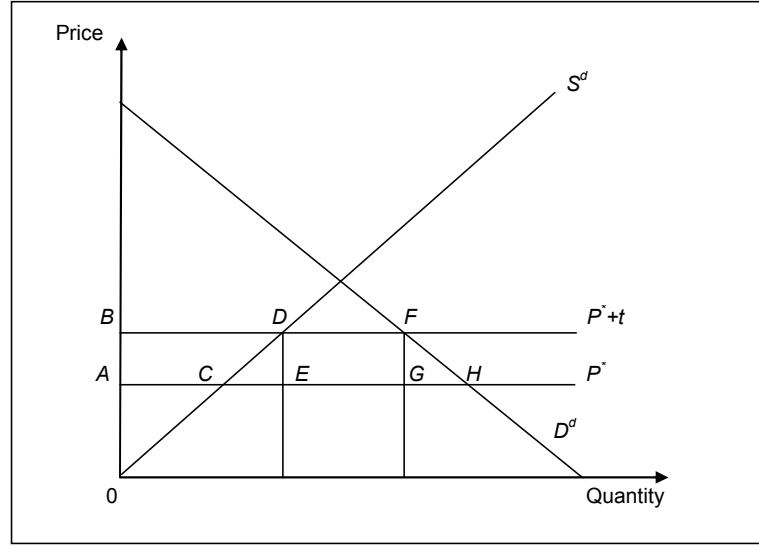
32. The partial equilibrium version of the AN-TRI that was suggested by Feenstra (1995) and implemented by Kee, Nicita, and Olarreaga (2006) is easier to calculate, more transparent, and more readily comparable than the AN-TRI, and it requires less information. We shall call this version the ANF-TRI. The ANF-TRI calculates the uniform tariff that, if applied to all imports, would leave the welfare of the importing country unaffected, assuming that world prices are fixed. It seems that this measure could be a feasible successor to the IMF's TRI.

33. The ANF-TRI takes as a first step the welfare loss for a small country from a given set of tariffs in partial equilibrium. The loss consists of the difference in welfare (the sum of consumer surplus, producer surplus, and net tariff revenue) at the given tariffs relative to welfare at free trade. Consider Figure 1, in which supply and demand are linear. The world price is P^* . At this price the good is imported because domestic demand, D^d , exceeds domestic supply, S^d . $M(\cdot)$ denotes imports and equals domestic demand less domestic supply. A specific tariff of t (or an ad valorem tariff of T where $TP^* = t$) raises the domestic price to $P^* + t$. Imports fall from CH to DF , producer surplus rises by $ABCD$, and net government revenue rises by $DEFG$, while consumer surplus is reduced by $ABFH$. The net effect is a loss of areas DCE and FGH , the two triangles of deadweight loss in Figure 1.¹²

¹¹ Tokarick (2007) looks at the sensitivity of the AN-TRI to alternative model structures.

¹² Note also that the tariff is equivalent to a production subsidy and a consumption tax at the same rate. A production subsidy of t would raise the price facing producers to $P^* + t$ but leave the price facing consumers unaffected. The result would be that producer surplus rises by $ABDC$, while government revenue falls by $ABDE$
(continued...)

Figure 1. Tariff in a Small Country



34. Now consider these two triangles. For FGH , the base is just the absolute value of the slope of demand times t , while the height is t . Similarly for DCE , the base is just the absolute value of the slope of supply times t , while the height is t . Thus the area of the two triangles is:

$$\begin{aligned}
 DCE + FGH &= -\frac{1}{2} \left(t \frac{d(D^d(P^*) - S^d(P^*))}{dP} \right) t \\
 &= -\frac{1}{2} \left(\frac{dM(P^*)}{dP} \frac{P^*}{M(P^*)} \right) \left(\frac{M(P^*)}{P^*} \right) (TP^*)^2 \\
 &= \frac{1}{2} \varepsilon (M(P^*) P^*) T^2
 \end{aligned}$$

where ε is the import demand elasticity defined as a positive number. Doing this across sectors ($i = 1, \dots, N$) gives the welfare loss of the tariffs to be:

$$\frac{1}{2} \sum_{i=1}^N \varepsilon^i M^i(P^{*i}) P^{*i} (T^i)^2 \quad (1)$$

where T^i is the ad valorem tariff in sector i .

with a net loss of CDE . A consumption tax would raise the price facing consumers to $P^* + t$ but leave the price facing producers unaffected. It would reduce consumer surplus by $ABFH$ and raise government revenue by $ABFG$ with a net loss of FGH . Note that together, the production subsidy and consumption tax have the same effect as a tariff! Similarly, a production subsidy is equivalent to a tariff and a consumption subsidy at the same rate.

35. Now suppose a uniform ad valorem tariff T is applied on all goods. Then, by the same reasoning, the welfare loss from that uniform tariff will be:

$$\frac{1}{2} \sum_{i=1}^N \varepsilon^i M^i (P^{*i}) P^{*i} (T)^2 \quad (2)$$

36. Setting (1) equal to (2) gives:

$$\begin{aligned} T &= \left[\sum_{i=1}^N \left(\frac{\varepsilon^i M^i (P^{*i}) P^{*i}}{\sum_{i=1}^N \varepsilon^i M^i (P^{*i}) P^{*i}} \right) (T^i)^2 \right]^{1/2} \\ &= \left[\sum_{i=1}^N s^i (T^i)^2 \right]^{1/2} \end{aligned}$$

where s^i is the elasticity-adjusted import value share of sector i :

$$s^i = \frac{\varepsilon^i M^i (P^{*i}) P^{*i}}{\sum_{i=1}^N \varepsilon^i M^i (P^{*i}) P^{*i}} .$$

By definition, T is the ANF-TRI and, as shown, it equals the square root of the weighted sum of the square of ad valorem tariffs. Note that higher tariffs and more variance both result in a higher index value. It is easy to see that for a given mean tariff, T is minimized when $s^i T^i$ is constant for all i . In other words, in this setting, greater generalized variance, given the mean, reduces welfare, as does increasing all tariffs proportionally. This makes intuitive sense, as free trade is first-best here so welfare is maximized at zero tariffs. Small tariffs, therefore, do not change welfare much, while large tariffs do, making greater tariff dispersion alone bad for welfare.

A. Calculating the Index

37. To calculate the ANF-TRI, all NTBs first need to be transformed into ad valorem tariff-equivalents (AVEs). This is done by assuming that all differences between domestic and international prices that are not due to existing tariffs are due to some unaccounted-for trade policies that we can lump together and call NTBs. This is quite a heroic assumption to make, given the existence of substantial unexplained price differences in freely traded goods. Once these unexplained price differences are inferred, the tariffs that would have induced them, given estimated values of import demand elasticities, can be backed out. These

elasticities are estimates across countries and products (at the six-digit level of the Harmonized System of product classification).¹³

38. Second, all specific tariffs need to be converted to AVEs. (It is important to be careful about this as ad valorem and specific tariffs are often reported separately, especially for agricultural goods, and can easily be missed.)¹⁴

39. Then a weighted sum of all ad valorem tariffs and AVEs is taken at the tariff line level. The weights are the elasticity-adjusted import-value shares denoted by s^i above. Note that these weights are increasing in the import shares and elasticities of import demand. The weights reflect the relative importance of restrictions on these goods in the overall restrictiveness of trade policy. Thus, information on tariff levels, AVEs of NTBs, and data on import shares, as well as elasticities of import demand, are needed for implementation. It is important to use the weights s^i on the ad valorem tariffs rather than just to take a simple average. Anderson (1998) shows that trade-weighted average tariffs are virtually uncorrelated with, and are about 50 percent lower than, the uniform tariff equivalent (AN-TRI) based on data from a cross-country sample.

B. Related Indices

40. A similar index, the Mercantilist Trade Restrictiveness Index, is calculated by Kee, Nicita, and Olarreaga (2006). This computes the equivalent uniform tariff of a country that would keep that country's imports at their observed levels. It is (somewhat confusingly) referred to as the Overall Trade Restrictiveness Index (OTRI) by its authors and in World Bank publications. So as not to muddy the waters further, I will use their nomenclature. Another index, the Market Access Overall Trade Restrictiveness Index (MA-OTRI), looks at the uniform tariff that, if imposed by all of a country's trading partners, would keep that country's exports constant. These indices are discussed in greater detail below.

The OTRI

41. The approach follows the same lines as the ANF-TRI outlined above. Consider the reduction in imports from a specific tariff t , as illustrated in Figure 1. Imports fall from CH to DF , i.e., by the sum of the bases of the two deadweight-loss triangles. For FGH , the base is just the absolute value of the slope of demand times t . Similarly for DCE , the base is just the absolute value of the slope of supply times t . Thus the fall in the value of imports due to t is:

¹³ For details on how these elasticities were estimated, see Kee, Nicita, and Olarreaga (2004).

¹⁴ Will Martin, in his comments on Cline (2003), suggested that this is a good part of the reason for unrealistically low estimates of Japan's agricultural protection.

$$\begin{aligned}
M &= - \left(t \frac{d(D^d(P^*) - S^d(P^*))}{dP} \right) P^* \\
&= - \left(\frac{dM(P^*)}{dP} \frac{P^*}{M(P^*)} \right) \left(\frac{M(P^*)}{P^*} \right) T(P^*)^2 \\
&= \varepsilon M(P^*) P^* T.
\end{aligned}$$

Thus, summing over sectors gives the import decrease due to the existing set of tariffs:

$$\sum_{i=1}^N \varepsilon^i M^i(P^{*i}) P^{*i} T^i. \quad (3)$$

42. The import decline from a uniform tariff T will then be:

$$\sum_{i=1}^N \varepsilon^i M^i(P^{*i}) P^{*i} T. \quad (4)$$

43. Hence, the uniform tariff that would result in the same decrease in import value, denoted by **Error! Objects cannot be created from editing field codes.**, is obtained by setting (3) equal to (4):

$$\begin{aligned}
T^o &= \sum_{i=1}^N \left(\frac{\varepsilon^i M^i(P^{*i}) P^{*i}}{\sum_{i=1}^N \varepsilon^i M^i(P^{*i}) P^{*i}} \right) T^i \\
&= \sum_{i=1}^N s^i T^i.
\end{aligned}$$

This is just the elasticity-adjusted import-share-weighted average tariff. Note that the OTRI does not depend on the variance of tariffs. This makes sense, as it is targeting imports, which vary at a constant rate with tariffs, and not targeting welfare.

The MA-OTRI

44. This index looks at the fall in a country's exports due to the tariffs imposed by the country's trading partners. The approach here follows the same lines as the ANF-TRI.

Consider a single good i exported by country k that has a specific tariff t^{ijk} imposed on it by trading partner j . The fall in the value of country j 's imports of good i from country k due to the specific tariff t^{ijk} is:

$$\begin{aligned}
X &= - \left(\epsilon^{ijk} \frac{dM^{ij}(P^{*i})}{dP^i} \right) P^{*i} \\
&= - \left(\frac{dM^{ij}(P^{*i})}{dP^i} \frac{P^{*i}}{M^{ij}(P^{*i})} \right) \left(\frac{M^{ij}(P^{*i})}{P^{*i}} \right) T^{ijk} (P^{*i})^2 \\
&= \epsilon^{ij} M^{ij}(P^{*i}) P^{*i} T^{ijk}.
\end{aligned}$$

45. Summing over countries and sectors gives the total decrease in imports from country k by country k 's trading partners due to their existing set of tariffs:

$$\sum_{i=1}^N \sum_{j \neq k} \epsilon^{ij} M^{ij}(P^{*i}) P^{*i} T^{ijk}. \quad (5)$$

46. The import decline from a uniform tariff T will then be:

$$\sum_{i=1}^N \sum_{j \neq k} \epsilon^{ij} M^{ij}(P^{*i}) P^{*i} T. \quad (6)$$

47. Hence, the uniform tariff that would result in the same decrease in import value, denoted by T^m , is obtained by setting (5) equal to (6):

$$\begin{aligned}
T^m &= \sum_{i=1}^N \sum_{j \neq k} \left(\frac{\epsilon^{ij} M^{ij}(P^{*i}) P^{*i}}{\sum_{i=1}^N \sum_{j \neq k} \epsilon^{ij} M^{ij}(P^{*i}) P^{*i}} \right) T^{ijk} \\
&= \sum_{i=1}^N \sum_{j \neq k} s^{ij} T^{ijk}.
\end{aligned}$$

C. Implementation

48. While not as simple as the IMF's TRI, the OTRI and MA-OTRI are reasonably easy to calculate. In addition, they are model-based and comparable across time and space.

49. The World Bank's website for the *Global Monitoring Report (GMR)* contains country-level estimates for the OTRI (72 countries) and MA-OTRI (102 countries), which are published in the *GMR* as well as in individual country briefs in the new World Trade Indicators (WTI) database.¹⁵ The indices are available separately for agriculture and

¹⁵ See <http://go.worldbank.org/C5VQJIV3H0> for the *GMR* and <http://go.worldbank.org/3Q2ER38J50> for the WTI database.

manufacturing, and both with and without the inclusion of NTBs (whose modeling is the weakest part of the procedure). The World Bank has committed to updating these indices annually.

50. The ANF-TRI index, as well as the OTRI and MA-OTRI, are reported in Kee, Nicita, and Olarreaga (2006) for 91 countries. Many, mostly smaller, countries do not have indices calculated, presumably because their data are poor. Obtaining better data and more comprehensive coverage is an area where cooperation between the World Bank, IMF, WTO and other multilateral agencies would be very useful.

D. Deficiencies

51. The ANF-TRI and the related indices discussed above all target different things, and like all measures they have some clear deficiencies. As a first example, the ANF-TRI does not account for subsidies, and to the extent that subsidies encourage domestic production (much as import tariffs do) and information on the impact of subsidies is necessary, this is a disadvantage. However, if one wanted to develop an index that measured the extent to which domestic production was being distorted by trade and domestic policies like subsidies, the appropriate “index of domestic subsidization” could be defined and estimated using an approach similar to the ANF-TRI described above.¹⁶ This seems like the appropriate way to deal with subsidies if the concern is production. If the concern is imports, one could include subsidies and tariffs at their given levels and ask what uniform tariff, combined with zero subsidies, would lead to the existing level of imports. As should be evident, a large number of such variations are possible and no one-size-fits-all index can be calculated.

52. Second, the estimation of NTB equivalents (a component of the above indices) is not very reliable, both because price differences need not be due to trade protection and because data on NTBs tend not to be updated annually. This makes the indices as a whole less useful for the IMF’s operational work. For this reason, it is important that the indices be reported both with and without NTBs, as is done by the World Bank. Ideally one would like to handle NTBs differently: with detailed information on which sectors are subject to NTBs and what form these NTBs take, one could model the effects of NTBs and estimate their AVEs sector-by-sector and case-by-case. But at present, this is unlikely to be practical. Further, better information on NTBs would help in the construction of some simple crosschecks. For

¹⁶ The Organization for Economic Cooperation and Development (OECD) publishes producer support estimates (PSEs) for agriculture in its member countries. The PSE is “an indicator of the annual monetary value of gross transfers from consumers and taxpayers to support agricultural producers, measured at farm gate level, arising from policy measures which support agriculture, regardless of their nature, objectives or impacts on farm production or income” (OECD, 2008). Thus it is obtained by taking all subsidies and dividing by total output. Unlike a subsidy indicator derived using the ANF approach, it does not give the uniform subsidy that would result in a given level of production.

example, it would be worth checking whether imputed ad valorem tariffs are higher in those sectors where we suspect that restrictive NTBs exist.

53. Third, the ANF-TRI and its related indices could be criticized because they assume perfect competition. This is much less of a concern, however. There is only one way to have perfect competition but an infinite number of ways to have imperfect competition and no clear choice of which form of imperfect competition to incorporate. Thus, while market imperfections should be noted, adding this complication to an index would not be advisable.¹⁷

54. Fourth, the proliferation of PTAs and the resulting complex web of overlapping preferences and rules of origin have made trade policies much more complicated (Krishna and Krueger, 1995; Krishna, 2006) and there is little hope of creating an index that incorporates these features of the real world. One approach might be to infer tariffs in the same manner as the tariff-equivalents of NTBs, but given the difficulties associated with inferring AVEs, this approach would be ill advised.

55. Finally, these indices are essentially partial equilibrium constructs. They ignore any general equilibrium interactions, both between final goods and between final and intermediates as captured by measures like the effective rate of protection.

56. Are the limitations of the ANF-TRI and its related indices serious enough that the IMF would be better off not using them? The answer is no. The best should not stand in the way of the good: the ANF-TRI and its related indices are much better than what the IMF has at present. As long as their limitations are kept in mind, they represent a useful advance over the status quo. While there will always be criticisms, the indices and the data and approach on which they are based are vetted—at least implicitly—by other multilateral organizations, notably the World Bank, but also the International Trade Center, UNCTAD, and the WTO.¹⁸ And critics would need to make the case that the index leaves out an important trade restriction, what this restriction is, and how it should be included. This would at least allow a common language for dialogue and would be preferable to loose arguments that the index value assigned to a country is too high.

¹⁷ In welfare-based measures like the ANF-TRI one may want to model imperfect competition because the welfare loss from tariffs could be much higher in distorted settings than in undistorted ones. For example, limited competition in the domestic market could allow import quotas to facilitate collusion and result in large welfare losses. This would be an argument for incorporating imperfect competition in the index.

¹⁸ The OTRI uses tariff data collected by UNCTAD and the International Trade Center (Geneva), working with the WTO. These data are published in the World Integrated Trade Solution, a database and software system. To convert specific duties into ad valorem tariff equivalents, UNCTAD's methodology is used.

V. CONCLUSIONS AND RECOMMENDATIONS

57. In interviews for this evaluation, current and former IMF staff highlighted a unifying concern that the IMF, given its macroeconomic focus, lacks enough trade expertise and institutional resources to develop and maintain a trade restrictiveness index that approaches the current best practice. The IMF's TRI was developed and (is) maintained in PDR (now called the Strategy, Policy, and Review Department (SPR)). The former Trade Policy Division in PDR was well placed to carry out certain operational aspects of the IMF's work on trade, including keeping track of trade policy changes and coordinating the IMF's role in the global institutional dialogue that is an important component of keeping the IMF current on trade policy issues. But it was not well placed to create and maintain a model-based trade restrictiveness index to match the standard of the OTRI. The responsibility for deciding and keeping under review how the IMF should monitor trade policy changes (whether by using the World Bank's measures or developing its own) ideally should be moved to the IMF Research Department. But since 2007, the Research Department's Trade and Investment Division has been eliminated. And even the Trade Policy Division has now become SPR's Trade, Institutions, and Policy Review Division, with a responsibility for non-trade-related issues as well.

58. In light of all of this, assuming that the IMF intends to stay involved in trade policy issues, it makes sense to use or modify an existing trade restrictiveness index instead of creating a new one. If the IMF needs to implement a concept of trade restrictiveness that differs from that underlying any of the existing indices, the ANF-TRI could be extended to address that need.

59. The IMF thus has two options. One, which is not advisable, is to improve its existing TRI. The range of the TRI would need to be redefined as most countries today fall in the lower part of the index (TRI of 5 or below). The coverage of NTBs could be improved significantly, using existing work by Kee, Nicita, and Olarreaga (2006). Such improvements would not, however, address the central problem with the TRI, which is that it is not conceptually well based. The use of such an "improved" TRI would still leave the Fund open to the kinds of criticisms that made the FDMD ask for reform of the index in 2004.

60. The second option is to use another existing index. The obvious choice is the ANF-TRI, given the World Bank's advantage with respect to trade expertise, the resources it has devoted to the ANF-TRI, OTRI, and MA-OTRI, and its commitment to update the indices annually. These three indices all have similar data requirements. If additional dimensions are deemed necessary, the Fund could use information from other indices such as the Doing Business indicators developed by the World Bank.¹⁹ The OTRI and MA-OTRI are reported

¹⁹ The Doing Business index provides a quantitative measure of regulations for starting a business, dealing with construction permits, employing workers, registering property, getting credit, protecting investors, paying taxes, (continued...)

in the *GMR*, which is produced jointly by the World Bank and the IMF, and has presumably been vetted by both institutions. This provides additional legitimacy for the IMF's use of the index.

61. In the interests of being evenhanded, it would also be well worth developing an index of subsidization using an approach similar to the ANF-TRI, as discussed above. While the IMF might be reasonably satisfied with a measure of protection based on the size of the welfare/utility loss resulting from tariffs and NTBs under perfect competition, many of the IMF's stakeholders, especially developing countries, may not be. Developing countries and LDCs are quite likely to be suspicious of a measure that is based solely on the welfare loss to the protecting country. Among their major concerns is that advanced economy subsidies (especially for agriculture) raise these economies' domestic production and reduce their imports. Maintaining an index of subsidization would address this concern and could also be of use in trade negotiations and discussions of the impact of trade protection on producers' competitiveness. One might ask whether the IMF should work on such an index alone or with other multilateral institutions. My view is that the latter would be preferable in order to have the implicit approval of as many of multilateral agencies as possible.

62. Greater cooperation with the World Bank, WTO, and UNCTAD should allow the needed indices to be generated annually for use by the IMF and other agencies. Such cooperation would also help improve the poor quality of data on NTBs, which researchers blame for the inadequate measurement of these barriers. UNCTAD's Group of Eminent Persons on NTBs (including Alan Deardorff and Anne Krueger) was directed in 2006 to come up with ways to better measure NTBs and strengthen UNCTAD's Trade Analysis and Information System database. However, progress has been slow and it seems unlikely that this initiative will produce much that is of use in the near future.

63. To conclude, one might also ask whether a trade restrictiveness index is still vital to the IMF's work, given the general reduction in tariffs that has taken place over the past few decades. Should trade protectionism increase in the next few years, would a good trade restrictiveness index give the Fund a substantial (though obviously not fail-safe) tool for identifying and combating it? The answer to both questions is a definite yes. Though tariffs have fallen, more creative ways are continually being found to restrict trade.²⁰ Thus, an index that attempts to capture such innovative barriers (as the NTB part of the OTRI does) is

trading across borders, enforcing contracts and closing a business—as they apply to domestic small and medium-size enterprises. See <http://www.doingbusiness.org/>.

²⁰ Note, for example, the voluntary export restraints and orderly marketing arrangements that proliferated in the 1980s to circumvent the General Agreement on Tariffs and Trade prohibition of quotas for manufactured goods. More recently, the possibility of using complex phytosanitary requirements to limit imports has been a subject of discussion especially in developing countries whose exporters may have a hard time meeting such requirements.

potentially very valuable in measuring both the level and the changes in protection. All multilateral institutions should be continually working on research that will help to improve the detection and measurement of such hidden restrictions. Clearly the IMF cannot do this alone—but no agency can. This has to be a cooperative effort, bearing in mind that the costs of coordination across institutions are large and should not be underestimated.

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