

3. Methods for Alternative Measure Studies

For studies looking to convert one NTM measure into an alternative one, as Figure 2 illustrates, we categorize these into two main methodologies, **price** and **quantity**, with a third category to capture those that do not easily fit these methodologies. In the two main methods, the basic idea is to compare an economic variable that results in the presence of an NTM (such as the price of an imported product) to a realization of that variable in a baseline case (such as the price of the good when produced domestically). The difference between these is attributed to the NTM, with that difference then being used to construct the “alternative” NTM measure. This is typically done via some form of structural estimation. The most common alternative measure that is constructed is a tariff equivalence, an alternative popular in part due to its usefulness in simulations. The difference between the price and quantity methods is in the variable used in the comparison.

The most popular method uses **price** data, comparing the price of a product under an NTM with the price of the product without an NTM. For example, a common approach is to use the monopolistically competitive model to derive the price of a good sold by firm i based in j in export market k as:

$$p_{i,j,k} = \frac{1}{1-\varepsilon} \tau_{j,k} a_i \quad (1)$$

where $1/a_i$ is firm productivity and $\tau_{j,k}$ are trade costs. Assuming a functional form for trade costs, which depend on NTMs, tariffs, and other factors, the researcher can then estimate parameters capturing the effects of the NTM and the tariff which can then be used to find a tariff equivalent to the NTM. Note that this estimation is typically, but not exclusively, done in a structural way. An alternative approach under this methodology is to utilize a “price gap”, i.e. the difference between a baseline price of the good (such as its domestic price) and that in the destination country (which again can depend on other factors). This is akin to using the above approach but takes advantage of the result that some factors determining the export

price are the same as those determining the domestic price (whereas in the above, the only difference would be due to the trade costs). For example, in the above, $p_{i,j,j} = \frac{1}{1-\varepsilon} a_i$, expressions such as $\ln p_{i,j,k} - \ln p_{i,j,j} = \ln \tau_{j,k}$ can be derived, the estimation of which requires less information than direct estimation of (1).

A second method compares the **quantity** (such as the quantity exported) under an NTM to that when no NTM is in place. For example, under monopolistic competition, sales in a given market are given by:

$$x_{i,j,k} = \left(\frac{1}{1-\varepsilon} \tau_{j,k} a_i \right)^{-\varepsilon} B_k \quad (2)$$

where B_k is a measure of the market size of k . Using a regression, this approach identifies the impact of the NTM. This can then be compared to, for example, the effect of a tariff on the quantity from which a tariff equivalent can be constructed. Although in theory this should be as valid as the price method, in practice because this may rely on comparison to a hypothetical baseline, the alternative measure constructed by the quantity method may be biased (see Ferrantino, 2006, for discussion).

The above methods rely on economic data (prices, trade, etc.) to construct the alternative measure. Alternatively, one can utilize only the information on the NTMs themselves to transform them (including counts of NTMs, frequency measures, indices, etc.). The goal in doing so is to obtain an overarching indication of the **restrictiveness** of the NTM measures. For example, this could include the combining of firm-level surveys of the challenges posed by the NTMs they face. Alternatively it could use two indices of NTMs and exploit the differences between them to infer something about their restrictiveness, such as whether or not the prime aim of the NTM is to restrict trade or achieve some other outcome.

Finally, we include a catch-all **other** grouping for studies which fall outside of these two primary categories. For example, a study could seek to convert the existence of an NTM

into the value to the consumer, via a “willingness-to-pay” approach. One type of analysis that this catch-all category could include using some other variable, such as profits, in an approach similar to the price or quantity methods.¹ In the models of monopolistic competition, the profits for firm i generated via exports from j to k would be expressed as a function of firm productivity ($1/a_i$), destination market factors (B_k), the demand elasticity of substitution (ε), and trade costs :

$$\pi_{i,j,k} = a_i^{1-\varepsilon} \tau_{j,k}^{1-\varepsilon} B_k. \quad (3)$$

Using this formula and assuming a functional form for trade costs, it is possible to write the difference in quantities as a function of, among other things, the NTM. Then the researcher can use this structural approach to estimate the various coefficients which can then be used to estimate the tariff that would be equivalent to the NTM.

Note that in all of these, the researcher has information on which product-country pair dyads face NTMs. Sometimes this information is not known. When that is the case, researchers sometimes resort to using a regression in which a measure of activity, such trade levels, is estimated to be the function of a variety of determinants (including unit cost and market size). By assumption, whatever effects are not attributable to the control variables is due to an NTM. Therefore the residual of the regression serves as a measure of the NTM. We do not, however, include this in the methodology inventory because, in a strict sense, it does not use an NTM measure in the estimation. Instead, this approach is used to construct an initial measure of an NTM (which can then be used in one of the above methodologies).

Finally, as studies constructing alternative measures of NTMs nearly universally would rely on data for actual prices, quantities, policies, and so forth, the expectation is that the majority of them would be retrospective studies. Further, unless the estimation is done in a general equilibrium framework that accounts, for example, on the ability of consumers to

¹ We suggest that this methodology might be useful in studying the activity of multinationals where profits of a subsidiary are observable, but prices and quantities are not

substitute between products as prices change due to NTMs, we would expect most of these studies to be partial equilibrium analyses.²

Example 1: Deardorff, A. V. and R. M. Stern (1997), “Measurement of Non-Tariff Barriers”, *OECD Economics Department Working Papers*, No. 179, OECD Publishing.

In this paper, among other things, the authors compare the prices for a variety of OECD countries in order to obtain a set of tariff equivalents. The way in which prices are compared varies and includes a comparison of domestically produced and imported prices, the prices sold in a “free trade” destination versus a protected destination, and more. In each case, the purpose here is to construct an alternative measure. In doing so, although their results cover numerous sectors, they do not consider linkages across sectors, making this a partial equilibrium analysis. Finally, since they are comparing actual prices, i.e. the NTMs are already in place, this is a retrospective analysis.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Price

Example 2: Ando, M. (2005). “Estimating tariff equivalents of core and non-core non-tariff measures in the APEC member economies.” in Dee, P. and Ferrantino, M. (eds.) *Quantitative Methods for Assessing The Effects of Non-Tariff Measures and Trade Facilitation*, World Scientific, Singapore.

This study uses data on products in the APEC countries and looks at the free-on-board and domestic prices, the difference in which is assumed to depend on tariffs and NTM measures. The author then regresses the non-tariff price difference on NTM measures, obtaining coefficients which are then used to convert the NTMs into tariff equivalents. As it uses past data but does not consider linkages in prices across products, it is a retrospective, partial equilibrium study.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Price

² We suggest that, to the extent that such substitutions are important, failure to account for them may bias the alternative measure results. This is more likely to be true when the scope under consideration is very detailed, such as when constructing alternative measures for different varieties of meat (beef, pork, etc.) than when using broader categories (such as agriculture versus textiles).

Example 3: Kee, H. L., A. Nicita and M. Olarreaga, (2005), “Ad Valorem Equivalents of Non-Tariff Barriers,” Washington, D.C.: World Bank.

This study uses data on imports and exports, i.e. quantities, for a wide variety of countries in order to convert a binary NTM variable into a trade restrictiveness indices (such as that of Anderson and Neary (1994)). The study covers 91 countries, both developed and developing, across 5000 products. The authors note that by using this approach they are specifically omitting some of the feedback effects that would arise in a CGE approach. Thus, this squarely falls into a retrospective, partial equilibrium study where the alternative measure is constructed using quantity methods.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Quantity

Example 4: Nogués, J. Olechowski, A., and Winters, L.A. (1986), “The Extent of Nontariff Barriers to Industrial Countries' Imports.” *The World Bank Economic Review*, 1(1), 181-199.

This paper reviews the extent of NTM barriers across sectors for a large selection of OECD countries. In doing so, it converts product level NTM binary variables into sector coverage ratios (i.e. what percentage of imports in a particular sector by a given country is subject to an NTM). Therefore this is a study where it creates an alternative measure, but does so via an “other” method which does not fit one of our other three categories.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Other

Example 5: Rau, M.-L., K. Shutes and S. Schlueter (2010), Index of Heterogeneity of Requirements in International Agri-Food Trade. NTM-Impact Working Paper 10/01.

This paper develops an index of regulatory differences, i.e. differences of import requirements in trade. It also provides the reasoning behind such an index for measuring the substance of NTMs and elaborates on its importance in comparison to other measurement methods.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Restrictiveness

Example 6: Li, Y. and J. C. Beghin (2013), Protectionism Indices for Non-Tariff Measures: An Application to Maximum Residue Levels. Working Paper #13-02, International Agricultural Trade Research Consortium.

This paper proposes aggregation indices of NTMs to quantify their protectionism relative to

international standards. The indices are applied to national Maximum Residue Limit (MRL) regulations affecting agricultural and food trade and using a science-based criteria embodied in Codex Alimentarius international standards. The approach links two streams of the NTM literature, one concerned with the aggregation of various NTMs into operational indices for econometric and modeling purposes, and the other attempting to evaluate the protectionism of NTMs.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Restrictiveness

Example 7: Fontagné, L., von Kirchbach, F. and M. Mimouni (2005), An assessment of environmentally-related non-tariff measures, *World Economy*, 28(10): 1417-1439.

In order to disentangle protectionism from dispositions justified on the grounds of true environmental concerns, this paper systematically reviews notifications of SPS and TBTs by importing countries at the tariff line level. Trade is considered as being potentially affected when an environmental SPS/TBT is notified on grounds of environmental concerns. Affected trade is defined as imports by countries notifying such barriers. Protectionist use of environmental barriers is likely when only a limited number of countries impose an environmental obstacle on the imports of a given product. The goal is therefore to compare two measures of NTMs to determine their relative trade restrictiveness.

Purpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Restrictiveness

Example 8: Klain, T.J., Lusk, J. K., Tonsor, G.T. and T. C. Schroeder (2011), An experimental approach to valuing information. *Agricultural Economics*, Volume 45, Issue 5, pages 635–648.

This article proposes a method to directly measure the value of information (VOI) conveyed in a label. Using data collected from a field experiment conducted in two grocery stores in Texas, we find the VOI contained in U.S. federally mandated country of origin labels for beef and pork is 36% lower using the new direct elicitation compared to the conventional approach. The mean value-of-origin information, in the context of our experiment, ranges from \$0.016 to \$1.08 per pound of steak/chop purchased, depending on the valuation method used and assumptions about labeling knowledge and average volume purchased per choice. The VOI is substantively influenced by ethnocentrism and meat consumption.

urpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Other

Example 9: Lusk, J. L., Norwood, F. B. and J. R. Pruitt (2006). Consumer Demand for a Ban on Antibiotic Drug Use in Pork Production, *American Journal of Agricultural Economics*, Agricultural and Applied Economics Association, vol. 88(4), pages 1015-1033.

Both bodies of the U.S. Congress have recently considered legislation to restrict use of antibiotics in livestock feed. Although several studies have addressed the costs of such restrictions, little is known about consumer demand. This study estimates consumers' willingness to pay for pork produced without subtherapeutic antibiotics and consumers' willingness to contribute to a reduction in antibiotic resistance by collecting data in a grocery store environment with mechanisms that involve the exchange of real food and real money. Results indicate that the welfare effects of a ban depend heavily on assumptions about consumers' current knowledge about antibiotic use in pork production and the extent to which consumers are currently able to purchase antibiotic-free pork.

urpose: Alternative Measure

Perspective: Retrospective

Scope: Partial equilibrium

Method: Other