PRONTO

FP7-SSH-2013-2
GA: 613504

Deliverable D1.2

Methodological inventory

Responsible Partner:	Ecorys
Status-Version	Final (subject to periodic review)
Date (this version):	17/03/2015 (subject to periodic update)
EC Distribution	Public

A Methodology Inventory for Studies Using NTM Data*

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Abstract: This document accompanies the Methodology Inventory Database on Non-Tariff Measures (the MIND), a directory of research using data on non-tariff measures (NTMs) which was generated as part of the EC Grant GA 613504 on Productivity, Non-Tariff Measures, and Openness (PRONTO). As the MIND is a crowd-sourced, living document which will evolve along with the literature, this overview gives instructions as to the classification system used in its construction in order allow additional users to add to the MIND as they produce new studies and/or encounter papers currently missing from the MIND.

JEL Codes: F13, F14, F17

Key Words: Non-tariff measures; Non-tariff barriers.

* The authors acknowledge that this paper is produced as part of the collaborative project "Productivity, Non-tariff Measures, and Openness (PRONTO)" funded by the European Commission under its Seventh Framework Programme – Contract No. 613504.

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1. Introduction

There is a sizable and swiftly growing literature that makes use of non-tariff measures (NTMs) in numerous ways. The OECD defines NTMs as "measures other than normal tariffs which have the effect of restricting trade between nations," however, we adopt an even broader definition that also includes policies that promote trade as well as those that can have both effects (such as a safety standard which is costly to meet but allays consumer concerns over the product's quality)[1]. With this broad definition, which covers the NTM classification presented in Table 1, the volume of existing research is not surprising.[2] With this in mind, the project "Productivity, Non-tariff measures, and Openness (PRONTO)" created a database of research using NTM data. The purpose of this inventory, called the Methodology INnventory Database on NTMs (MIND) is to provide a systematic categorization of different approaches of analysing NTMs applied in the existing literature, with the clear focus on methodology. The aspects looked at are as follows:

- Purpose, perspective, scope (Section 2)
- Alternative measure. i.e. using NTM information to obtain an alternative measure (Section 3)
- Studies of outcome of NTMs (Section 4)

[1] Some NTMs, such as standards for example, tackle the issue of incomplete or asymmetric information between buyers and sellers in the market. In this case, NTMs promote trade rather than restrict trade, which has often not been considered in analyses usually focusing on the costs of NTMs.

[2] This classification was developed by the Multi-Agency Support Team (MAST), which was set by the United Nations Conference on Trade and Development (UNCTAD) Group of Eminent Persons on NTMs and also includes representatives from other organizations such as the Food and Agriculture Organization of the United Nations (FAO), International Monetary Fund (IMF), International Trade Centre (ITC), Organization for Economic Cooperation and Development (OECD), United Nations Industrial Development Organization (UNIDO), World Bank and World Trade Organization (WTO), as well as observers from the United States Department of Agriculture (USDA), the United States International Trade Commission (USITC) and the European Commission (EC).

- Studies determining NTMs (Section 5)

The MIND then serves as an entry point for researchers working on NTMs by identifying relevant existing work which may be of use in their own studies. By identifying what is commonly done, this helps a researcher to find existing literature relevant to their topic, determine best practice, easily locate common difficulties and ways to overcome them, and identify innovative techniques suitable for their analysis. What the MIND is not intended to do, however, is identify the different existing NTM databases. That service is provided by PRONTO's database inventory details of which are available on the PRONTO website.[3] Finally, note that the goal of the MIND is not that it will include all papers related to NTMs. Given that the literature on NTMs is as large and varied as the measures the NTM designation covers, this is only to be expected. Further, given the policy and research attention being devoted to NTMs, the set of studies that can be included is continuously growing. With that said, it is important for users of the MIND to participate by including their own work (particularly their work that is on the frontier of NTM research) as well as studies that they consider seminal and/or particularly helpful. Thus, the MIND is intended to be a living, growing, and evolving database; the shape of which will change as the literature changes.

This document is intended to provide an introduction to the classification used in the construction of the MIND. In this classification, there is a conscious balancing between detail and simplicity. One result of this trade-off is that, just as a 3 digit industry classification can group firms with different properties at a

[3] The website can be found at (add webpage address)

disaggregated level into (to a certain degree) homogenous group, studies which differ in details may be grouped together into an overarching category indicating certain, common characteristics. A second important implication is that many studies will fall into multiple categories (for example a study which transforms binary NTM data into tariff equivalents which are then used in a computable general equilibrium (CGE) analysis). Thus, while the MIND's construction is aware of such issues, the choice was made to have a classification that is relatively streamlined and to instead make users aware that, when using the MIND, they must be cognizant of such matters.

In the next section, we give a walkthrough of the top layer of description which identifies the purpose, perspective, and scope of the study. Following that, we guide the reader through the methodologies under each of those purposes, a guide which includes illustrative examples. Finally, we conclude.

2. Purpose, Perspective, and Scope

When constructing the system for classifying methodologies for the MIND, three overarching descriptions of the research under consideration proved useful when categorizing the studies. First, there is the **purpose** of the study, that is, the goal the researcher had in mind when carrying out the analysis. Second, there is the **perspective** of the study which describes whether it is "backwards looking" and using data on what has already happened or predictive and trying to provide an estimate of future NTMs and their relationship to the economic environment. Third, there is the **scope**, which boils down to whether the study looks at a partial equilibrium setting that focuses on a small number of sectors or whether it considers broader, general equilibrium-type effects.

2.1 Purpose

In setting up the classification, the key determinant of the way in which an NTM is used in a study was the purpose of the study, that is, the goal the researcher had in mind. As illustrated in Figure 1, we identified four purposes: 1) construct an **alternative measure of an NTM**, 2) consider the **outcome from NTM use**, 3) examine the **determinants of NTM use**, and 4) provide a **literature review**.

As discussed in the PRONTO inventory of NTM data, a good deal of NTM data is qualitative or ordinal. For example, oftentimes the available NTM data is a binary variable that simply indicating whether or not an NTM is in place for a given country, year, and product. Such binary data, however, is not easily used for analyses such as simulations. Therefore there is a body of work that converts one measure of NTMs, such as a binary variable, into another, such as a tariff equivalent. Note that this **alternative measure** purpose is often combined with other purposes (such as when the same study creates a tariff equivalent and then uses this in a CGE simulation).

The second, and most common, purpose of an NTM study is to consider the **outcome** of NTM use. Here, the NTM is the input into a process where the researcher's goal is to examine how the NTM affects the outcome of that process. For example, in a regression analysis of the impact of NTMs on trade levels, the NTM would be a control variable and the goal would be to estimate its impact on trade. Alternatively, a CGE analysis would consider changes in the NTM and how this affects per-capita GDP. Therefore, in both of these, the NTM is on the right hand side of the estimation equation (explanatory variable), i.e. it is a driving force of the outcome.

An important thing to be aware of is that in some studies[4], whether the NTM has a positive or a negative effect is somewhat *a priori* determined by the way in which it is used. For example, in a CGE study, the standard approach is to measure NTMs as trade barriers and, just as the moniker "non-tariff barrier" presupposes, an increase in the NTM reduces trade (and therefore typically income). Nevertheless, there are several situations where NTMs can have a positive outcome. As a classic example of this is the infant industry argument, which suggests that by using trade restrictions it is possible to increase domestic productivity growth. With that said, the use of the term "outcome" is intentionally neutral in this regard as many NTMs are implemented in order to achieve a positive outcome, particularly in a non-economic area. For example, sanitary and phytosanitary (SPS) regulations are presumably implemented to improve product safety for consumers. Therefore a study examining, for example, the effect of SPS NTMs on the rate of *E. coli* infections, the effect of the NTM on consumer health can be expected to be positive. The overall outcome of the aforementioned SPS NTM is determined by the costs and benefits of the measures, taking into account producers, consumers and possibly society as a whole. A similar line of argumentation can be established for technical barriers to trade (TBT) (e.g. compatibility standards, labelling, and so forth). There are situations where the effect could go either way. For example, suppose that an NTM mandates safety-testing and product labelling on imports. This could present a barrier for foreign exporters due to the costs of testing or alternatively improve their ability to export if it relieves domestic concerns over product quality. Therefore, *a priori* the NTM could have a positive or a negative effect on the overall outcome. Because of the potential ambiguities in what one might expect, we do not break down the outcome purpose

[4] Cf. footnote 1

along these lines. However, we encourage users to be aware of the link between how an NTM measure is used as the potential pre-determination of the direction of its impact on the outcome.

The third purpose we use in classifying NTMs is for when the study looks into the **determinants** of NTM usage. In contrast to the outcome classification where the NTM is an input into a process, here the NTM is the outcome of a (oftentimes political) process. For example, a paper that uses Probit to determine in which industries a particular country uses NTMs would fall into this category. A second example would be work which examines how politicians vote on the implementation of NTMs as it depends on the characteristics of their jurisdiction. In both of these, the NTM is on the left hand side of the estimation equation, i.e. a dependent variable.

The fourth purpose is to provide an overview of the **existing literature**. Here, oftentimes authors compare and contrast different NTM measures. One of the valuable reasons for doing so is to identify the differing ways in which NTMs operate both within and across industries as well as how the different measures of NTMs compare in terms of the information they convey.

2.2 Perspective

The second key descriptor of a particular study is its perspective. Here, we use two categories: **retrospective** and **predictive.** A retrospective study is one that considers past events. Some methods of analysis, such as regressions, are by their nature **retrospective** because they require data on events and variable realizations that have already happened in order to carry out the method. Others, such as CGE modelling, are usually **predictive** as they seek to provide estimates of potential outcomes for events that have yet to occur, such as a proposed reduction in NTMs.

Indeed, one of the benefits of such predictive methodologies is that they generate estimates of the outcomes from proposed policy changes to provide guidance on whether they ought to be implemented. Note that predictive studies include both simulations and out-of-sample predictions.

Finally, note that a given study can be **both** retrospective and predictive. For example, a study that converts actual NTM data from a binary variable to a tariff equivalent and then uses that equivalent in a forecast the impact of reductions in NTMs would include both retrospective and predictive elements.

2.3 Scope

The third overarching description captures the scope of a particular study. First, we establish the level of analysis in terms of economic agents focussed on in the study. Here, we differentiate between consumers/households, firms, public (governmental) sector, business sector, and country-level analysis. In many cases multiple options are applicable, which can also be caused by linking different methods to for example make more nuanced statements regarding the impact of an NTM introduction/reduction on economic agents at hand (e.g. using NTM induced changes in a CGE model to run micro-analyses based on household survey data). Having defined the level of analysis we then classify papers into two groups: **partial equilibrium** and **general equilibrium** studies. The key distinction between the two is whether or not spillovers between sectors, firms, or countries play a role. As with the perspective, the scope of the study will occasionally govern which methods are possible. When a given paper focuses on one industry, such as when it estimates the impact of SPS NTMs on beef trade, this clearly falls into the **partial equilibrium** category. Sometimes a study may include several sectors by, for example, considering

how NTMs affect a variety of agricultural products but it nevertheless does not consider interactions between the products (as might occur due to impacts on intermediate goods prices or via input-output tables). This too would be a partial equilibrium study.

In contrast, a **general equilibrium** study has interactions between observations at its heart. This is most obvious in a CGE study where sectors are linked via an input-output table. Alternatively, even if a study only considers a small number of industries, if NTMs on one industry lead to a reallocation of resources to another, this too would be a general equilibrium study. Thus, at the risk of repetition, the distinction is less about the number of products or industries covered but more about the interactions between industries. Similarly, a study which considers, for example, a reduction in NTMs within the EU and how this has knock-on effects for trade with the US, would be a general equilibrium study even if it ignores trade with Asia. As a final point, note that this interaction is an "economic" one and not a simple statistical issue such as the mere correlation of error terms. Thus, a spatial autoregression regression in which, say output in one industry explicitly depends on output in another, would count as a general equilibrium study whereas a spatial error regression (in which errors are correlated across observations in a manner similar to clustering) would not.

Finally, as with the perspective of a paper, its scope can include **both** partial and general equilibrium elements by, for example presenting a set of CGE results and then following this up with more detailed sector by sector discussion that omits these interactions in order to focus on sector-specific features. Table 2 summarizes the different scope and perspective categories.

Thus, each study is initially described by its purpose, its perspective, and its scope. In the next three sections, we describe the methods that are used to fulfil each purpose.

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:

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

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:

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

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.[5] 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 the write the difference in quantities as a function of, among other things, the NTM. Then

[5] 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

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 substitute between products as prices change due to NTMs, we would expect most of these studies to be partial equilibrium analyses.[6]

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

[6] 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).

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

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

4. Methods for Outcome Studies

When the goal of a study is to examine the outcome of an NTM[7], a wide variety of different approaches are used. In order to provide a more useful taxonomy, we have six broad categories, some of which have sub-categories as illustrated in Figure 3. In the literature, two approaches vie for the most common methodologies. The first is the **regression** method in which the NTM measure is a control variable. The second is the **simulation** method in which the NTM is a part of the overall economic environment. Below we discuss with each of these in more detail.

In addition to regressions and simulations, there are four less commonly used methods. The **VAR** method is in some sense a blend of the regression and simulation methods, as it involves estimating coefficients and then examining how changes in the NTM filter through an economic structure. It differs considerably, however, both in terms of the estimation procedure (since variables are jointly determined) and the simulation (which focuses more on transition dynamics than traditional simulation

[7] The outcome of NTMs comprises many effects. Usually, price and quantity effects are determined, especially in CGE simulation models, but other effect for example the participation of firms, market structure effects as well as the benefits of measures are also analysed. In the MIND, we focus on the methods applied for analyzing the respective effects as outcomes of NTMs.

does). In this setting, the researcher might, for example, assume that the stringency of the NTM is a function of trade which itself depends on the NTM and both of which affect and are affected by GDP growth.

Event studies also differ from the standard regression approach in that they examine how high frequency data changes in response to a presumed unexpected event. For example, there are event studies which look at rulings on NTM cases (such as anti-dumping) and the impact this has on the stock market value of affected firms. Thus, if the NTM works to the benefit of domestic firms via limiting import competition, the outcome of the NTM announcement would be an unusually large increase in the stock market price of the relevant firms. As with VARs, we separate this out due to the markedly different estimation procedures used and the very different standards for reporting results.

Cost-Benefit studies use the methodology their name implies, namely comparing the benefits created by an NTM with its associated cost. This method differs from others in that it acknowledges that NTMs are often implemented to achieve specific non-trade, and often non-economic, objectives. For example, in 2011, Australia created a law requiring that cigarettes be sold in plain packaging in the hopes that this would reduce the desire to smoke with attendant health improvements. As the bulk of Australian cigarettes are imported, this was a *de facto* NTM even though the primary objective was not to inhibit trade, a result which ultimately led to Australia being charged with a violation of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organisation's (WTO), which prohibits trademark usage from being "unjustifiably" held back by special requirements. A cost-benefit study on this could, for example, compare the benefits gained from a reduction in smoking (such as by correlating smoking levels to the ban,

using the estimated reduction in use to improved person-years, and the latter into a monetary figure via a value of the statistical life estimate) with its costs (such as reduced trade and/or smaller excise tax revenues). Note that this can involve multiple regressions in the construction of the costs and benefits attributed to the NTM, but as the end result is a comparison of benefits and costs and the common involvement of non-economic factors, we wish to separate out such studies in the MIND.

Finally, there are informal estimates in which very simple calculations are used to create "educated guesses" about the impact of an NTM. These **back of the envelope** results have the benefit of simplicity and transparency (and as such often require less information to construct), however this comes at the risk of over-simplification. For example, if a ban in imports of hormone-treated beef results in a reduction of imports by €5 million, but increases domestic output by €4 million, then a back of the envelope estimate is that the outcome of the NTM is an increase in GDP by €4 million.[8] This clearly leaves out many aspects one might be interested in – such as where the resources for domestic production come from, the impact on consumer prices, and so forth – hence the "educated guess" label.

4.1 Regression Studies of NTM Outcomes

As the name NTM suggests, the most common regression when using an NTM measure as a control variable is one estimating a globalization-related outcome such as trade, foreign direct investment, or migration. As the traditional regression specification is the **gravity** specification, we use this term to cover this set of studies. In each, the regression looks something like:

$$Y_{i,j,t} = \alpha NTM_{i,j,t} + \beta X_{i,j,t} + \varepsilon_{i,j,t} \quad (4)$$

[8] Recall that GDP is the sum of consumption (which falls by €1 million), investment, government spending, and net exports (which rises by €5 million).

where $Y_{i,j,t}$ is, for example, exports from *i* to *j* in *t*, $X_{i,j,t}$ is a vector of controls outside of the NTM measure (GDP of each country and distance, for example), and $\varepsilon_{i,j,t}$ is the error term. This category covers both extensive estimations (where the dependent variable is, for example, a dummy variable indicating whether or not exports are positive) and intensive estimations (where the left-hand side variable is, for example, the log of export values). This category also includes alternative methods besides the traditional "log-log" approach to estimating gravity, including the structural estimation of Anderson and van Wincoop (2004) and methods intended to deal with zeros (including two-step estimations and PPML). Studies that take into account the intensive and extensive margin of trade constitute the state of the art for estimating the effect of NTMs on trade. In each, the end result is an estimate of α , giving an indication of the impact the NTM has on the outcome variable *Y*. Finally, whereas many gravity regressions use pair information (i.e. exports between two countries), some will use unilateral information (i.e. total immigration into country *i*) due to data limitations. Others, however, may augment the detail of the observation by breaking exports down into sector- or product-level exports.

When the estimation considers the NTM's impact on some **other economic outcome**, such as per-capita income, the regression specification will again look something akin to (4), but the specification can often be quite different and will depend on best practice for the specific question at hand. For example, if the goal is to estimate the impact of an NTM on GDP growth in country *i*, it is standard to include the starting value of GDP, education of the country in question, and so forth. In addition, as the dependent variable is country-year specific, rather than country-pair specific, the regression would typically only include information on *i*. Other examples that would fall in this category are studies that estimate the impact of NTMs on for

example firm costs. Despite the heterogeneity of the different types of non-globalization economic outcomes that can be studied, in order to keep the MIND's classification tractable, we group these other economic outcome regressions together.

As with the other economic outcome sub-category, regressions for **non-economic outcomes** will be varied, with the difference being the dependent variable is, at least arguably, one that would not be considered an economic outcome. Sometimes, these variables will still be innately quantitative, such as a regression considering the impact of an NTM mandating the emissions standards for imported vehicles on carbon emissions. Other times, they may be more qualitative, such as a regression examining whether or not consumer attitudes towards a product vary according to whether or not the industry is subject to mandatory environmental labelling. Again, as best practice in terms of controls and precise regression technique vary depending on the topic under consideration, so too will the details of the studies in this category.

Finally, we include a catch-all **other** category for studies which do not fit in any obvious way into the above categorization. This is done for ease of entry for those looking to add to the MIND since, by definition, any regression would have either an economic or non-economic dependent variable.

4.2 Simulation Studies of NTM Outcomes

Within simulations we designate two categories, the difference in which is related to the partial versus general equilibrium designation. The first of these is the **sector-level simulation** method. Here, the researcher uses estimates about various parameter values (including the impact of NTMs on different factors such as trade levels) to estimate how the impact of a change (typically a reduction) in the NTM will

affect the sector's features, including outputs, prices, and factor usage. In contrast, a **CGE** simulation does a similar analysis but does so in a general equilibrium setting that accounts for the relationships between sectors and/or countries.

Each method has its benefits and costs. Typically, a sector-level simulation is more detailed and tailored to the specifics of the industry under study. For example, where a CGE analysis might simply include "meat" as an industry and then consider how a relaxation on the ban against hormone treated meat affects the equilibrium, a sector-level simulation might consider how the response varies across beef, chicken, and pork. As such, it can provide much more nuanced results. This comes, however, at the expense of general equilibrium results. In particular, it typically would ignore how changes in the overall meat industry might affect the cost of feed or labour, features that a CGE simulation would include. Again, there is some grey area in this distinction because it is not precisely clear how many sectors are needed to call a set of results "general equilibrium"; that said, the typical distinction between sector-level simulations and CGE ones is the extent to which factor prices are endogenous.

Example 10: Babula, R., et al. (2005), "Using Directed Acyclic Graphs And VAR Econometrics To Simulate The Upstream And Downstream Effects Of Imposition Of An Import Quota: An Application To U.S. Wheat-Related Markets," in P. Dee and M. Ferrantino (eds.), *Quantitative Measures for Assessing the Effect of Non-Tariff Measures and Trade Facilitation*, Singapore: World Scientific Ltd. For APEC, pp. 193-215.

This paper uses a VAR analysis to consider the impacts of implementing a wheat quota for the US comparable to one that was used by Canada. The VAR analysis uses existing data to estimate parameters for several jointly determined variables relating to wheat and five interrelated industries (wheat, bread, flour, mixes, cereal, and cookies). Note that as the industries are interrelated, this would be a general equilibrium analysis. It then uses the results to predict the changes arising from a wheat quota. This study concludes with an out of sample forecast, adding a predictive element to the retrospective estimation.

Purpose: Outcome
Perspective: Both
Scope: General equilibrium

Method: VAR

Example 11: Desai, Mihir A. & Hines Jr., James R., 2008. "Market reactions to export subsidies," *Journal of International Economics*, 74(2) 459-474.

This paper uses data on the share returns of U.S. firms benefiting from the U.S. export subsidies (via the Foreign Sales Corporation (FSC) regulations) to estimate how they responded to news of an EU complaint against the controversial policy. Using an event study estimation, they show that export-intensive firms utilizing the FSC and firms with higher profit margins showed the greatest negative reaction to the initiation of the case. This then gives an indication of how investor expectations of firm profits depend on the FSC.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Event Study

Example 12: Liebman, B., Tomlin, K. 2007. Steel Safeguards and the Welfare of U.S. Steel Firms and Downstream Consumers of Steel: A Shareholder Wealth Perspective. *Canadian Journal of Economics* 40, 812-842.

This paper studies the shareholder response of downstream consumers of steel following the implementation of steel safeguards implemented in 2002. Similar to Desai and Hines (2008), they use an event study on existing data to analyse changes in investor expectations of firm profits as embodied in stock returns. Of importance when classifying this paper is that, rather than looking just at the steel industry, they also analyse the responses in the downstream consumers of steel, such as auto and construction producers, where they find that stock returns reacted negatively to upstream protection and the presumed increase in input costs that would follow. Therefore, in contrast to Desai and Hines's (2008) partial equilibrium study, this is a general equilibrium analysis.

Purpose: Outcome
Perspective: Retrospective
Scope: General equilibrium
Method: Event Study

Example 13: van Tongeren, F. et al. (2010), "Case Studies of Costs and Benefits of Non-Tariff Measures: Cheese, Shrimp and Flowers", OECD Food, Agriculture and Fisheries Working
Papers, No. 28, OECD Publishing.

As the title suggests, this paper undertakes three cost-benefit analyses for regulations in three industries. For example, in the cheese study, it compares estimates of the willingness to pay to avoid *Listeria* contamination against relative to the desire among some consumers to pay for specific varieties of soft French cheeses (with the analysis suggesting that these losses outweigh the benefits). For the other markets, they also include additional costs such as border inspection costs.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Cost-Benefit

Example 14: Anders, S. and J. A. Caswell (2009), The Benefits and Costs of Proliferation of Geographical Labelling for Developing Countries, *Estey Centre Journal of International Law and Trade Policy*, Estey Centre for Law and Economics in International Trade, vol. 10(1).

Food product attributes related to geographical origins are a topical issue in global food trade. The provision of geographical labelling may occur through geographical indications under the mandated trade rules of the TRIPS Agreement, through trademarks, or through country-of-origin labelling. The overall effect of the expansion of geographical labelling on developing countries depends on a complex mix of market opportunities that may yield substantial benefits as well as implementation costs. Increasingly, the analysis of this overall effect will need to evaluate the joint impacts of different forms of geographical labelling on the market position of developing countries.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Cost-benefit

Example 15: Peterson, E. B. and D. Orden (2008). Avocado Pests and Avocado Trade, *American Journal of Agricultural Economics,* Agricultural and Applied Economics Association, vol. 90(2), pages 321-335.

This article evaluates the effects of a November 2004 phytosanitary rule that removed seasonal and geographic restrictions on the importation of fresh Hass avocados from approved orchards in Mexico to the United States. With the remaining systems approach compliance measures in place, pest risks do not substantially increase and U.S. net welfare rises by $77 million. Removal of remaining compliance measures may lead to lower net welfare gains depending

on which measures are eliminated and the estimated probabilities of pest infestations.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Cost-benefit

Example 16: Sarkar, S. (2005). "Non-tariff measures in services: measuring gains from movement of skilled personnel," in Dee, P. and Ferrantino, M. (eds.) *Quantitative Methods for Assessing The Effects of Non-Tariff Measures and Trade Facilitation*, World Scientific, Singapore.

This book chapter considers the increase in total wage receipts from a proposed increase in the number of visas issued by the US to skilled workers in the IT industry (an NTM to trade in services). In calculating the increase in income, the author multiplies the average wage in the industry by the proposed increase in the number of workers, ignoring, for example, changes in wages within the sector. In addition, it excludes any estimates about how this might affect industries for which IT is an input. This is therefore a back of the envelope analysis.

Purpose: Outcome
Perspective: Predictive
Scope: Partial equilibrium
Method: Back of the Envelope

Example 17: Disdier, A.-C. Fontagné, L., and M. Mimouni (2008), The impact of regulations on agricultural trade: evidence from SPS and TBT agreements, *American Journal of Agricultural Economics*, 90(2): 336 – 350.

This paper analyses the structure of regulations under the Agreements on Sanitary and Phyto-Sanitary (SPS) and Technical Barriers to Trade (TBT). It takes an inventory approach. It is suggested that European countries have among the lowest coverage ratios of all OECD countries. The measures are applied in a gravity equation in order to estimate their stringency.

Purpose: Alternative Measure, Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Restrictiveness, Regression (Gravity)

Example 18: Fontagné, L., Orefice, G., Piermartini, R. and Rocha, N. (2013). "Product Standards and Margins of Trade: Firm Level Evidence," CEPII Working Paper No. 2013-06.

This paper uses French firm-level product export data to examine the impact of SPS regulations on several aspects of firm behaviour, in particular, the extensive and intensive margins of trade and the price of exports. Therefore, the regression methodologies includes both gravity and other economic outcomes.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Gravity); Regression (Other economic outcomes)

Example 19: Czaika, M. and de Haas, H. (2014). "The Effect of Visa Policies on International Migration Dynamics," International Migration Institute Working Paper No. 89.

This paper estimates bilateral migration flows for a panel of 28 countries from 1973-2012 as a function of source, destination, and dyad characteristics. In addition, it includes a variable capturing whether or not a travel visa is required, something which acts as proxy for an NTM to services trade. It finds that introducing a visa requirement reduces migration inflows to the destination but also reduces reverse migration (outflows back the source). As it estimates the impact of the NTM on migration outcomes via a gravity regression, the categorization is clear-cut.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Gravity)

Example 20: Kox, H.L.M. and H.K. Nordas, H.K. (2007), Services Trade and Domestic Regulation. OECD Trade Policy Working Paper No. 49, Paris.

This paper argues that regulatory measures affect the fixed cost of entering a market as well as the variable costs of servicing that market. Moreover, differences in regulation among countries often imply that firms have to incur entry costs in every new market. Indicators of regulatory intensity and heterogeneity are introduced in a gravity model and their impact on market entry and subsequent trade flows estimated for total services, business services and financial services.

Purpose: Alternative Measure and Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Restrictiveness and Regression (Gravity)

Example 21: Maskus, K., Otsuki, T. and J. S. Wilson (2005), The costs of compliance with product standards for firms in developing countries: an econometric study, working paper, no. 3590, The World Bank, Washington DC.

Standards and technical regulations exist to protect consumer safety or to achieve other goals, such as ensuring the interoperability of telecommunications systems, for example. Standards and technical regulations can, however, raise substantially both start-up and production costs for firms. Maskus, Otsuki, and Wilson develop econometric models to provide the first estimates of the incremental production costs for firms in developing nations in conforming to standards imposed by major importing countries. They use firm-level data generated from 16 developing countries in the World Bank Technical Barriers to Trade (TBT) Survey Database. Their findings indicate that standards do increase short-run production costs by requiring additional inputs of labor and capital. A 1 percent increase in investment to meet compliance costs in importing countries raises variable production costs by between 0.06 and 0.13 percent, a statistically significant increase. The authors also find that the fixed costs of compliance are nontrivial-approximately $425,000 per firm, or about 4.7 percent of value added on average. The results may be interpreted as one indication of the extent to which standards and technical regulations might constitute barriers to trade. While the relative impact on costs of compliance is relatively small, these costs can be decisive factors driving export success for companies. In this context, there is scope for considering that the costs associated with more limited exports to countries with import regulations may not conform to World Trade Organization rules encouraging harmonization of regulations to international standards, for example. Policy solutions then might be sought by identifying the extent to which subsidies or public support programs are needed to offset the cost disadvantage that arises from nonharmonized technical regulations.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Other Economic Outcome)

Example 22: Augier, P., Cadot, O, and Dovis, M. (2013) "NTM harmonization, profits, and productivity Firm-level evidence from Morocco," Mimeo.

This analysis uses firm- and product-level data to examine the effects of regulatory convergence between Morocco and the EU, the disjoint between which amounted to a NTB. It finds that harmonization increases operating profits and labour productivity, especially when the firm faces competition from other low-cost exporters to the EU (such as competition by Chinese firms). Note that in this, they do not consider how, for example, increased exporting by other Moroccan firms to the EU affects the prices of inputs a given Moroccan firm uses.

Purpose: Outcome
Perspective: Retrospective

Scope: Partial equilibrium
Method: Regression (Other Economic Outcome)

Example 23: Lee, J. (1996) "Government Interventions and Productivity Growth," *Journal of Economic Growth,* Vol. 1, 391-414.

This study looks at the growth of labour productivity and total factor productivity in Korea as it depends on factors including government policies such as tariff and NTM protections. It finds that, on the whole, protection lowers growth. By ignoring spillovers from one sector to another it ranks as a partial equilibrium study.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Other Economic Outcome)

Example 24: Damodaran, A. (2002) "Conflict of Trade-Facilitating Environmental Regulations with Biodiversity Concerns: The Case of Coffee-Farming Units in India," *World Development,* 30(7), 1123-1135.

This study uses data from Indian coffee growers that differentiates between whether or not they are SPS compliant. It then compares the activities undertaken by these different groups of firms. In particular, it considers whether or not they engage in activities which might reduce biodiversity such as the felling of endemic shade trees. Thus, one of its conclusions is that SPS compliance reduces biodiversity.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Non-economic outcome)

Example 25: Lusk, J. L. and J. D. Anderson (2004), Effects of country of origin labelling on meat producers and consumers, *Journal of Agriculture and Resource Economics*, 29(2): 185 - 205.

Although several studies have estimated the costs of country-of-origin labeling (COOL), no

previous study has documented how these costs will be distributed across the livestock sector or how producer and consumer welfare will be affected. This analysis presents an equilibrium displacement model of the farm, wholesale, and retail markets for beef, pork, and poultry that documents how producers and consumers will be affected by COOL. Findings reveal that as the costs of COOL are shifted from the producer to the processor and retailer.

Purpose: Outcome
Perspective: Predictive
Scope: Partial equilibrium
Method: Simulation (Sector-level)

Example 26: CEPR (2013). "Reducing Transatlantic Barriers to Trade and Investment," report to the European Commission by Francois, J., M. Manchin, H. Norberg, O. Pindyu, and P. Tomberger; CEPR (London).

This study is a CGE analysis of the various changes to be expected should the Trans-Atlantic Trade and Investment Partnership agreement between the EU and the US be completed. It is a classic example of CGE analysis of an NTM.

Purpose: Outcome
Perspective: Predictive
Scope: General equilibrium
Method: Simulation (CGE)

Example 27: Antle, J.M. (1998). The Cost of Quality in the Meat Industry: Implications for HACCP Regulation. In L. Unnevehr, ed., The Economics of HACCP: Studies of Costs and Benefits. Eagan Press, St. Paul MN.

This paper develops a framework for measuring the plant-level cost of quality regulations, based on models of the production of quality-differentiated products. This framework emphasizes the potential importance of the impacts of regulations on both variable and fixed costs of production. Evidence on the potential impacts of food safety regulation on variable costs of production is presented from a recent study of the meat and poultry industry.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Other Economic Outcome)

Example 28: Everet, P. B. and D. Orden (2005). Effects of Tariffs and Sanitary

Barriers on High- and Low-Value Poultry Trade, *Journal of Agricultural and Resource Economics*, Western Agricultural Economics Association, vol. 30(01), April.

A competitive partial-equilibrium spatial model with heterogeneous goods is constructed to evaluate effects of the removal of tariffs, tariff-rate quotas, and sanitary regulations on world poultry trade. The model distinguishes between "high-value" (mostly white meat) and "low-value" (mostly dark meat) poultry products and simulates the trade flows among eight exporting and importing countries and regions. Removing all barriers simultaneously has a larger impact on trade than removing only tariffs and tariff-rate quotas. Imposition of sanitary barriers against U.S. products by Russia shifts trade flows, but does not have large net impacts on U.S. producers.

Purpose: Outcome
Perspective: Predictive
Scope: Partial equilibrium
Method: Simulation (Sector-level)

Example 29: Andriamananjara, S. Dean, J., Feinberg, R., Ferrantino, M., Ludema, R., and Tsigas, M. (2004) "The Effects of Non-Tariff Measures on Prices, Trade, and Welfare: CGE Implementation of Policy-Based Price Comparisons," U.S. International Trade Commission Working Paper No. 2004-4-A.

This study crosses several purposes and methodologies. It uses retail price data on disaggregated products in a comparison with purchasing power parity prices. This price gap is then regressed on different factors, including the presence of an NTM in order to construct tariff equivalents. This is then used as an input into a simulation analysis where the price of a product is determined by equilibrium with trade among large countries in order to estimate the price and welfare impacts of a reduction in NTMs.

Because the study does not use cross-industry or product effects in the estimation of price effects, but does allow for changes in consumption patterns across goods, it has elements of both partial and general equilibrium studies. As it uses both existing data to construct the alternative measure and predicts the effects of NTM reductions it is both retrospective and predictive.

Purpose: Alternative Measure; Outcome
Perspective: Both
Scope: Both
Method: Price; Simulation (CGE)

Example 30: Chung C., Zhang T. and D. S. Peel, (2009), Effects of Country of Origin Labeling in the U.S. Meat Industry with Imperfectly Competitive Processors, *Agricultural and Resource Economics Review,* 38/3 (December 2009) 406–417.

The study examines the impacts of implementing mandatory country of origin

labeling (COOL) on producer and consumer welfare in the U.S. meat industry. The equilibrium displacement model developed in this study includes twenty-nine equations representing retail-, processing-, and farm-level equilibrium conditions for the beef, pork, and chicken industries. Unlike previous studies, the model allows trade between domestic- and foreign-origin products and considers the imperfectly competitive market structure of meat processers. Empirical results show that without a significant increase in domestic meat demand, producers are not expected to benefit from the mandatory COOL implementation. Results of a sensitivity analysis indicate that consumers tend to bear more COOL costs than producers, as the own-price elasticity becomes more inelastic, and that producers' benefits increase as the elasticity of domestic demand becomes more elastic with respect to the price of imported products. The existence of market power in upstream and downstream markets of processors negatively affects both consumer and producer surplus. One implication of their findings is that U.S. beef and pork producers' promotion and advertising programs would be successful in expanding domestic demand when the programs make the own-price elasticity of domestic demand more inelastic and the cross-price elasticity of domestic demand more elastic with respect to import price.

Purpose: Outcome
Perspective: Predictive
Scope: Partial equilibrium
Method: Simulation (Sector-level)

Example 31: Espinosa, J.A. and Smith, K. (1995). " Measuring the Environmental Consequences of Trade Policy: A Nonmarket CGE Analysis." American Journal of Agricultural Economics, 77(3), 772-777.

In this paper, the authors conduct a CGE analysis of the impacts arising from a 50% NTM reduction by the UK with respect to its trade with the rest of the EU. In addition to the typical changes in income and prices, the authors include potential changes in emissions and the attendant negative health consequences. This therefore is a predictive, general equilibrium study of outcomes (here including non-economic outcomes) using a CGE methodology. As very few simulations include predictions for non-economic outcomes, we did not add this as a separate sub-category for simulation studies.

Purpose: Outcome
Perspective: Predictive
Scope: General equilibrium
Method: Simulation (CGE)

Example 32: Paarlberg, P. L. and J. G. Lee, (1998). Import Restrictions in the Presence of a Health Risk: An Illustration Using FMD, *American Journal of Agricultural Economics*, Agricultural and Applied Economics Association, vol. 80(1), pages 175-183.

This paper presents a simple model linking infection risk from imports to a tariff. The risk causes the exporter of the infected product to face a higher tariff than would otherwise be the case. A numerical example is developed for U.S. beef imports from nations with Foot-and-Mouth Disease (FMD). The additional tariffs are sensitive to the specification of risk and the expected magnitude of loss due to an FMD outbreak. For a low risk of importing FMD, the tariffs levied against the exporter of FMD-infected beef are not prohibitive but become so as the risk or expected output loss rises.

Purpose: Outcome
Perspective: Retrospective
Scope: Partial equilibrium
Method: Cost-benefit

5. Methods for NTM Determinants Studies

Figure 4 illustrates the two primary methodologies for studies examining the determinants of NTMs. The first of these is a **regression**, in which the NTM itself is the dependent variable. Within this, there are two sub-categories. The first of these, **implementation**, examines whether or not an NTM is in place. For a product *i*, country *j* may decide whether or not to implement an NTM on imports from country *k*, resulting in a regression specification along the lines of:

$$NTM_{i,j,k,t} = \beta X_{i,j,k,t} + \varepsilon_{i,j,k,t} \quad (5)$$

where $X_{i,j,k,t}$ is a vector of variables which can vary by product, implementing country, and partner country. For example, the researcher might include information on the extent of import competition, the lobbying efforts of the industry, or measures of political cooperation between the two countries. The precise regression methodology will vary according to how the NTM variable is measured, i.e. whether it is a continuous variable or categorical (including a simple binary variable indicating the presence of any NTM).

A second type of regression is one that considers the **opinion** of an individual regarding a particular NTM. For example, a study can look at the voting behaviour of

politicians on an NTM such as stricter SPS standards. This behaviour can be modelled as a function of variables describing the individual (such as gender or party affiliation), those they represent (such as their jurisdiction's employment in the industry the NTM applies to), and other factors (such as voting behaviour by others in the same party). Note that within this methodology, it is standard that, as opinions are typically measured as discrete variables (such as 1 if the politician voted yes, zero otherwise), a discrete dependent variable estimation method such as Probit would be the standard technique.

In addition to regressions, the analysis on NTM determinants can be **qualitative**. Here, the study describes the specifics of a given NTM's situation, including historical, political, and other non-quantitative factors which feed into whether or not the NTM is used and, if it is, its severity and the precise mechanisms by which it operates. Thus, this is much more a case study approach rather than a quantitative approach.

Example 34: Ray, E.J. (1981). "The Determinants of Tariff and Nontariff Trade Restrictions in the United States," *Journal of Political Economy*, 89(1), 105-121.

This seminal paper examines tariff and NTM levels for different U.S. industries. The NTM measures include a binary variable indicating whether or not they are present, as well as a measure of the intensity of the NTMs. It finds that NTMs are more likely and more severe in industries in which the US has a comparative disadvantage.

Purpose: Determinants
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Implementation)

Example 35: Aisbett, E. and L. Pearson (2012). "Environmental and Health Protections, or new Protectionism?" Mimeo.

This paper estimates whether or not an SPS notification occurs depending on, among other factors, the extent of tariff overhang a particular product faces. It finds that indeed, smaller tariff overhang leads to increases in the probability of new SPS measures, however, that this is dominated by governance and environmental factors.

Purpose: Determinants
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Implementation)

Example 36: Liebman, B. (2004). "ITC Voting Behavior on Sunset Reviews," *Review of World Economics*, 140 (3), 446-475.

This paper estimates the voting behaviour of commissioners on the US ITC panel with respect to the removal of anti-dumping duties. It finds that, among other things, a vote in favour of removing duties depends on whether or not the protected industry is active in the commissioner's home jurisdiction.

Purpose: Determinants
Perspective: Retrospective
Scope: Partial equilibrium
Method: Regression (Opinion)

Example 37: Richman, E. (2009). "The NAFTA Trucking Provisions and the Teamsters: Why They Need Each Other," *Northwestern Journal of International Law and Business,* 29(2), 555-576.

This paper is a case study of the NAFTA provisions regarding the trade in shipping services. In particular, it delves into the details on why the US delayed following through with reducing this NTM and the legal battles that eventually led to the US opening to Mexican trucks (albeit in a very limited fashion).

Purpose: Determinants
Perspective: Retrospective
Scope: Partial equilibrium
Method: Qualitative

Example 38: Calvin, L. and B. Krissoff (1998) "Technical Barriers to Trade: A Case Study of Phytosanitary Barriers and US-Japanese Apple Trade." *Journal of Agricultural and Resource Economics*, 23(2), 351-366.

This study covers several categories. First, it is a case study looking at the impact of PSP regulations on several aspects of Japanese apple production including non-economic aspects such as disease transmission. What makes this a case study is its attention to detail regarding apples varieties, the development of policies in Japan, and so forth. It then proceeds by converting the regulations into an alternative measure (tariff equivalents) using the price method. Finally it uses these to undertake a predictive cost-benefit analysis of removing these regulations. Therefore, although it is definitely partial equilibrium, it has both retrospective and predictive aspects and employs multiple purposes and methodologies.

Purpose: Alternative Measure; Outcome; Determinants
Perspective: Both
Scope: Partial equilibrium
Method: Price; Cost-Benefit; Qualitative

6. Literature Reviews

Within literature reviews, we do not provide different methodologies. Since the goal of these reviews is to **compare and contrast** NTMs, both in terms of how they operate and how the different measures are constructed (with consequences for the information they contain), we do not see a need to disaggregate this purpose's methodology. Note that as these reviews use existing data they are retrospective by default. Finally, since it is possible for the review to include a discussion on how existing measures do or do not consider cross-industry spillovers, they can still have a partial or general equilibrium scope.

Example 39: Bora, B., Kuwahara, A. and S. Laird (2002), "Quantification of non-tariff measures." Policy Issues in International Trade and Commodities Studies Series, No. 18, UNCTAD, Geneva.

This paper reviews various approaches to measure and quantify NTMs within the context of the existing data collections. It provides a landscape of NTM incidence for selected countries and for selected product categories.

Purpose: Literature Review
Perspective: Retrospective

Scope: Partial equilibrium
Method: Compare and contrast

Example 40: Carrere, C. and J. De Melo (2009), "Non-Tariff Measures: What Do We Know, What Should Be Done?" CERDI, *Etudes et Documents*, E 2009.33, available at http://hal.archivesouvertes.fr/docs/00/55/35/99/PDF/2009.33.pdf

This paper surveys the state of knowledge with the view to drawing implications for policy suggestions to reduce those NTM barriers that are welfare reducing. Following a description of data bases and their shortcomings, the paper reviews the state of understanding on the effects of NTMs on trade flows.

Purpose: Literature Review
Perspective: Retrospective
Scope: Partial equilibrium
Method: Compare and contrast

7. Conclusion

The MIND has been constructed in order to provide researchers with a way to identify relevant studies and techniques when researching NTMs. A key part of this is that the MIND will evolve as researchers add additional works to the inventory. This document is intended to aid in that process since, although new entries will be periodically reviewed by PRONTO-affiliated researchers, the goal is to keep the MIND as up-to-date as possible.

References

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UNCTAD (2013), "Classification of Non-Tariff Measures," United Nations Publication UNCTAD/DITC/TAB/2012/2.

Table 1. The MAST Classification System of NTMs.

Technical measures	**Chapter A**, on sanitary and phytosanitary measures (SPS), refers to laws, decrees, regulations, requirements, standards and procedures to protect human, animal or plant life or health from certain risks such as the establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms; risks from additives, contaminants, toxins, disease causing organisms in foods, beverages or feedstuffs. Hygienic requirements, fumigation requirements or quarantine are examples. The chapter is also known as SPS. **Chapter B**, on technical barriers to trade (TBT), contains measures referring to the technical specification of products or production processes and conformity assessment systems thereof. They exclude SPS, but a TBT measure may be applied to food products, if the measure is not for food safety. Product identity or quality requirements are examples. **Chapter C**, on pre-shipment inspection and other formalities, refers to the practice of checking, consigning, monitoring and controlling the shipment of goods before or at entry into the destination country.
Non-technical measures	**Chapter D**, on price control measures, implemented to control the prices of imported articles in order to: support the domestic price of certain products when the import price of these goods is lower; establish the domestic price of certain products because of price fluctuation in domestic markets or price instability in a foreign market; and counteract the damage resulting from the occurrence of 'unfair' foreign trade practices. **Chapter E**, on licences, quotas, prohibitions and other quantity control measures, measures that restrain the quantity of goods that can be imported, regardless of whether they come from different sources or from one specific supplier. These measures can take the form of restrictive licensing, fixing of a predetermined quota or through prohibitions. **Chapter F**, on charges, taxes and other para-tariff measures, refers to measures other than tariffs that increase the cost of imports in a similar manner, i.e. by a fixed percentage or by a fixed amount. They are also known as para-tariff measures. Customs surcharges and general sales taxes are examples. **Chapter G**, on finance measures, refers to measures that are intended to regulate the access to and cost of foreign exchange for imports and define the terms of payment. They may increase import costs in the same manner as tariff measures **Chapter H**, on anti-competitive measures, intended to grant exclusive or special preferences or privileges to one or more limited groups of economic operators. **Chapter I**, on trade-related investment measures, by requesting local content or requesting that investment be related to

	export to balance imports. **Chapter J**, on distribution restrictions, related to the internal distribution of imports. **Chapter K**, on restrictions on post-sales services, measures restricting the provision of post-sales services in the importing country by producers of exported goods. **Chapter L**, on subsidies, includes measures related to financial contributions by a government or government body to a production structure, be it a particular industry or company, such as direct or potential transfer of funds (e.g. grants, loans, equity infusions), payments to a funding mechanism and income or price support. **Chapter M**, on government procurement restrictions, refers to measures controlling the purchase of goods by government agencies, generally by preferring national providers. **Chapter N**, on intellectual property, measures related to intellectual property rights in trade. Intellectual property legislation covers patents, trademarks, industrial designs, layout designs of integrated circuits, copyright, geographical indications and trade secrets **Chapter O**, on rules of origin, covers laws, regulations and administrative determinations of general application applied by the governments of importing countries.
Exports	**Chapter P**, on export-related measures, encompasses all measures that countries apply to their exports. It includes export taxes, export quotas or export prohibitions.

Source: UNCTAD (2013).

Table 2: Perspective and Scope with Examples

	Scope			
Perspective		Partial equilibrium	General equilibrium	Both
	Retrospective	Regression	Spatial Autoregression	A comparison of gravity estimates with structural, "third-country" estimates
	Predictive	Back of the envelope predictions of effects of relaxing visa requirements	CGE	Partial equilibrium simulation & CGE

	Both	Regression with out-of-sample prediction	Construction of tariff equivalents which are used in CGE	

Figure 1: Purposes of NTM Studies

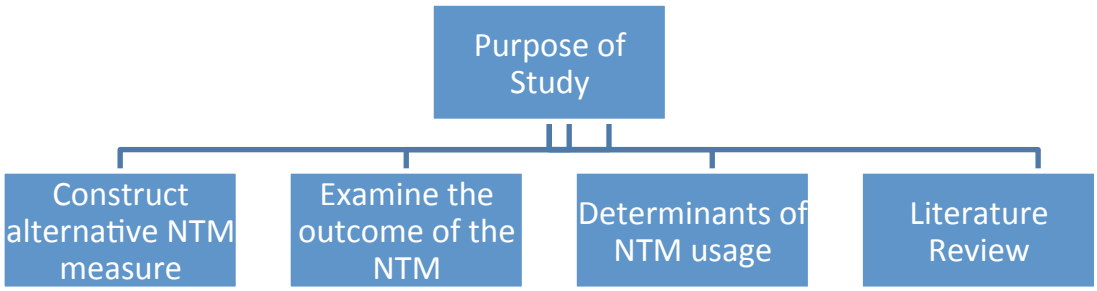

Figure 2: Methods for Alternative Measure Studies

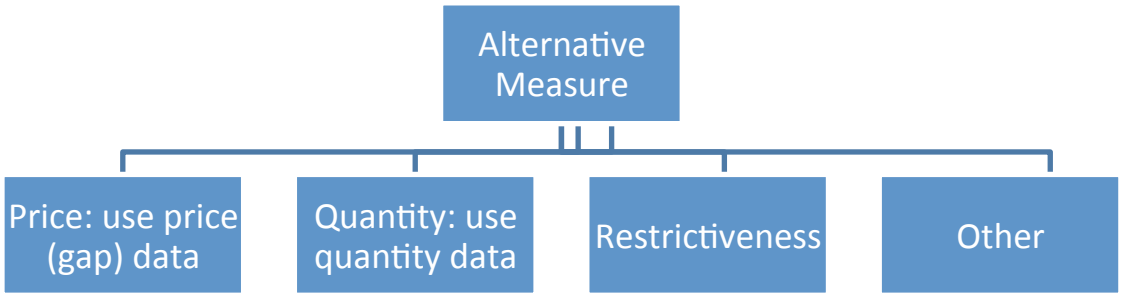

Figure 3: Methods for NTM Outcome Studies

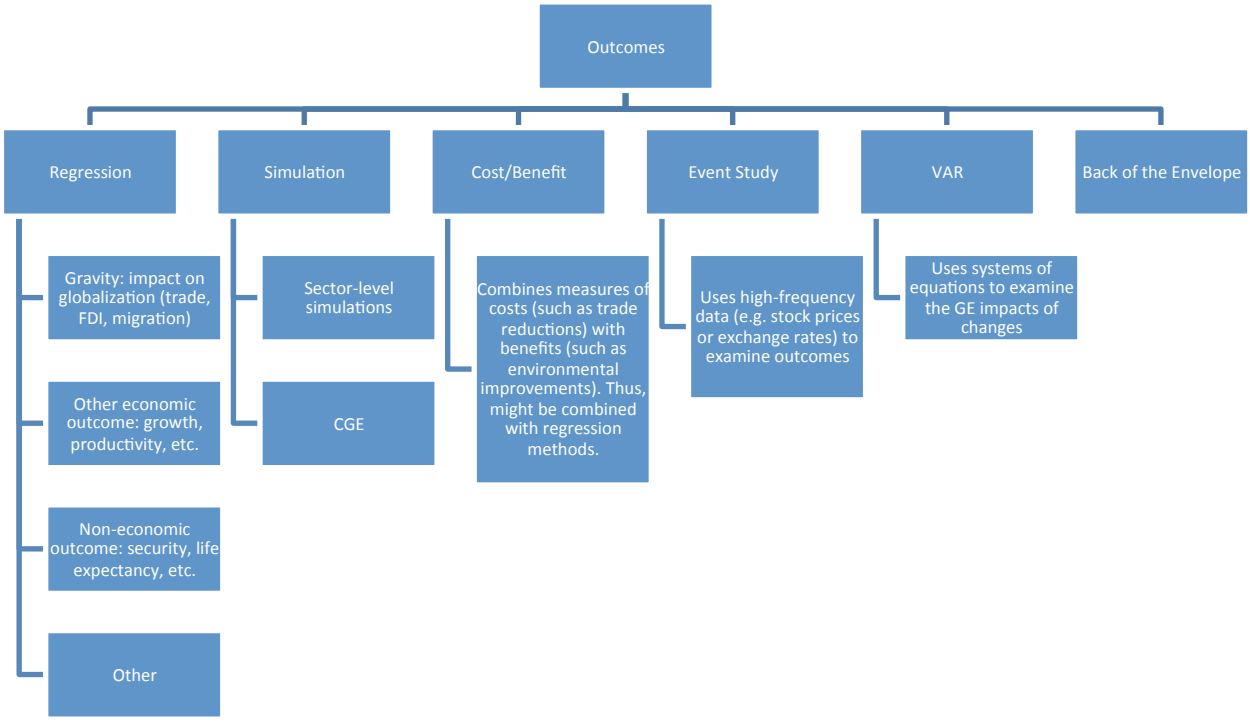

Figure 4: Methods for NTM Determinants Studies