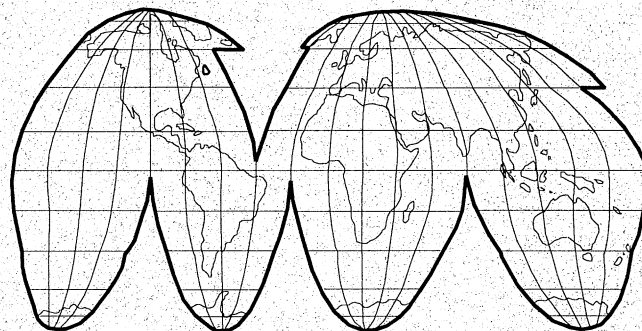# Understanding Technical Barriers to Agricultural Trade

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Sanitary and Phytosanitary Trade Barriers and Empirical Trade Modeling*

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Economists have been trying to deal with technical trade barriers in agriculture for decades (Hillman 1978). It is a difficult conceptual and empirical subject that will not be settled soon. Recently, trade policy economists have noted that appropriate treatment of technical barriers in trade policy modelling may be of growing importance. One standard argument is that, as other non-tariff barriers in agriculture are eliminated and as tariffs are reduced, the relative (and perhaps absolute) importance of technical barriers is increased (Josling 1994; Sumner 1995b).

Among the most important technical trade barriers are those relating to sanitary and phytosanitary [SPS] and food safety concerns. These were dealt with in several places in recent trade agreements. The agriculture provisions of the Uruguay Round trade agreements [URA] reduced the scope for non-tariff barriers and lowered tariffs. The provisions found in the Uruguay Round "Agreements on the Application of Sanitary and Phytosanitary Measures" and the "Agreement on Technical Barriers to Trade" require that import restrictions based on SPS claims be more consistent with science and that technical barriers in general be less arbitrary.

Analyses of SPS and other technical barriers have often been conducted as case studies. The procedure has been to examine the effects of specific SPS measures on particular markets (Forsyth and Lynch 1992). Some of these efforts have detailed descriptive content and can show how specific barriers operate and the forces behind their adoption (Roberts and Orden 1995). Other studies show the impact of relaxing or modifying trade rules.

However, most econometric and simulation models that deal with the relaxation of trade barriers have either ignored SPS and other technical barriers, or dealt with them in simplified ways. The standard approach is to assume that trade is either completely blocked by an SPS barrier, or that trade is unaffected (Tyers and Anderson 1992). For example, in the analysis of beef trade between foot and mouth free and foot and mouth endemic markets, the barrier is considered absolute and its effects are then analyzed in two (or more) distinct markets. For some commodities and some markets this approach may be acceptable, but simply assuming that SPS rules either have no effect or imply that there is no trade is clearly not always appropriate. Therefore a more detailed assessment of the treatment of technical barriers in empirical trade models seems warranted.

The purpose of this paper is to explore ways in which SPS and other technical trade barriers may affect (and be introduced into) empirical analysis of agricultural trade and trade

policy. In particular, we discuss some common types of SPS rules and how these may be represented in export supply and import demand functions. The perspective is that of empirical simulation models that incorporate trade policy components, and which need to account for SPS and other technical rules. We explore, in particular, how we might use our experience modeling other trade policies to model SPS barriers. To provide a context for the discussion, we focus on a specific region, North East Asia, and a set of related commodity markets. In particular, we use a model that focuses on supply and demand of rice and horticultural products.

Agricultural Trade with SPS and Other Barriers in North East Asia

The agricultural markets in North East Asia have been relatively open for wheat, most feed grains, oilseeds and cotton (USDA 1994). Beef trade has recently been opened and has expanded rapidly. Japan and South Korea, in particular, have long been major importers for these goods, relying on imports for a large share of their domestic use of agricultural products. Both countries are important to international agricultural trade and agricultural trade is important to these countries (Elleson and Dyck 1993; Lee, Jung-Hwan 1993).

The markets for rice and horticultural commodities have been much less open than the markets for grains, oilseeds and cotton. In Japan and South Korea, rice and many horticultural crops have been restricted by non-tariff barriers (WTO 1994; Lee, Jaeok 1993). These are commodities for which the URA is likely to be particularly important (Sumner 1995a).

Rice markets are special in several ways. First, rice by itself makes up a major share of cropland use and value of crop output for both Japan and South Korea. Second, rice remains a major component of the diet and, especially, of the total caloric intake of the population in these countries. Third, rice comprises a major share of total government agricultural support. Fourth, as a function of the previous three factors, rice imports remain subject to absolute import quotas (rather than tariff rate quotas) under the URA on agriculture (Japan Food Agency 1995; Kim 1993; Koo et al. 1992; Suh 1993; Tsujii 1993). Finally, even in the post-Uruguay Round world, rice remains special in the politics of North East Asia.

Markets for horticultural products also have special features. There are many distinct horticultural product markets, making aggregation troublesome. Products are not perfect substitutes or complements and relative prices are not constant so composite commodity theorems do not hold. Disaggregation is evident in the tariff schedules that these commodities face. For example, the URA schedule filed with the World Trade Organization [WTO] by the Republic of Korea has hundreds of lines, from number 0601 to 0910, where most of the horticultural products are listed, and another hundred or so lines from number 2001 to 2009, where processed horticultural products are listed. Each separate tariff line represents a product for which supplies, demands and policies may be considered separately and thus, modeled separately. Each of these tariff lines may also have a distinct SPS barrier.

As explicit trade barriers have been lowered in South Korea and Japan, technical trade barriers concerning standards, testing, labeling, and certification are most often cited as limiting trade. For example, rice shipments from California to Japan in 1995 incurred substantial costs in complying with import requirements. Some of these procedures seemed extreme: "The Food Agency, for example, has hired a laboratory in Portland, Ore. to test each 2,000-ton lot of rice for signs of 63 pesticides even though only six pesticides are allowed in rice production under California law" (Tirschwell 1995, p. 8A). Some of the required procedures, such as shipping rice in small bags rather than in bulk, allowed more convenient handling in the Japanese marketing system. Other procedures may have provided assurance to Japanese customers. However, given that imports are controlled by the Japanese government, there may have been an effort to raise the price of imported rice before it arrived in Japan so as to reduce adverse publicity from comparisons with domestic prices or to reduce the markups applied within Japan that are used to reduce the retail price differential between domestic and imported rice. Japan met its URA minimum access commitment on rice. It was, therefore, not using these technical import rules to reduce the import quantity, that quantity was fixed. Instead the import rules affected the import price.

For products other than rice, agricultural imports into these countries are now subject only to tariffs and tariff-rate quotas. But technical and administrative barriers remain. This is particularly true with horticultural crops. Included in the list of "problems" cited by the United States [US] are health and safety standards that deviate from international norms and that are drafted so that they apply only to imports. For example, the imports of horticultural products into South Korea were reported by the US Trade Representative to be subject to a number of restrictive and unjustified SPS regulations (USTR 1995). These regulations were questioned relative to excessive inspection or fumigation which added to costs and delayed import delivery.[1]

A Simple Model with Trade and Trade Policies

A simple equilibrium displacement model may be used to consider the effects of trade policy and other economic changes in agriculture. The model is used to represent crop agriculture in a country that is an importer and not an exporter. In this framework we will discuss import demands and not focus on the behavior of the exporters. The model describes the supply and demand conditions for agricultural inputs and outputs.[2]

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[1]Recently, South Korea announced changes in customs policy which should expedite the customs process for imported products. The new procedures involve only sampling the imported products and inspecting the samples after the products have left the customs area. The period from sampling to inspection is designed to take only three days and therefore, in the case of a problem, the products may be recalled before they reach retailers. How well this policy will be implemented is not yet certain.

[2]See Sumner 1995c; Anderson 1989; and Anderson and Warr 1987.

a) $D_i = D^i(p_1,..,p_k;z)$ for i = 1,...,k; where D_i is total domestic demand for good i, p_i is the price of good i, and z is a vector of exogenous variables.

b) $p_i = \partial C^i(w_1,...,w_n,y_i)/\partial y_i$ price = marginal cost of y_i, for i=1,...,k; where y_i is the domestic production of good i, $C^i(.)$ is the cost function for y_i, and w_f is the price of input f where f = 1,...,n.

c) $x^i_f = \partial C^i(.)/\partial w_f$ derived demand for input f in industry i, for i=1,...,k, and f=1,...,n; where x^i_f is the quantity of input f used in the production of good i.

d) $x_f = \sum_i x^i_f$ total demand for input f, f=1,...,n.

e) $x_f = g^f(w_f)$ supply of input f, f=1,...,n.

We will leave aside domestic farm subsidies. Trade and trade policy may be introduced into the model by setting the product market equilibrium as:

f) $D_i = y_i + q_i + m_i$ equilibrium condition for output i market, for i=1,...,k; where q_i is the quantity of imports of good i subject to an absolute import quota (or tariff rate quota for the range over which the low or zero tariff applies) and m_i represents the imports of good i subject to tariffs.

In general,

g) $m_i = m(p_{mi})$ supply function for imports of good i for i = 1,...,k; where p_{mi} is the importer's price, which is usually the domestic price minus the specific tariff, τ_i, ($p_{mi} = p_i - \tau_i$), of course ad valorem tariffs are only slightly different.

The model treats imports and home-produced goods as identical. An alternative is to treat them as non-homogeneous. In that specification prices of import goods may be introduced in equation set (a) as (less than perfect) substitutes for the home-produced good.

The demand for each good depends on the prices of other goods as well as its own price. This demand equation may include variables exogenous to the model, including (in the small country case) prices of imported goods. The demand curves may also be affected by S&P and other technical rules affecting the market. Equation set (b), the cost-minimizing conditions for domestic production of good i, yields the supply response function for each produced good i. (There are no explicit supply functions for domestic goods specified.) With n inputs for each commodity, there are k×n derived input demand equations. Equation set (f) describes a market equilibria under which total demands for goods equals the sum of domestic production, the import quota-quantities, and imports that are limited by tariffs. Trade and trade policy enter the model here for goods that are homogeneous so that imports and home-produced goods are perfect substitutes. SPS barriers and other trade rules affect this equation. Equation set (g) represents the supply functions for imports into the market. Import supplies are potentially upward sloping functions of the net price received. An upward sloping supply curve is used when any conditions cause the net price received to be

a function of the quantity imported. These conditions may include regulations and import barriers.

For simplicity the cost function has the following form for all i:

$$C^i(w_1,...,w_n,y_i) = c^i(w_1,...,w_n)h(y_i),$$

where $C^i(.)$ is a well-defined cost function with the usual properties, implying that function $c^i(.)$ is non-decreasing, concave, and linearly homogeneous in input prices, and $h(y)$ is increasing in y. The underlying technology for the above cost function is homothetic.

The Model in Log Differential Form: An Example

To provide specificity, we illustrate the case of crop agriculture in an importing nation with four outputs and three inputs. We used the model to simulate the following policy scenario:

o The minimum access of rice is increased from zero to a percentage of the no-import consumption level of rice.
o Initially, imported horticultural crops are subject to an ad valorem tariff. The policy shock is a tariff reduction. Imported and home-produced goods are perfect substitutes. The domestic price equals the import price plus the tariff.
o For other tradable crops, there already exists a large market share of imported crops with a open border. The country has no market power in the international market. Thus, there is no change in the import price and thus the domestic price.

Totally differentiating the equations in the basic model and rewriting in elasticity terms yields the following system of equations. Carets denote the proportional changes; r, h, t, and n index rice, horticultural crops, other tradable crops and non-tradable crops; and three inputs (land, labor, and purchased inputs) are indexed by 1, 2, and 3.

1.1) $\hat{y}_r + dq_r/D_r = \sum_j \eta_{rj} \hat{p}_j$,   j=r,h,t,n
1.2) $(s_h) \hat{y}_h + (1-s_h)\hat{m}_h = \sum_j \eta_{hj} \hat{p}_j$
1.3) $(s_t) \hat{y}_t + (1-s_t)\hat{m}_t = \sum_j \eta_{tj} \hat{p}_j$
1.4) $\hat{y}_n = \sum_j \eta_{nj} \hat{p}_j$

2) $\hat{p}_j = \sum_f \gamma^j_f \hat{w}_f + \rho_i \hat{y}_i$,   f=1,2,3, $\forall j$ (=r,h,t,n)

3.1) $\hat{x}^j_1 = - (\gamma^j_1 \sigma^j_{21} + \gamma^j_1 \sigma^j_{31}) \hat{w}_1 + \gamma^j_1 \sigma^j_{21} \hat{w}_2 + \gamma^j_1 \sigma^j_{31} \hat{w}_3 + \hat{y}_j$, $\forall j$ (=r,h,t,n)
3.2) $\hat{x}^j_2 = - (\gamma^j_1 \sigma^j_{21} + \gamma^j_2 \sigma^j_{32}) \hat{w}_2 + \gamma^j_1 \sigma^j_{21} \hat{w}_1 + \gamma^j_2 \sigma^j_{32} \hat{w}_3 + \hat{y}_j$, $\forall j$ (=r,h,t,n)
3.3) $\hat{x}^j_3 = - (\gamma^j_1 \sigma^j_{31} + \gamma^j_2 \sigma^j_{32}) \hat{w}_3 + \gamma^j_1 \sigma^j_{31} \hat{w}_1 + \gamma^j_2 \sigma^j_{32} \hat{w}_2 + \hat{y}_j$, $\forall j$ (=r,h,t,n)

4) $\hat{w}_f = (1/\epsilon_f) \sum_j \lambda^j_f \hat{x}^j_f$,   j=r,h,t ,n, $\forall f$ (=1,2,3)

5) $\hat{m}_h = \omega \hat{p}_{mh}$

where new parameters are:

η_{ij}:　　　Demand elasticity of output i with respect to the price of output j

s_h:　　　Market share of domestic production in the horticultural market

s_t:　　　Market share of domestic production in the market for tradable crops

γ^j_f:　　　Cost share of input f in production of output j　$(\sum_f \gamma^j_f = 1)$

ρ_i :　　　Elasticity of marginal cost with respect to output

σ^j_{fg}:　　　Allen elasticity of input substitution between inputs f and g in output j industry

λ^j_f:　　　Share of input f used in output j industry　$(\sum_j \lambda^j_f = 1)$

ϵ_f:　　　Supply elasticity of input f

ω:　　　Import supply elasticity of horticultural products with respect to the price received by importer, where $p_{mh} = p_h/(1+\tau_h)$.

The system consists of 24 equations including four output demand equations (1.1-1.4), four output supply equations (2), twelve input demand equations (3.1-3.3), three input supply equations (4) and one import supply equation for horticultural goods (5). With the predetermined price of other tradeable crops, we solve for 24 variables which represent percentage changes associated with:

y_i, i = r, h, t, n
m_i, i = h, t
p_i, i = r, h, n
x^i_f, i = r, h, t, n and f = 1, 2, 3
w_f, f=1, 2, 3.

Imports enter the model in four places. In equation 1.1, rice imports and import policy are captured by the policy variable dq_r/D_r. Horticultural imports enter in both the supply demand equilibrium equation 1.2 and in the import supply equation 5, with policy variable τ_h implicit in 5. Finally, imports of other tradable crops are included in 1.3, but, for simplicity, there is no associated tariff or quota. SPS restrictions would most naturally enter the model in equation 5, but, as we will see, they have the potential to affect the model in a number of other ways.

Simulation of the empirical model requires data on, estimates of, or assumptions about: base period prices, quantities, input-use shares across industries, cost shares of inputs within industries, marginal cost elasticities, elasticities of input substitution, supply elasticities of inputs, demand elasticities of outputs, and the import supply elasticity for horticultural crops. Simulation results provide projected impacts of trade or other policy changes. The model may be easily modified to: a) include more products, b) allow for imports and domestic production to be other than perfect substitutes in demand, and c) trace the effects back to specific import suppliers.

Specification of SPS and Other Technical Rules in an Empirical Trade Policy Model

Technical trade regulations, including SPS barriers may affect commodity supply and demand in a number of ways. The effects listed below may occur individually or together depending on the nature of the regulations.

The simplest of SPS trade barriers is an import ban. One may consider the cross-commodity implications of relaxing an import ban by treating the restriction as an absolute import quota and showing the implications of allowing trade and removing the zero quota. In the formulation above, equation 1.1 would be used to represent the severe quantitative import restriction that was then relaxed as the SPS rules were liberalized.

Regulations that are not complete import bans, often require extra services, processing, delays, or other responses that increase the cost of the export commodity. Some of these costs may be incurred in the export country before shipment, others may occur in the import country before the commodity clears the port. Sometimes these costs may be modeled as a simple addition to the per unit costs. In this case, equation (g) can be written as a function of $p_{mi} = p_i - \tau_i - \tau_{reg}$, where τ_{reg} is the per unit cost incurred to meet the regulations. Sometimes costs may be a function of the unit value of the commodity and in this case they may enter a trade model like an ad valorem tariff. Equation 5 in the log linear specification would then include an ad valorem term, τ_{reg}.

Consider a technical trade barrier that requires certification and additional inspection of shipments before they leave the exporting country. The imposition of new technical trade rules causes the marginal cost of shipping to a specific market to shift up. In the case of a small country importer, the price facing the import market simply shifts up by the full amount of the added costs. This effect is analogous to a specific tariff as long as the added costs are constant per unit. Thus, in our simple model, a term τ_{reg} may be added to reflect costs imposed by the regulation. If the new import rules create costs that add a percentage on the price, the effects would be analogous to an ad valorem tariff.

Whether costs imposed by SPS or other technical trade rules are science-based or consistent with international standards (as required by the Uruguay Round "Agreements on the Application of Sanitary and Phytosanitary Measures" and the "Agreement on Technical Barriers to Trade") is relevant only to some questions and under certain circumstances. For example, if the rules are arbitrary they may be more likely to be modified in the future and this can affect the analysis if we allow for dynamics and perhaps uncertainty related to regulatory change.

Consider an example in which Japan requires added fumigation of cherries beyond what is required for any other market, and this fumigation is not a reflection of consumer demand in Japan (say because it is related to phytosanitary not human health considerations). The fumigation adds to costs and has effects similar to an import duty whether the rule has any scientific basis or not. In this case, if the rule has no scientific basis it raises the import price to Japan, and provides neither tariff revenue nor added plant health in Japan. A scientific basis for the rule, say to provide border control on crop pests, means that local benefits to

agriculture in Japan would offset (some or all of) the welfare costs imposed on Japanese consumers and exporting producers. With phytosanitary rules, in some cases we may want to consider the effects of the rule and compliance on the production function for crops in the importing country. Legitimate phytosanitary barriers may affect the parameters such as γ^j_f, ρ_i and σ^j_{fg} that determine domestic costs of production. Looser rules mean higher expected cost of production and less domestic supply. One indication of the illegitimacy of phytosanitary rules may be that, if domestic expected costs do not rise perceptively when they are loosened, then the rules were tighter than could be justified.

Technical barriers may themselves become more severe as the quantity of imports increases. In this case, the (barrier inclusive) unit cost of the import commodity is an upward sloping function of the quantity imported. Such increasing tightness of regulations may be a function of political pressure by the domestic industry of the importing country. Tighter controls, more vigorous enforcement, delays in processing, and similar responses may occur when imports increase. Such increasing tightness of regulations may be built into the import system. For example, if the number of import inspectors is constant and they process only a fixed quantity of imports each day, the delay to enter the market intensifies as the quantity attempting to enter rises. This case may be quite common. For example, delays at the South Korean port of entry for fruits likely depend directly on the quantity being imported. Note however, if inspectors or other import officials cover a variety of products, delays may depend on the total import volume and not the quantity of any one commodity. Thus, cost of import may not be a function of individual commodity imports for those products that are a small share of imports of a particular type. This distinction is not modeled above because all horticultural products are treated as a single aggregate.

To model this effect the supply function of imports shifts up and becomes more inelastic as a function of the way regulations are imposed or enforced. If we consider the cost of regulation as a tariff equivalent $\tau_{h,reg}(m_h)$, where $\partial(\tau_{h,reg})/\partial(m_h) > 0$, the parameter ω in equation 5 would become smaller with the imposition of rules that raised per unit import costs at an increasing rate as the amount of imports increased.

Regulations may also affect the demand function for the imports. Food safety, labeling rules, and other regulations affect the way the imported commodity is perceived in the importing country market. In the simplest instance, the demand curve for imports may simply shift out or shift back when regulations are met. In one limiting case imports and domestic goods may be considered perfect substitutes, with a fixed quality differential that is affected by regulations. In general however, a model recognizing heterogeneity between imports and the home-good may include separate demand functions for each.

For example, rice consumers in Japan may be more willing to consume California rice if it has been certified by the Japanese government as having met a series of severe regulations. In this case, we may model imported rice and home-produced rice as less than perfect substitutes, so that the price of imported rice separately enters the demand function in equation 1.1. The four good model would need to be elaborated to include imported rice as a separate good and equation 1.1 would leave imports out of the supply side. The price of imported rice would be included on the demand sides of equations 1.1, 1.2 and 1.3. A

separate demand function for imported rice would be added to the model, and regulations that were perceived as improving the quality of California rice would be modeled as a demand intercept shifter.

Technical import rules may also affect the cross-elasticity of demand between imports and home-produced goods. Import rules may cause home-produced goods and imports to be perceived as more or less substitutable. That is, regulations may raise or lower the cross-elasticity of demand. Import regulations on California rice shipments to Japan could raise or lower the η_{ij} between domestic rice and imports in equations like 1.1. In the limiting case of making goods more substitutable, trade regulations that convinced consumers that the imported product really met all the same standards of the local product could cause the home-produced and imported goods to be perceived as homogeneous. Alternatively, labeling regulations, such as those undertaken in Japan for fruits and vegetables, may cause goods that were previously considered perfect substitutes to become distinct goods in the minds of consumers. The point here is that SPS regulations may not simply shift import supply curves and it is reasonable to also allow demand parameters to be functions of the import regulations.

Finally let us consider some impacts of SPS regulations that are less conveniently incorporated in the model developed above.

The specified model focuses on the import market and the effects of regulations on agriculture in the importing country. Imported goods are treated as homogeneous independent of the national origin. But, import regulations may affect the relative costs among export suppliers and thus favor some suppliers over others. Higher costs of meeting regulations are similar to differential shipping costs to particular markets, and may change the spatial distribution of trade and comparative advantage across commodities. For example, Japan's regulations on imported rice may favor imports from California and Australia relative to imports from China or Vietnam. The model above does not examine the export countries individually and would need to be developed further to consider alternative export suppliers.

Technical trade regulations may create sub-markets in which the importing country is a large share of the relevant market. Although Japan may be a relatively small part of the world rice market, it may be a significant share of the japonica-type rice market, and an even larger share of the market for high-quality japonica rice that can meet tight SPS rules. This example suggests that a country may be a "small country" in an overall market, but behave as a "large country" in a sub-market differentiated by SPS or other trade rules. Importer market power may be created by import regulations and this has implications for optimal import tariffs and other trade policy as well as implications for trade policy modeling.

Regulations may also limit the number of available suppliers who meet the import specifications for a particular market. If the regulations impose differential costs, only a few of the potential suppliers may find it feasible to enter the market. Trade rules that effectively limit the number of sellers may create market power on the part of exporters. If imports are a large share of the domestic market or if home-produced goods and imports are considered distinct goods, exporters may face downward sloping demand functions. These exporters may exploit market power created by the trade barriers that raise their costs but keep out

other potential suppliers. The implication for trade policy modeling is, again, that imperfect competition may be a function of the technical barriers, whether or not they are within the international standards of the WTO.

Measurement of Trade with SPS and Other Technical Import Regulations

If the costs imposed by regulations do not depend on where the regulation is enforced, then where the regulations is imposed may not affect import quantities or prices in the importing country. However, real resources are used in the process of meeting import standards and new rules affect the demand for services to meet these rules. Therefore, whether costs are imposed prior to shipment or at the point of entry matters to determining the ultimate cost and benefits to the industries providing marketing services.

Where rules are imposed may also affect total expected costs of complying with regulations. Inspection at the port of entry, after shipping costs are incurred, have higher expected costs than inspections at the point of export because it is often costly to divert the shipment to another market.

Where costs are imposed is also relevant to the data on international trade in commodities and thus may affect econometric work and the interpretation of data on export revenue. When import rules cause costs to be incurred within the export country, then export prices will reflect these costs (Tirschwell 1995). Data on export revenue will be different if costs are imposed before shipping, rather than after shipping, even though the quantity impact is the same and the import price is unaffected. For example, Japanese regulations and specifications have added more than $100 per ton to the price of rice exported to Japan from California. Thus export value (for 200,000 tons) is at least $20 million higher than if those same costs would have been added at the port of entry instead.

Complications also arise in econometric modeling. For example, when costs are reflected in the export price we observe the effects of a new regulation as a movement along the demand for export function. If those same costs are imposed in the importing country we will observe a reduced quantity shipped without the associated export price increase. In this case the appropriate price data would be from the importer not the exporter. Econometric specifications that do not account for where the costs are imposed may be using price data that do not correspond to prices actually paid by the buyers.

Conclusions

Incorporation of SPS and other technical barriers into empirical trade models remains a challenge. Trade regulations may raise the cost of exporting to a particular market, cause the supply function to shift up, and lower the quantity shipped. They may also shift import demand functions in complicated ways. But, as the discussion above has made clear, each case needs to be considered carefully. The focus of a model, for example, whether one is focusing on the importing country or a specific exporting country, also determines which

features and impacts of the trade regulations are most important. For example, it may not matter to importers or to overall trade flows if regulations impose differential costs on exporters, but that certainly matters to individual exporters.

SPS and other technical barriers may also change the nature of the appropriate model more fundamentally. For example, these regulations may create homogeneous goods from goods that were previously distinct. Or they may create or facilitate product differentiation. Particular types of barriers may cause a small country assumption to no longer be appropriate for an import market or for an exporting country. Barriers may also create market power on the part of individual firms. None of these issues have been dealt with adequately here, but they have been raised and some tentative suggestions have been offered.

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