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Source: *The Journal of Legal Studies*, Vol. 40, No. 1 (January 2011), pp. 149-203
Published by: The University of Chicago Press for The University of Chicago Law School
Stable URL: http://www.jstor.org/stable/10.1086/658402
Accessed: 28/09/2011 12:58

International Trade, National Treatment, and Domestic Regulation

Robert W. Staiger and Alan O. Sykes

Existing formal models of the relationship between trade policy and regulatory policy suggest the potential for a regulatory race to the bottom. World Trade Organization (WTO) rules and disputes, however, center on complaints about excessively stringent regulations. This paper bridges the gap between the existing formal literature and the actual pattern of rules and disputes. Employing the terms-of-trade framework for the modeling of trade agreements, we show how "large" nations may have an incentive to impose discriminatory product standards against imported goods once border instruments are constrained and how inefficiently stringent standards may emerge under certain circumstances even if regulatory discrimination is prohibited. We then assess the WTO legal framework in light of our results, arguing that it does a reasonably thorough job of policing regulatory discrimination, but that it does relatively little to address excessive nondiscriminatory regulations.

1. INTRODUCTION

Existing formal models of the relationship between trade policy and domestic regulatory policy suggest the potential for a regulatory race to the bottom (for example, Markusen 1975; Copeland 1990; Ederington

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[*Journal of Legal Studies*, vol. 40 (January 2011)]

2001; Bagwell and Staiger 2002, chap. 9). When nations constrain their tariffs through trade agreements, they in effect promise a certain degree of market access to trading partners. A subsequent relaxation of regulatory standards that apply to import-competing industries (labor and environmental standards, for example) can undermine these market access commitments. In particular, if "large" nations relax such regulations, foreign suppliers who export to these markets may lower their prices to remain competitive with domestic producers, and some of the costs of the weakening of domestic regulations are thereby shifted abroad through these foreign-exporter price ("terms of trade") movements. Such models provide a formal basis for concern that large nations may weaken their regulatory standards to inefficiently low levels when they have constrained their trade policies as a result of tariff negotiations.[1]

The existing race-to-the-bottom models highlight an important potential concern for the world trading system, but they have limited purchase when it comes to explaining the specific obligations that have been negotiated in the World Trade Organization (WTO) system with respect to national regulatory policies and the actual disputes that have arisen over such policies. In particular, the legal obligations that explicitly address national regulatory policies—embodied in the General Agreement on Tariffs and Trade (GATT) Article III "national treatment" (nondiscrimination) principle, the WTO Agreement on Technical Barriers to Trade (TBT), and the WTO Agreement on Sanitary and Phytosanitary Measures (SPS)—do not place legal constraints on nations that wish to lower domestic regulatory standards or otherwise underregulate their domestic industries relative to some efficient regulatory ideal. Rather, these legal obligations restrict the ability of member governments to impose regulations on foreign suppliers.[2] Likewise, virtually all of the

1. Ederington (2009) surveys the recent body of empirical research that lends some support to the concerns emphasized by these models. Aspects of the North American Free Trade Agreement (NAFTA) side agreements on labor and the environment also lend some support, as they encourage NAFTA members to maintain high standards and require them to enforce their labor and environmental regulations.

2. Of course, the trade implications of underregulating domestic firms can be quite similar to the trade implications of overregulating foreign suppliers, and in this sense a degree of symmetry exists between the two phenomena. The key point for our purposes is that the specific obligations in WTO law to which we refer in the text do not prevent nations from relaxing their domestic regulations as they wish as long as they do not concurrently attempt to impose more stringent obligations on foreign suppliers. Likewise, as we next discuss in the text and describe further in note 3, the bulk of WTO disputes reflect cases in which foreign suppliers complain about regulations that apply to their own products, rather than about a relaxation of the regulations applicable to import-competing firms.

pertinent disputes in the WTO system regarding national regulations, such as the *EC—Hormones* dispute (WT/DS26 and DS39; EC prohibition on domestic production and importation of hormone-raised beef) and the *EC—Asbestos* dispute (WT/SDS135; French prohibition on domestic production and importation of asbestos-containing products), involve complaints about excessive regulation by importing nations.[3]

This paper seeks to bridge the gap between the existing economics literature on trade and domestic regulatory policy and the explicit WTO obligations and pattern of actual WTO disputes. To this end, we develop a formal economic analysis that is capable of accounting for the basic features of the actual WTO disputes highlighted above. We then apply the results of this analysis to interpret and evaluate the relevant WTO obligations.

The analysis adapts and extends the general insights of Bagwell and Staiger (2001) to a setting that can more readily be applied to the kinds of regulatory standards that are typically the subject of WTO disputes.[4]

3. Other disputes involving allegations of excessive or inappropriate regulation on imported products include *EC—Sardines*, WT/DS231 (EC prohibition on labeling of certain species of fish as "sardines"); *Korea—Bovine Meat and Meat Products*, WT/DS391 (Canadian challenge to Korean beef import restrictions imposed to prevent mad cow disease); *Japan—Apples*, WT/DS245, and *Australia—Apples*, WT/DS367 (both involving restrictions on apple imports to prevent the spread of harmful organisms); *Australia—Salmon*, WT/DS18 (prohibition on salmon imports from Canada); *United States—Shrimp*, WT/DS58 and DS61 (U.S. prohibition on shrimp imports from countries not certified to harvest in a manner that protects sea turtles); *Brazil—Retreaded Tyres*, WT/DS332 (ban on imports of retreaded tires for environmental reasons with exception for Mercosur trading partners); *EC—Approval and Marketing of Biotech Products*, WT/DS291, DS292, and DS293 (EC restrictions on imports of genetically modified organisms); *Mexico—Black Beans*, WT/DS284 (Mexican restrictions on black bean imports); *Australia—Quarantine Regime*, WT/DS287 (Australian limits on agricultural imports including pork and poultry); and *EC—Seal Products* WT/DS400 and DS401 (EC prohibition on imports of seal products). This list is not exhaustive. During the GATT era, the most prominent dispute along these lines was the *Tuna-Dolphin* case, involving a U.S. prohibition on imports of tuna from countries that were not certified as fishing in a dolphin-safe manner. The one WTO dispute that might be viewed as involving a complaint about a relaxation of the regulations applicable to import-competing firms is *Japan—Film*, WT/DS44, in which it was alleged that lax antitrust enforcement facilitated exclusive dealing arrangements that disadvantaged imports. We discuss this case a bit further in Section 4.2 below.

4. The existing models do suggest that governments may have an incentive to raise some standards above efficient levels, but this incentive would typically arise in export sectors. What is not well represented in the existing formal literature is the incentive to raise standards to inefficiently high levels in import-competing sectors, which as we have noted seems to be the type of complaint that is most prevalent in actual WTO disputes. Of course, observed or actual disputes may themselves represent only the tip of the iceberg when it comes to understanding the scope of government incentives that are kept in check by existing WTO obligations, since much of the enforcement of WTO commitments may be

In particular, in contrast to the industrial regulatory standards at issue in race-to-the-bottom models, our focus is on product standards. We use a simple two-country model with one-way trade to explore the problem faced by the government of the importing nation that must choose trade policy as well as domestic tax and regulatory policy with respect to a product that is both domestically produced and imported, and whose domestic consumption generates a negative externality ("pollution") that is costly in terms of domestic utility (but does not cross international borders). A higher standard reduces the pollution generated when the product to which the standard applies is consumed, but the cost of compliance with a higher standard is also higher. We explore the government's problem under different legal regimes, with and without legal constraints on discrimination against imports. The model allows us to isolate the pure international cost-shifting incentive that drives the race-to-the-bottom results of the existing literature, and we establish that this same incentive can create a tendency for governments to impose excessive regulatory standards on imported goods after the tariffs on those goods are constrained by a trade agreement.

We proceed in several stages. We first derive the jointly efficient policies for the two countries. We then show that, in the absence of a trade agreement when policy choices are made in noncooperative (Nash) fashion, only tariffs (and the exporting nation's export tax) are distorted from the efficient level: domestic tax and regulatory policies are set efficiently. This finding flows from the fact that terms-of-trade manipulation is the only motive for inefficient policy choices in the model, and the tariff is the first-best policy instrument for manipulating the terms of trade (that is, for inducing foreigners to bear part of the cost of domestic intervention by accepting lower foreign exporter prices). Because the noncooperative tariff is distorted (upward) from its efficient level, however, a trade agreement is useful to lower the tariff and enhance trade volumes. But the emergence of restrictions on tariffs raises the possibility of distortions in the choice of domestic regulatory and tax policies.

We show that absent a nondiscrimination (national treatment) rule applied to domestic consumption taxes, tariff commitments could be completely undone by the introduction of consumption taxes that discriminate against foreign products. The model thus affords an easy ex-

accomplished through "off-equilibrium" threats and therefore not manifested in observed disputes (see, for example, Bagwell and Staiger 2002, chap. 6).

planation for the national treatment obligation applicable to taxation in GATT Article III(2).

We next show that a commitment to lower tariffs that is accompanied by a national treatment clause that applies only to domestic consumption taxes also fails to achieve internationally efficient policies. The constraint on discriminatory consumption taxes causes product standards on domestically produced goods to become inefficiently lax and leads to higher (discriminatory) standards on imports. The standard on imports will in general be set at an inefficient level, as will the level of the (nondiscriminatory) consumption tax. Intuitively, when tariffs are constrained, other policy instruments become attractive as tools for terms-of-trade manipulation that shift costs onto foreign exporters. The consumption tax can be used for this purpose to some extent, but it is an imperfect substitute for the tariff because it applies to both domestic and imported goods. The importing nation will then further exploit its power to reduce foreign exporter prices by engaging in a form of regulatory cost shifting—raising the standard applied to foreign imports while reducing the standard applied to domestically produced goods. This allows the importing nation to attain the same overall level of pollution at a lower domestic cost, because foreign producers will absorb some of the cost of pollution abatement in order to remain competitive in the domestic market. Our model thus offers an explanation for the national treatment obligation in GATT Article III(4), which prohibits discrimination in "laws, regulations, and requirements" affecting the internal sale of like domestic and foreign goods.

We then consider how the importing nation will behave under this broader national treatment obligation and ask, Will a tariff agreement that includes the broad nondiscrimination rule allow governments to reach internationally efficient policies? Again we show that the answer is no, because governments have an incentive to distort their consumption taxes to inefficiently high levels even if these taxes cannot be set in a discriminatory fashion. Furthermore, and of special interest given our focus on the potential for excessive regulation, importing nations have an incentive to impose inefficiently stringent nondiscriminatory product standards in settings where product-specific consumption taxes are administratively infeasible, a situation that we suspect is quite common in practice.

Our economic analysis thus leads to the following broad conclusion. To achieve a first best outcome on all policy margins, trade agreements must not only constrain tariffs and include rules that prevent the use of

discriminatory domestic tax and regulatory policies, but must also prevent governments from setting excessively high nondiscriminatory taxes and regulatory product standards when some of the costs of these policies can be shifted onto foreign exporters.

The key regulatory cost-shifting mechanism that drives this conclusion can be illustrated using stylized facts from the beef-hormones case as an example.[5] We can think of beef as the product in our model, and let us suppose that it is freely traded as a result of negotiated tariff commitments and produced worldwide according to an increasing-cost technology that reflects the diminishing quality of pastureland that must be employed on the margin as the quantity of beef production is increased, generating a supply curve of beef that is upward sloping. The regulation concerns the intensity with which cows are treated with hormones as part of the production process: we can think of increases in hormone treatment as leading to increases in the amount of beef production per acre of pastureland and hence as leading to outward shifts in the supply curve of beef. Assuming that individual consumers are unaware of or unconcerned about any health risks associated with hormone-treated beef, if the beef industry is unregulated worldwide then there will be an optimal level of hormone treatment that minimizes the cost of beef production, and let us assume that this level is independent of total production.

Now consider the possibility that the home (beef-importing) country imposes a nondiscriminatory regulation amounting to a total ban on the domestic production and importation of hormone-treated beef. This regulation will not affect the position of the home demand curve for beef (since by assumption consumers are not sensitive to the hormone content of the beef they consume). But to satisfy this demand, producers must now shift to the production of (higher-cost) hormone-free beef. Foreign exporters will be willing to make this shift in a competitive market as long as the equilibrium price of hormone-free beef sold to the home country is just high enough relative to the price of hormone-treated beef to cover the additional marginal production cost. Note, however, that if the world price of hormone-treated beef falls as a result of the home-country regulation, the price of hormone-free beef exported to the home market in equilibrium—which is the price of hormone-treated beef plus

5. An important WTO Appellate Body opinion in this long-running dispute is *EC Measures Concerning Meat and Meat Products (Hormones)*, WT/DS26 and DS48/AB/R, report adopted February 13, 1998.

the cost of regulatory compliance—will rise by less than the cost of regulatory compliance; the home country will then enjoy whatever benefits flow from compliance with the regulation, but will have externalized some of its cost. Assuming the home country is "large" in economic terms (as in our model), the home-country regulatory ban on hormone-treated beef does indeed result in a fall in its world price, and so the price of hormone-free beef exported to the home market does not rise by the full cost of compliance. This is the regulatory cost-shifting mechanism that is at the heart of our paper.

Although the focus of our paper is on international cost shifting and its implications for multilateral trade agreements, we note in passing that the implications of our analysis are broader. Anytime a large jurisdiction (lacking the freedom to set tariffs) is allowed to set its regulatory policy unilaterally without regard to the harm that it may do to sellers outside the jurisdiction, the general set of issues we address is in play. Thus, the possibility of significant cost shifting may arise when California sets environmental standards that product manufacturers in other states must meet in order to serve the California market. Likewise, Germany's regulatory policies may impose significant costs on manufacturers in other EU members if they must comply with the German standards. Hence, the concerns we identify here may have implications for U.S. federal law, EU law, and other federal or regional legal systems as well.

With our economic analysis developed, we next consider its implications for understanding the structure of WTO obligations and disputes. As noted, the analysis offers an immediate explanation for the national treatment obligations of GATT and can also illuminate the further strengthening of these obligations embodied in the WTO SPS and TBT agreements. The harder question is whether WTO law does enough to address the possibility of inefficient nondiscriminatory tax and regulatory policies. With regard to domestic consumption taxes in particular, the WTO imposes no explicit restrictions on nondiscriminatory taxation. On the regulatory front, we evaluate the requirements in the TBT and SPS agreements concerning the use of international standards, the need for scientific evidence to support certain regulatory measures, the possibility of "mutual recognition," and the need for regulatory "consistency." We conclude that these requirements either cannot or at least have not in practice done much to address the problem of excessive nondiscriminatory regulation. Likewise, as currently interpreted, GATT's "nonviolation" doctrine is also probably ineffective at providing discipline.

We are agnostic on whether this state of affairs presents a serious problem. One possibility is that the problem of cost shifting through nondiscriminatory tax and regulatory policies is simply unimportant as an empirical matter. Regarding this point, however, it is interesting to note that Broda, Limao, and Weinstein (2008) report evidence that after GATT/WTO tariff commitments agreed to by the United States constrained its ability to use tariffs for the purpose of terms-of-trade manipulation, the United States then set significantly higher nontariff barriers in import-competing sectors where it has greater ability to affect foreign exporter prices. The measures of nontariff barriers employed by Broda, Limao, and Weinstein reflect a broader set of policies than simply the domestic regulatory policies that we have in mind here (for example, they include voluntary export price restraints), but these measures do include domestic product standards and other technical regulations; and so the evidence reported by Broda, Limao, and Weinstein is suggestive of the pattern one would expect based on our model.

It is also possible that cost shifting through nondiscriminatory tax and regulatory policies represents an empirically significant problem, but the task of crafting acceptable legal rules to ferret out excessive nondiscriminatory policies may be too difficult. It is perhaps hard to know in practice when cost shifting may have led to significant distortion in regulatory policy, and legal rules that open the door to an inquiry about that issue might be perceived to intrude too much on matters of national sovereignty. In short, perhaps the WTO membership would find the cure worse than the disease.

2. ECONOMIC ANALYSIS: NONCOOPERATIVE AND EFFICIENT POLICIES

Before delving into the formal economic analysis, we first briefly survey the related literature. Our paper is related to a number of papers that explore the logic of the national treatment principle. This is the subject of recent formal analysis by Horn (2006) and Horn, Maggi, and Staiger (2010), but the focus in those papers is on domestic taxes rather than regulatory standards. Costinot (2008) provides a formal analysis of the national treatment clause as applied to regulatory standards, but the focus of his paper (comparing the national treatment clause of the GATT/WTO to the mutual recognition rules of the European Union) is quite different from that of our paper. Gulati and Roy (2008) also consider the role of national treatment in the presence of regulatory standard setting, and some of our results parallel their findings; but they focus

on the small open economy case, and as a result the emphasis of the two papers is quite different. Finally, Hoekman and Trachtman (2010) provide a discussion that echoes a number of the broad themes that we develop here, but that paper does not contain any formal analysis.

In some ways, our focus is closest to that of Battigalli and Maggi (2003). Battigalli and Maggi also focus on the treatment of product standards in trade agreements and, like us, develop a possible role for a national treatment rule. But again the two papers emphasize different things. Battigalli and Maggi abstract from tariffs and consumption taxes to focus on standards, and they adopt an incomplete contracts perspective in which standards for existing products can be and are contracted over, but standards for future potential products cannot be contracted over ex ante. They then show how a national treatment rule in combination with a dispute settlement body can help to remedy the incompleteness of the agreement in this setting. By contrast, our approach follows that of Bagwell and Staiger (2001) in focusing on the substitutability between tariffs and domestic policy instruments and in developing a terms-of-trade interpretation of the externalities associated with national product standards.

We now turn to the formal economic analysis. In the remainder of this section, we set out the basic economic model and characterize the efficient policies and also the noncooperative (Nash) policies that would be chosen by governments in the absence of a trade agreement. A comparison of the efficient and noncooperative policies then allows us to identify and understand the problem that a trade agreement must solve if it is to move governments from inefficient Nash choices to the efficiency frontier. Then, in the following section, we consider how various design features of a trade agreement might help to solve this problem.

2.1. The Basic Model

We consider a simple partial equilibrium model of trade between a domestic and a foreign country, with asterisks denoting foreign variables. The product under consideration is produced in both countries but only demanded in the domestic country, where its demand can be represented by the linear demand curve $D = \alpha - P$ for $P \in [0, \alpha]$, with P the consumer price of this good in the domestic market. Consumption of the good generates a negative externality (an "eyesore" pollutant) that is not internalized by individual consumers (and hence does not impact demand for the product) and that does not affect production, but de-

tracts from aggregate national welfare in the domestic country (the externality does not cross borders).

The domestic government can impose a regulatory standard that specifies a (maximum) level of pollution generated per unit of the good consumed, and the standard may differ across domestically produced and imported units. We denote by r the standard imposed on domestically produced units and by ρ the standard imposed on imported units, with $\theta(r)$ and $\theta^*(\rho)$ the associated per-unit pollution levels generated by consumption of domestically produced and imported units under the respective standards r and ρ. We assume that θ and θ^* are decreasing and convex in their respective arguments.

To meet the standard r, domestic producers must incur the per-unit compliance cost $\phi(r)$; similarly, to meet the standard ρ, foreign producers must incur the per-unit compliance cost $\phi^*(\rho)$. We assume that ϕ and ϕ^* are increasing and convex in their respective arguments. For any regulatory standards r and ρ, domestic and foreign supply are then given by $S = q - \phi(r)$ for $q \geq \phi(r)$, and $S^* = q^* - \phi^*(\rho)$ for $q^* \geq \phi^*(\rho)$, where q and q^* are the domestic and foreign producer prices, respectively.

In addition to the regulatory standards, the domestic government has at its disposal an import tariff τ and a consumption tax t (both expressed in specific terms).[6] The foreign government has an export tax τ^* (also expressed in specific terms). Assuming that all taxes are set at nonprohibitive levels, the domestic consumer and producer price must satisfy

$$P = q + t, \tag{1}$$

while the domestic and foreign producer prices must satisfy

$$q = q^* + \tau + \tau^*. \tag{2}$$

Notice that all units of the product sell in the domestic country at the same price P regardless of the standard to which they are produced, owing to the fact that individual consumers do not differentiate across units of the good on the basis of how much pollution it generates when they consume it, and so their willingness to pay for the good is inde-

6. A tariff and a consumption tax represent a complete set of tax instruments for the home government in this industry (that is, they in effect amount to an independent consumption tax and production subsidy), because the tariff itself is equivalent to a combination consumption tax and production subsidy. Also, for now we assume without loss of generality that the consumption tax is applied in a nondiscriminatory manner across domestically produced and foreign-produced goods and postpone consideration of discriminatory consumption taxes until our discussion of trade agreements in Section 3, when a strict incentive to apply discriminatory consumption taxes first arises in our model.

pendent of its pollution-generating characteristics. We also define the "world" price (that is, the price at which the good is available for sale in international markets once it clears customs in the exporting country):

$$q^{w} \equiv q^{*} + \tau^{*} = q - \tau. \tag{3}$$

Equilibrium in this market is determined by the market-clearing condition that the volume of domestic imports must equal the volume of foreign exports $D - S = S^{*}$, which, using the explicit expressions for demands and supplies and the pricing relationships in equations (1)–(3), determines the market-clearing world price as a function of the tax and regulatory policies:

$$\tilde{q}^{w} = \frac{1}{3}[\alpha - 2\tau + \tau^{*} - t + \phi(r) + \phi^{*}(\rho)]. \tag{4}$$

Moreover, using equations (1)–(3) we may derive expressions for the market-clearing levels of each of the other prices as functions of the tax and regulatory policies:

$$\begin{aligned}
\tilde{P} &= \frac{1}{3}[\alpha + \tau + \tau^{*} + 2t + \phi(r) + \phi^{*}(\rho)], \\
\tilde{q} &= \frac{1}{3}[\alpha + \tau + \tau^{*} - t + \phi(r) + \phi^{*}(\rho)], \\
\tilde{q}^{*} &= \frac{1}{3}[\alpha - 2(\tau + \tau^{*}) - t + \phi(r) + \phi^{*}(\rho)].
\end{aligned} \tag{5}$$

It will be helpful in what follows to define as well the market-clearing foreign producer price of the "raw" unregulated good—before it is brought into compliance with the prevailing regulatory standard—as a function of the tax and regulatory policies, and the associated world price of the foreign-produced unregulated good, by

$$\begin{aligned}
\tilde{q}_{0}^{*} &\equiv \tilde{q}^{*} - \phi^{*}(\rho) = \frac{1}{3}[\alpha - 2(\tau + \tau^{*}) - t + \phi(r) - 2\phi^{*}(\rho)], \\
\tilde{q}_{0}^{w} &\equiv \tilde{q}^{w} - \phi^{*}(\rho) = \frac{1}{3}[\alpha - 2\tau + \tau^{*} - t + \phi(r) - 2\phi^{*}(\rho)].
\end{aligned} \tag{6}$$

We will refer to $\tilde{q}_{0}^{w}$ rather than $\tilde{q}^{w}$ as the terms of trade, although for any ρ there is a one-to-one mapping between the two notions of world

price, as the bottom line of equation (6) indicates.[7] Notice that $\tilde{q}_0^*$ is also the market-clearing volume of foreign exports (production, S^*).

We next introduce expressions for domestic and foreign welfare. Welfare in the domestic country is given by the usual partial equilibrium measure of consumer surplus plus producer surplus plus tax revenue, with the disutility of the consumption-generated pollution subtracted off. Domestic consumer surplus (CS) and producer surplus (PS) are given by

$$\text{CS} = \int_{\tilde{P}}^{\alpha} [\alpha - P]dP \equiv \text{CS}(\tilde{P}),$$

$$\text{PS} = \int_{\phi(r)}^{\tilde{q}} [q - \phi(r)]dq \equiv \text{PS}(r, \tilde{q}).$$

Using the pricing relationships above and the definition of $\tilde{q}_0^{\text{w}}$, the tax revenue collected by the domestic government (TR) is given by

$$\text{TR} = [\tilde{P} - \tilde{q}] \times [\alpha - \tilde{P}] + [\tilde{q} - \tilde{q}_0^{\text{w}} - \phi^*(\rho)] \times \left\{\left(\alpha - \tilde{P}\right) - [\tilde{q} - \phi(r)]\right\}$$

$$\equiv \text{TR}(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^{\text{w}}).$$

Finally, the utility cost of domestic pollution (Z) is given by

$$Z = \theta(r) \times [\tilde{q} - \phi(r)] + \theta^*(\rho) \times \left\{\left(\alpha - \tilde{P}\right) - [\tilde{q} - \phi(r)]\right\} \equiv Z(r, \rho, \tilde{P}, \tilde{q}).$$

With these definitions, domestic welfare may now be expressed as

$$W = \text{CS}(\tilde{P}) + \text{PS}(r, \tilde{q}) + \text{TR}(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^{\text{w}}) - Z(r, \rho, \tilde{P}, \tilde{q}) \tag{7}$$

$$\equiv W(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^{\text{w}}).$$

Using equation (7) and the definition of $\text{TR}(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^{\text{w}})$, observe that $W_{\tilde{q}_0^{\text{w}}} = -\{(\alpha - \tilde{P}) - [\tilde{q} - \phi(r)]\} < 0$ (where here and throughout a subscripted variable denotes a partial derivative with respect to the variable). This reflects the domestic welfare loss that comes when the terms of trade move against the domestic country (that is, when $\tilde{q}_0^{\text{w}}$ rises), holding all regulatory standards and domestic local prices fixed, and it is nothing

7. Our focus on $\tilde{q}_0^{\text{w}}$ rather than $\tilde{q}^{\text{w}}$ as the terms of trade is the key step by which we keep the dimensionality of our analysis at a manageable level, despite the fact that in the presence of the (continuous) product standard there is a continuum of possible varieties of the product that could be imported and consumed by the domestic country, corresponding to each possible setting of the standard. See Bagwell and Staiger (2001, note 8) for a discussion of the dimensionality problem associated with product and consumption standards in this context.

other than the income effect of the terms-of-trade deterioration for the domestic country, which amounts to the domestic import volume.

Turning now to foreign welfare, the absence of foreign demand for the product under consideration and of foreign pollution makes the foreign welfare measure very simple: foreign welfare is given by the sum of producer surplus and trade tax revenue. More specifically, using the pricing relationships above and the definitions of $\tilde{q}_0^*$ and $\tilde{q}_0^w$, foreign producer surplus (PS*) and trade tax revenue (TR*) can be defined as

$$\text{PS}^* = \int_{\phi^*(\rho)}^{\tilde{q}_0^*+\phi^*(\rho)} [q^* - \phi^*(\rho)]dq = \int_0^{\tilde{q}_0^*} q^* dq^* \equiv \text{PS}^*(\tilde{q}_0^*),$$

$$\text{TR}^* = [\tilde{q}_0^w - \tilde{q}_0^*] \times \tilde{q}_0^* \equiv \text{TR}^*(\tilde{q}_0^*, \tilde{q}_0^w).$$

With these definitions, foreign welfare may now be expressed as[8]

$$W^* = \text{PS}^*(\tilde{q}_0^*) + \text{TR}^*(\tilde{q}_0^*, \tilde{q}_0^w) \equiv W^*(\tilde{q}_0^*, \tilde{q}_0^w). \tag{8}$$

Finally, using equation (8) and the definition of $\text{TR}^*(\tilde{q}_0^*, \tilde{q}_0^w)$, note that $W^*_{\tilde{q}_0^*} = \tilde{q}_0^* > 0$, reflecting the foreign welfare gain when the terms of trade move in favor of the foreign country (that is, when $\tilde{q}_0^w$ rises), holding the foreign local price fixed. This gain is the income effect of the terms-of-trade improvement for the foreign country, which amounts to the foreign export volume.

We close this section by developing an expression for the joint (sum of) domestic and foreign welfare. When we characterize efficient policies in the next section, we will look for the policy choices that maximize the sum of the welfare across the two countries (and thereby assume that lump-sum transfers are available to distribute surplus across the two countries as desired). Using the equilibrium condition that the volume of domestic imports $(\alpha - \tilde{P}) - [\tilde{q} - \phi(r)]$ must equal the volume of foreign exports $\tilde{q}_0^*$, observe first that the world price cancels from the sum of domestic and foreign tax revenue:

8. Notice that, as expressed by $W^*(\tilde{q}_0^*, \tilde{q}_0^w)$, foreign welfare does not depend directly on the standard ρ with which foreign producers must comply, but only indirectly through the impact of ρ on $\tilde{q}_0^*$ and $\tilde{q}_0^w$, the market-clearing producer price and world price of the foreign-produced unregulated good. Intuitively, we have modeled production of the unregulated good as an increasing-cost (upward-sloping supply) industry, while for a given standard level ρ the per-unit cost of coming into compliance with the standard is then constant (and equal to $\phi^*(\rho)$) regardless of how many units of the unregulated good must be altered to meet the standard. As a consequence, foreign producer surplus is impacted by the standard level ρ only to the extent that ρ impacts the market-clearing foreign supply decisions for the unregulated good (through $\tilde{q}_0^*$).

$$\begin{aligned} \mathrm{TR} + \mathrm{TR}^* &= [\tilde{P} - \tilde{q}] \times [\alpha - \tilde{P}] + [\tilde{q} - \tilde{q}_0^* - \phi^*(\rho)] \\ &\quad \times \left\{(\alpha - \tilde{P}) - [\tilde{q} - \phi(r)]\right\} \\ &\equiv g(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^*). \end{aligned}$$

With this and the above expressions for W and W^*, we may write

$$\begin{aligned} W + W^* &= W(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^{\mathrm{w}}) + W^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}) \\ &= \mathrm{CS}(\tilde{P}) + \mathrm{PS}(r, \tilde{q}) + \mathrm{PS}^*(\tilde{q}_0^*) \\ &\quad + g(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^*) - Z(r, \rho, \tilde{P}, \tilde{q}) \\ &\equiv G(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^*). \end{aligned} \tag{9}$$

Note that the world price $\tilde{q}_0^{\mathrm{w}}$ enters into each country's welfare function, but it does not enter into joint welfare, because movements in the world price represent pure (lump-sum) international transfers between countries; that is, $W^*_{\tilde{q}_0^{\mathrm{w}}} + W_{\tilde{q}_0^{\mathrm{w}}} = \tilde{q}_0^* - \{(\alpha - \tilde{P}) - [\tilde{q} - \phi(r)]\} = 0$.

2.2. Efficient Policies

With the basic model described, we now turn to characterize the jointly efficient policy choices. As indicated above, we will subsequently compare these policies to the noncooperative policy choices that each government would make absent any international agreement and will thereby be able to identify and understand the problem that a trade agreement must solve if it is to move governments from inefficient Nash choices to the efficiency frontier.

To characterize efficient policy choices, observe first from equations (4), (5), and (6) that world prices depend on both τ and τ^* independently, but that τ and τ^* affect all local prices only through their sum. However, as we have observed and as equation (9) indicates, the only prices that are relevant for joint welfare are the local prices. Therefore, in addition to the choices of t, r, and ρ, efficiency ties down only the sum of τ and τ^*, not their individual levels.

Accordingly, with reference to the expression for joint welfare given in equation (9), the efficient policy choices must satisfy the following four first-order conditions:[9]

9. We assume throughout that policy choices correspond to interior solutions of the relevant maximization problems. It is easily confirmed that the second-order conditions associated with the maximization problems considered here and throughout the paper are satisfied under our convexity assumptions for θ, θ^*, ϕ, and ϕ^*.

$$
\begin{aligned}
W_{\tilde{P}}\frac{d\tilde{P}}{d\tau} + W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W^*_{\tilde{q}^*_0}\frac{d\tilde{q}^*_0}{d\tau} &= 0,\\
W_{\tilde{P}}\frac{d\tilde{P}}{dt} + W_{\tilde{q}}\frac{d\tilde{q}}{dt} + W^*_{\tilde{q}^*_0}\frac{d\tilde{q}^*_0}{dt} &= 0,\\
W_r + W_{\tilde{P}}\frac{d\tilde{P}}{dr} + W_{\tilde{q}}\frac{d\tilde{q}}{dr} + W^*_{\tilde{q}^*_0}\frac{d\tilde{q}^*_0}{dr} &= 0,\\
W_\rho + W_{\tilde{P}}\frac{d\tilde{P}}{d\rho} + W_{\tilde{q}}\frac{d\tilde{q}}{d\rho} + W^*_{\tilde{q}^*_0}\frac{d\tilde{q}^*_0}{d\rho} &= 0.
\end{aligned}
\tag{10}
$$

Employing the expressions in equations (4)–(8) to evaluate the first-order conditions for efficiency contained in equation (10), and denoting the efficient policy choices by $\tau^{\mathrm{E}} + \tau^{*E}$, t^{E}, r^{E}, and ρ^{E}, the following expressions for the efficient policy levels may be derived:

$$
\begin{aligned}
\tau^{\mathrm{E}} + \tau^{*E} &= \theta^*(\rho^{\mathrm{E}}) - \theta(r^{\mathrm{E}}),\\
t^E &= \theta(r^{\mathrm{E}}),\\
-\theta'(r^{\mathrm{E}}) &= \phi'(r^{\mathrm{E}}),\\
-\theta^{*\prime}(\rho^{\mathrm{E}}) &= \phi^{*\prime}(\rho^{\mathrm{E}}),
\end{aligned}
\tag{11}
$$

where here we have used primes to denote derivatives. A number of features of the efficient policies are worth emphasizing.

First, notice that $t^{\mathrm{E}} = \theta$, and so the efficient domestic consumption tax is set at a Pigouvian level that reflects the externality associated with consumption of a unit of the domestically produced good, even if this externality differs from the externality associated with consumption of a unit of the imported good. The efficient way to respond to any difference in the externality generated by consumption of the domestically produced and imported goods is via tariffs: as the top expression of equation (11) indicates, $\tau^{\mathrm{E}} + \tau^{*E}$ is positive (a net tax on imports) if consumption of a unit of the imported good generates more pollution than a unit of the domestically produced good; $\tau^{\mathrm{E}} + \tau^{*E}$ is negative (a net subsidy to imports) if consumption of a unit of the imported good generates less pollution than a unit of the domestically produced good. This feature may at first seem puzzling, but it can be given a natural interpretation once it is observed that a tariff can be equivalently thought of as a (discriminatory) domestic tax on the consumption of the imported good: thus, these two policies together represent the usual Pigouvian intervention to address the (possibly distinct levels of) consumption ex-

ternality associated with consumption of the domestically produced and imported good.

Second, notice that the efficient standard on domestically produced goods r^{E} equates the marginal per-unit benefit of reduced pollution that comes with a slightly tighter standard $-\theta'(\cdot)$ with the marginal per-unit cost of domestic compliance with the tighter standard $\phi'(\cdot)$. Similarly, the efficient standard on imported goods ρ^{E} equates the marginal per-unit benefit of reduced pollution that comes with a slightly tighter standard $-\theta^{*\prime}(\cdot)$ with the marginal per-unit cost of foreign compliance with the tighter standard $\phi^{*\prime}(\cdot)$. In general, neither the efficient regulatory standards for domestic and imported goods nor the efficient level of the externality produced by each type of good will be the same (see also Gulati and Roy 2008).

Third, and related to this last point, it is interesting to consider the efficient policies for a symmetric benchmark case in which domestically produced and imported goods share an identical technology, in the particular sense that both domestic and foreign producers face the same compliance cost for any (common) standard level (that is, the functions ϕ and ϕ^{*} are identical), and consumption of both the domestically produced and imported good generates the same per-unit level of pollution for any (common) standard level (that is, the functions θ and θ^{*} are identical). In this case, because of symmetry in the compliance cost functions ϕ and ϕ^{*}, the level of r that satisfies the third condition in equation (11) is the same as the level of ρ that satisfies the fourth condition in equations (11): hence, $\rho^{E} = r^{E}$. And given that $\rho^{E} = r^{E}$, symmetry in the pollution functions θ and θ^{*} then implies by the first condition in equation (11) that $\tau^{E} + \tau^{*E} = 0$. Therefore, in the symmetric benchmark case, the efficient policies are given by

$$\begin{aligned} \tau^{E} + \tau^{*E} &= 0, \\ t^{E} &= \theta(r^{E}), \\ -\theta'(r^{E}) &= \phi'(r^{E}), \\ \rho^{E} &= r^{E}. \end{aligned} \tag{12}$$

As equation (12) indicates, efficient policy intervention in the case of identical technologies across countries takes the intuitive form of free trade, a nondiscriminatory regulatory standard that equates the marginal benefit of pollution reduction to the marginal compliance cost, and a Pigouvian consumption tax set at the level of the consumption externality.

2.3. Noncooperative Policies

Next we turn to characterize the noncooperative (Nash) policy choices. Using the domestic welfare expression given in equation (7), and facing any foreign export tax τ^*, the best-response domestic policy choices are the choices of τ, t, r, and ρ that satisfy the following four first-order conditions:

$$\begin{aligned}
W_{\tilde{P}}\frac{d\tilde{P}}{d\tau} + W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W_{\tilde{q}^{\mathrm{w}}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\tau} &= 0,\\
W_{\tilde{P}}\frac{d\tilde{P}}{dt} + W_{\tilde{q}}\frac{d\tilde{q}}{dt} + W_{\tilde{q}^{\mathrm{w}}}\frac{d\tilde{q}_0^{\mathrm{w}}}{dt} &= 0,\\
W_r + W_{\tilde{P}}\frac{d\tilde{P}}{dr} + W_{\tilde{q}}\frac{d\tilde{q}}{dr} + W_{\tilde{q}^{\mathrm{w}}}\frac{d\tilde{q}_0^{\mathrm{w}}}{dr} &= 0,\\
W_\rho + W_{\tilde{P}}\frac{d\tilde{P}}{d\rho} + W_{\tilde{q}}\frac{d\tilde{q}}{d\rho} + W_{\tilde{q}^{\mathrm{w}}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\rho} &= 0.
\end{aligned} \tag{13}$$

Similarly, facing any domestic choices of τ, t, r, and ρ, the best-response foreign export tax must satisfy the following first-order condition:

$$W^*_{\tilde{q}^0}\frac{d\tilde{q}_0^*}{d\tau^*} + W^*_{\tilde{q}^{\mathrm{w}}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\tau^*} = 0. \tag{14}$$

The Nash equilibrium policy choices are the policies that simultaneously satisfy the conditions in equations (13) and (14), ensuring that each country is adopting the policy that is its best response to the other country's policy choices.

Using the expressions in equations (4)–(8) to evaluate the first-order conditions contained in equations (13) and (14) that define the Nash policies, and denoting the Nash volume of foreign export supply by $S^{*\mathrm{N}}$ and the Nash policy choices by τ^{N}, t^{N}, r^{N}, ρ^{N}, and $\tau^{*\mathrm{N}}$, the following expressions for the Nash policy levels may be derived:

$$\begin{aligned}
\tau^{\mathrm{N}} &= [\theta^*(\rho^{\mathrm{N}}) - \theta(r^{\mathrm{N}})] + S^{*\mathrm{N}},\\
\tau^{*\mathrm{N}} &= \frac{S^{*\mathrm{N}}}{2},\\
t^{\mathrm{N}} &= \theta(r^{\mathrm{N}}),\\
-\theta'(r^{\mathrm{N}}) &= \phi'(r^{\mathrm{N}}),\\
-\theta^{*\prime}(\rho^{\mathrm{N}}) &= \phi^{*\prime}(\rho^{\mathrm{N}}).
\end{aligned} \tag{15}$$

And finally, in the symmetric benchmark case of identical technologies, Nash policies reduce to

$$\begin{aligned} \tau^{N} &= S^{*N}, \\ \tau^{*N} &= \frac{S^{*N}}{2}, \\ t^{N} &= \theta(r^{N}), \\ -\theta'(r^{N}) &= \phi'(r^{N}), \\ -\theta^{*\prime}(\rho^{N}) &= \phi^{*\prime}(\rho^{N}). \end{aligned} \tag{16}$$

We next turn to a comparison of the noncooperative and efficient policy choices, in order to identify and understand the problem that a trade agreement must solve if it is to move governments from inefficient Nash choices to the efficiency frontier.

2.4. The Problem for a Trade Agreement to Solve

A comparison of the bottom two conditions in equations (11) and (15) reveals that the Nash standards choices satisfy the same conditions as the efficient standards choices, and indeed $r^{N} = r^{E}$ and $\rho^{N} = \rho^{E}$: the Nash standards correspond to the efficient standards. Moreover, given that $r^{N} = r^{E}$, it also follows from a comparison of the middle conditions in equations (11) and (15) that $t^{N} = t^{E}$: the Nash consumption tax corresponds to the efficient consumption tax. Given that $r^{N} = r^{E}$ and $\rho^{N} = \rho^{E}$, it is then apparent from a comparison of the first condition in equation (11) with the first two conditions in equation (15) that $\tau^{N} + \tau^{*N} > \tau^{E} + \tau^{*E}$.[10] And it is easily shown that the difference between Nash and efficient tariffs is driven by each country's incentive to manipulate the terms of trade ($\tilde{q}_0^{w}$) with its unilateral tariff choice (that is, to impose its Johnson [1953–54] "optimal tariff").[11] Finally, it can be seen that the same characterization applies in the case of identical technologies, by comparing the efficient policies for the symmetric benchmark case in

10. This follows from our focus on nonprohibitive intervention, which ensures that the Nash export volume S^{*N} is strictly positive.

11. To confirm this, note that the elasticity of foreign export supply in this model can be written as $(\partial S^{*}/\partial \tilde{q}^{w})(\tilde{q}^{w}/S^{*}) = \tilde{q}^{w}/S^{*}$. But then, dividing τ^{N} by $\tilde{q}^{w}$ to convert the specific import tariff of the domestic country into an ad valorem equivalent yields $\tau^{N}/\tilde{q}^{w} = [\theta^{*}(\rho^{N}) - \theta(r^{N})]/\tilde{q}^{w} + (S^{*}/\tilde{q}^{w})$, and hence the second term in this expression is simply the inverse of the foreign export supply elasticity (which is the Johnson [1953–54] optimal ad valorem tariff term). A similar calculation can be performed for the foreign export tax, leading to an analogous interpretation.

equation (12) to the Nash policies in the symmetric benchmark case given in equation (16).

The inefficiency of the Nash equilibrium can thus be traced to a single source: Nash tariffs are higher than is efficient, and Nash trade volumes are correspondingly too low, because each country seeks to manipulate its terms of trade with its tariff (see Bagwell and Staiger [2001] on this point more generally). And from this vantage point, a key insight emerges: despite the complex domestic policy environment, the fundamental problem for a trade agreement to address is to prevent terms-of-trade manipulation and to thereby reduce tariffs and raise trade volumes, without introducing distortions into the choice of domestic regulatory and tax policies.

This insight can be confirmed at a more general level by following Bagwell and Staiger (1999, 2001) and defining "politically optimal" policies as those policies that would hypothetically be chosen by governments unilaterally if they did not value the terms-of-trade implications of their policy choices.[12] In particular, we suppose hypothetically that the domestic government acts as if $W_{\tilde{q}^0} \equiv 0$ when choosing its politically optimal policies, while the foreign government acts as if $W^*_{\tilde{q}^0} \equiv 0$ when choosing its politically optimal policies. Politically optimal policies are therefore defined as those policies that satisfy the following five first-order conditions:

$$\begin{aligned}
W_{\tilde{P}}\frac{d\tilde{P}}{d\tau} + W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} &= 0,\\
W_{\tilde{P}}\frac{d\tilde{P}}{dt} + W_{\tilde{q}}\frac{d\tilde{q}}{dt} &= 0,\\
W_r + W_{\tilde{P}}\frac{d\tilde{P}}{dr} + W_{\tilde{q}}\frac{d\tilde{q}}{dr} &= 0, \qquad (17)\\
W_\rho + W_{\tilde{P}}\frac{d\tilde{P}}{d\rho} + W_{\tilde{q}}\frac{d\tilde{q}}{d\rho} &= 0,\\
W^*_{\tilde{q}^0}\frac{d\tilde{q}^*_0}{d\tau^*} &= 0.
\end{aligned}$$

12. This terminology reflects the fact that Bagwell and Staiger (1999, 2001) work with government objective functions that allow for general political economy motives. We have abstracted from political economy motives here, but as we discuss further in Section 3.6, our results hold in the presence of such motives, and so we continue to adopt the terminology of Bagwell and Staiger.

Defining politically optimal policies in this way then allows us to ask whether politically optimal policies are efficient when evaluated in light of the governments' actual objectives and, thereby, to explore whether the Nash inefficiencies identified above can in fact be given the terms-of-trade interpretation we have just outlined.

But with the bottom condition in equation (17) implying that $W^*_{\tilde{q}^{\mathrm{w}}_0} = 0$, it is immediate that the first four conditions in equation (17) then satisfy the respective four conditions for efficiency given in equation (10), and it may thus be concluded that politically optimal policies are indeed efficient. Hence, if governments could be induced to make policy choices free from motives reflecting terms-of-trade manipulation, there would be nothing left for a trade agreement to do. And as a consequence, the fundamental inefficiency for a trade agreement to correct in this setting—and therefore the problem that gives rise to the need for a trade agreement to exist—is the unilateral incentive for governments to manipulate the terms of trade $\tilde{q}^{\mathrm{w}}_0$ with their tariff choices.

3. THE DESIGN OF TRADE AGREEMENTS

With the problem for a trade agreement to address now identified, we next illustrate a number of points that can help illuminate the possible logic behind features of trade agreements that are designed to correct this problem. To highlight the main themes, we now focus on the symmetric benchmark case considered in the previous section in which domestic and foreign technologies are identical, and we henceforth denote the (common) per-unit pollution function by $\theta(\cdot)$ and the (common) cost-of-compliance function by $\phi(\cdot)$. We do this for two reasons. First, the assumption itself may often be plausibly met in reality because technology is often internationally transferable. Second, even if technologies are in fact distinct across countries, and are distinct in particular with regard to pollution and the compliance cost associated with a given regulation, it is not at all obvious which way the distinction would go between imports and domestically produced goods, and so abstracting from such differences seems a reasonable simplification for the purpose of illuminating the possible design features of trade agreements.[13]

13. A more sophisticated analysis might allow for the possibility that each country is privately informed about the pollution and regulatory compliance-cost details of its own industry, and the analysis might then seek to characterize the design features of trade agreements that could best handle this complication. This suggests an interesting direction for research (for some related analyses, see Ludema and Wooton 1994, 1997; Ludema and

3.1. National Treatment for Taxation

We begin with a simple thought experiment: What would be the shortcoming of an international agreement that simply constrained tariffs to their efficient levels? After all, as the discussion in the previous section indicates, of all the policies chosen by governments, it is only the tariffs that are set inefficiently absent an agreement (that is, in the Nash equilibrium).

An immediate answer to this question is that, without any other limitations on policies, the domestic government could simply undo its tariff commitments by imposing discriminatory consumption taxes on imported goods, which as we have already observed above are identical to tariffs except in name. Hence, tariff commitments alone that are not protected by a nondiscrimination ("national treatment") clause applied to domestic taxation are meaningless.

Suppose, then, that countries agree to bind their tariffs below their Nash levels and also agree (in the domestic government's case) not to impose discriminatory consumption taxes on imported goods. To fix ideas, let us consider an agreement to eliminate tariffs completely, as free trade is the efficient trade policy in this identical-technology environment according to equation (12) above. If in response to the elimination of the domestic and foreign tariffs, the domestic government would not alter its domestic tax and regulatory policies from their Nash levels, then efficiency would be achieved, owing to the fact that the domestic tax and regulatory Nash policies are already efficient as we have shown. The question, then, is whether the domestic government's choices of t, r, and ρ will be altered by the move from Nash tariffs to free trade and, if so, how.

To answer this question, we evaluate the bottom three first-order conditions in equation (13) under the assumption that $\tau \equiv 0 \equiv \tau^*$ (and hence the top first-order condition in equation [13] does not hold). This characterizes the domestic government's best-response choices of t, r, and ρ given the hypothesized tariff commitments $\tau \equiv 0 \equiv \tau^*$.

Consider first the domestic government's best-response choice of consumption tax in this setting, taking as given the levels of r and ρ. Denoting this choice by $t^{BR}(\tau \equiv 0 \equiv \tau^*, r, \rho)$, the following characterization may be derived:

Takeno 2007; Bagwell and Staiger 2005; Bagwell 2009), but it is beyond the scope of the present paper.

$$t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*, r, \rho) = \theta(r) + \frac{\alpha - \theta(r) - \phi(r)}{7} + \frac{3[\theta(\rho) - \theta(r)] + 2[\phi(r) - \phi(\rho)]}{7}. \tag{18}$$

It can be shown that the second term on the right-hand side of equation (18) is strictly positive for nonprohibitive policies. The third term on the right-hand side is zero if $\rho = r$, and is negative (positive) if $\rho > r$ ($\rho < r$). Hence, if r and ρ remain at their Nash and efficient levels $\rho^{\mathrm{E}} = r^{\mathrm{E}}$, equation (18) implies that the domestic government will raise its consumption tax above the efficient level (that is, $t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*, r^{\mathrm{E}}, \rho^{\mathrm{E}}) > \theta(r^{E})$) in response to the tariff binding. Intuitively, as we have already observed, the Nash import tariff is higher than the efficient level of free trade owing to the domestic government's incentive to utilize the tariff as an instrument for reducing $\tilde{q}_0^{\mathrm{w}}$ and hence manipulating the terms of trade to its advantage; and as the bottom expression in equation (6) indicates, if the domestic government is prevented by a trade agreement from setting its tariff with an eye toward reducing $\tilde{q}_0^{\mathrm{w}}$, it can (imperfectly) substitute a rise in the consumption tax t to accomplish this goal.

Consider next the domestic government's choice of regulatory standards. With $\tau \equiv 0 \equiv \tau^*$ and with $t = t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*, r, \rho)$ as defined in equation (18), the first-order conditions that define the domestic government's best-response levels of r and ρ can be written, respectively, as

$$\begin{aligned} &-\theta'(r)[2\alpha - \theta(r) - \theta(\rho) - 5\phi(r) + 3\phi(\rho)] \\ &= \phi'(r)[3\alpha - 5\theta(r) + 2\theta(\rho) - 4\phi(r) + \phi(\rho)], \\ &-\theta'(\rho)[2\alpha - \theta(\rho) - \theta(r) + 2\phi(r) - 4\phi(\rho)] \\ &= \phi'(\rho)[\alpha - 4\theta(\rho) + 3\theta(r) - 2\phi(\rho) + \phi(r)]. \end{aligned} \tag{19}$$

Solving the two expressions in equation (19) for r and ρ yields the domestic best-response levels of r and ρ given $\tau \equiv 0 \equiv \tau^*$ (and with t set to $t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*, r, \rho)$), which we denote respectively by $r^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*)$ and $\rho^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*)$. Plugging these into the expression in equation (18) then yields $t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*)$ as well. Several conclusions may be drawn from the expressions in equation (19).

First, it can be shown that $\rho^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*) > r^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^*)$: binding tariffs at free trade (or more generally below the Nash level) introduces an incentive for the domestic country to implement discriminatory reg-

ulation against foreign imports.[14] Intuitively, as indicated above, with its tariff constrained, the domestic government will look for alternative methods of manipulating the terms of trade $\tilde{q}_0^w$: the consumption tax can be raised to partially accomplish this, but as we have observed it is an imperfect substitute for the tariff; and by raising ρ and reducing r, the same overall level of pollution can be attained at a lower domestic cost, because as the bottom expression in equation (6) indicates this maneuver depresses $\tilde{q}_0^w$ and hence forces some of the cost of pollution abatement onto foreign producers. When the tariff itself is unavailable to depress $\tilde{q}_0^w$, the regulatory "cost shifting" accomplished with standards that discriminate against foreign imports becomes attractive.[15]

Note also that, in light of our finding that regulatory standards must discriminate against imports, it need not be the case that the best-response consumption tax $t^{BR}(\tau \equiv 0 \equiv \tau^*)$ is necessarily higher than θ. In particular, if the incentive to discriminate is high enough, then $t^{BR}(\tau \equiv 0 \equiv \tau^*) < \theta$, as can be confirmed with equation (18). The ability to set discriminatory regulation provides an attractive means of manipulating the terms of trade when the first best means—the tariff—is unavailable; indeed, this attraction may be so powerful as to wipe out the use of the (nondiscriminatory) domestic consumption tax for this purpose.

Second, the two expressions in equation (19) can be used to confirm the following: we must have $-\theta'(r^{BR}(\tau \equiv 0 \equiv \tau^*)) > \phi'(r^{BR}(\tau \equiv 0 \equiv \tau^*))$, while we may have $-\theta'(\rho^{BR}(\tau \equiv 0 \equiv \tau^*)) \gtreqless \phi'(\rho^{BR}(\tau \equiv 0 \equiv \tau^*))$.[16] In words, binding tariffs at free trade (or more generally below Nash levels) induces the domestic country to lower the standard that it applies to

14. This can be shown by supposing that $\rho = r$ and then confirming that (i) if the top condition in equation (19) is satisfied, so that r is indeed the best response, then the left-hand side of the bottom condition is strictly greater than the right-hand side, indicating that the best-response ρ must be higher; and similarly, (ii) if the bottom condition in equation (19) is satisfied, so that ρ is indeed the best response, then the left-hand side of the top condition is strictly less than the right-hand side, indicating that the best-response r must be lower.

15. While our formal analysis is restricted to a two-country setting, it should now also be clear that the same incentives that give rise to the desire to discriminate between domestic and foreign producers through regulatory choices in our two-country model can in a many-country setting also give rise to the desire to discriminate among different foreign suppliers for cost-shifting reasons. We will return to this observation later in the paper.

16. This can be established by showing that the condition that $-\theta'(r) < \phi'(r)$ and $-\theta'(\rho) < \phi'(\rho)$ is inconsistent with the two expressions in equation (19). This finding, together with the already established fact that $\rho^{BR}(\tau \equiv 0 \equiv \tau^*) > r^{BR}(\tau \equiv 0 \equiv \tau^*)$, then yields the result.

domestic production below the efficient level, while the standard that it applies to imported products is always more stringent than the domestic standard but may be lower or higher than the efficient level.

Summarizing what we have established thus far, an agreement to eliminate tariffs that is accompanied by a nondiscrimination rule applied to domestic consumption taxes will fail to achieve internationally efficient policies, because discriminatory standards will be implemented against foreign imports and the standards on domestically produced units will be inefficiently lax. In addition, the standard on foreign imports will in general be set at an inefficient level, as will the level of the consumption tax, although these policies may be set either too high or too low relative to their efficient levels.

3.2. National Treatment for Taxation and Regulation

Let us next suppose, then, that in addition to a nondiscrimination rule applied to domestic consumption taxes, governments also agree to a nondiscrimination rule applied to domestic regulation. Will a commitment to free trade that is protected by these two rules allow governments to reach the internationally efficient policies described by equation (12)?

The regulatory nondiscrimination rule amounts to a restriction that $\rho \equiv r$. A first immediate implication is that international efficiency still cannot be achieved, even with the addition of this rule. The reason is that the domestic consumption tax will now surely be set higher than its efficient level as an imperfect way for the domestic government to manipulate the terms of trade when its tariff—and discriminatory standards—are unavailable. This can be seen with reference to equation (18) and by noting that the restriction $\rho \equiv r$ implies that

$$t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^{*}, \rho \equiv r) = \theta(r) + \frac{\alpha - \theta(r) - \phi(r)}{7}. \tag{20}$$

As indicated previously, the second term on the right-hand side of equation (20) is strictly positive for nonprohibitive policies, and so equation (20) implies that $t^{\mathrm{BR}}(\tau \equiv 0 \equiv \tau^{*}, \rho \equiv r) > \theta(r)$: when tariffs are eliminated and countries commit to not using discriminatory domestic taxes or regulations, the domestic consumption tax will be raised above its Pigouvian level as a means of manipulating the terms of trade.

What about the regulatory standard level chosen by the domestic government? Interestingly, once the ability to set a discriminatory product standard is taken away from the domestic country, when tariffs are eliminated all of the government's incentive to manipulate the terms of

trade is shifted to the consumption tax, and the (nondiscriminatory) product standard chosen by the domestic government is efficient. That is, imposing the restriction that $\rho \equiv r$, it can be shown with analogous steps to those described above that $r^{BR}(\tau \equiv 0 \equiv \tau^*)$ satisfies $-\theta'(r) = \phi'(r)$. As long as the domestic government remains free to set its (nondiscriminatory) consumption tax when its tariff options are restricted through an international trade agreement, the appeal of using product standards as a means to manipulate the terms of trade is completely eliminated if the standards must be set in a nondiscriminatory fashion.

Intuitively, this last finding is analogous to the finding reported earlier, that product standards are not distorted when the domestic government is free to use its tariff as a means to manipulate the terms of trade. To see this analogy, recall that the tariff is identical to a discriminatory tax imposed on consumption of the imported good, and so this earlier finding indicates that a discriminatory consumption tax always dominates the use of (possibly discriminatory) product standards for the purpose of terms-of-trade manipulation, implying in turn that product standards are not distorted when discriminatory consumption taxes are available. As we have demonstrated, if the tariff is set to zero and discriminatory consumption taxes are prohibited but discriminatory product standards are still permitted, then the ability to discriminate against imports with product standards becomes attractive to the domestic government, and both the nondiscriminatory consumption tax and discriminatory product standards become part of the domestic government's preferred method of manipulating the terms of trade. What our last finding indicates is that, if discriminatory product standards are also prohibited, so that the domestic government is faced with the prospect of using nondiscriminatory consumption taxes and nondiscriminatory product standards for terms-of-trade manipulation, the use of consumption taxes will once again dominate the use of product standards for this purpose, and as a consequence (nondiscriminatory) product standards are not distorted when (nondiscriminatory) consumption taxes are available.

3.3. Limited Consumption Taxes and Excessive Nondiscriminatory Regulation

Our analysis thus far has adopted the view that product-specific consumption taxes are available to the domestic government. The ability of governments to impose product-specific consumption taxes at the same level of detail as tariffs and product standards is crucial to the finding reported in the previous section, namely, that when national

treatment requirements apply to both taxes and regulations, only consumption taxes will be distorted upward.

In practice, however, we do not observe governments imposing many product-specific consumption taxes. Some exist, to be sure (for example, on gasoline), but they are infrequent, and we suspect that the collection costs of such fine-level consumption taxes make them broadly unattractive to governments. As a result, we tend to observe uniform sales taxes at various levels of government (sometimes with exemptions for relatively broad categories such as food and medicine), uniform value-added taxes in jurisdictions that employ them, and so on.

Accordingly, we conclude our detailed formal analysis by asking, What happens to regulatory policy when product-specific consumption taxes are unavailable? The answer, as shall be seen, is that regulatory standards become inefficiently stringent because of regulatory cost shifting, even when they must abide by national treatment.

To develop this result, we consider policy choices in our model under the constraint that $t \equiv 0$.[17] According to equation (1), this implies that $P \equiv q$ so that there is a single local (producer and consumer) price in the domestic industry, which we denote by q, with the pricing relationships in equations (2) and (3) then still applying. To highlight the main point, we focus on the symmetric benchmark case in which there is a common per-unit pollution function $\theta(\cdot)$ and a common cost-of-compliance function $\phi(\cdot)$ across countries, and we consider only nondiscriminatory standards; that is, we impose the condition that $\rho \equiv r$. Our purpose is to consider what happens to this nondiscriminatory standard when tariffs are constrained by a trade agreement.

Proceeding as before, we may derive the market-clearing world price as a function of the tax and regulatory policies:

$$\tilde{q}^{w} = \frac{1}{3}[\alpha - 2\tau + \tau^{*} + 2\phi(r)], \tag{21}$$

and also the market-clearing levels of the local domestic and foreign prices as functions of the tax and regulatory policies:

$$\begin{aligned} \tilde{q} &= \frac{1}{3}[\alpha + \tau + \tau^{*} + 2\phi(r)], \\ \tilde{q}^{*} &= \frac{1}{3}[\alpha - 2(\tau + \tau^{*}) + 2\phi(r)]. \end{aligned} \tag{22}$$

17. As mentioned just above, such a restriction on instruments can be motivated by the high level of collection costs that would likely accompany a system of consumption taxes that varied by product.

In addition, the market-clearing foreign producer price of the unregulated good, and the world price of the unregulated good—which we continue to call the terms of trade—are given by

$$\tilde{q}_0^* \equiv \tilde{q}^* - \phi(r) = \frac{1}{3}[\alpha - 2(\tau + \tau^*) - \phi(r)],$$
$$\tilde{q}_0^{\mathrm{w}} \equiv \tilde{q}^{\mathrm{w}} - \phi(r) = \frac{1}{3}[\alpha - 2\tau + \tau^* - \phi(r)]. \tag{23}$$

Consider next the expressions for domestic and foreign welfare. Foreign welfare continues to be represented by

$$W^* = \mathrm{PS}^*(\tilde{q}_0^*) + \mathrm{TR}^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}) \equiv W^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}), \tag{24}$$

where

$$\mathrm{PS}^* = \int_{\phi(r)}^{\tilde{q}_0 + \phi(r)} [q^* - \phi(r)]dq^* = \int_0^{\tilde{q}_0} q^* dq^* \equiv \mathrm{PS}^*(\tilde{q}_0^*),$$

$$\mathrm{TR}^* = [\tilde{q}_0^{\mathrm{w}} - \tilde{q}_0^*] \times \tilde{q}_0^* \equiv \mathrm{TR}^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}).$$

Domestic welfare is now given by

$$W = \mathrm{CS}(\tilde{q}) + \mathrm{PS}(r, \tilde{q}) + \mathrm{TR}(r, \tilde{q}, \tilde{q}_0^{\mathrm{w}}) - Z(r, \tilde{q}) \equiv W(r, \tilde{q}, \tilde{q}_0^{\mathrm{w}}), \tag{25}$$

where

$$\mathrm{CS} = \int_{\tilde{q}}^{\alpha} [\alpha - q]dq \equiv \mathrm{CS}(\tilde{q}),$$

$$\mathrm{PS} = \int_{\phi(r)}^{\tilde{q}} [q - \phi(r)]dq \equiv \mathrm{PS}(r, \tilde{q}),$$

$$\mathrm{TR} = [\tilde{q} - \tilde{q}_0^{\mathrm{w}} - \phi(r)] \times \{(\alpha - \tilde{q}) - [\tilde{q} - \phi(r)]\} \equiv \mathrm{TR}(r, \tilde{q}, \tilde{q}_0^{\mathrm{w}}),$$

$$Z = \theta(r) \times [\alpha - \tilde{q}] \equiv Z(r, \tilde{q}).$$

Finally, we develop an expression for the joint (sum of) domestic and foreign welfare. As before, using the equilibrium condition that the volume of domestic imports $(\alpha - \tilde{q}) - [\tilde{q} - \phi(r)]$ must equal the volume of foreign exports $\tilde{q}_0^*$, the world price $\tilde{q}_0^{\mathrm{w}}$ again cancels from the sum of domestic and foreign tax revenue:

$$\mathrm{TR}(r, \tilde{q}, \tilde{q}_0^{\mathrm{w}}) + \mathrm{TR}^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}) = [\tilde{q} - \tilde{q}_0^* - \phi(r)] \times \{(\alpha - \tilde{q}) - [\tilde{q} - \phi(r)]\}$$
$$\equiv g(r, \tilde{q}, \tilde{q}_0^*).$$

With this and the above expressions for W and W^*, we may write

$$\begin{aligned} W + W^* &= W(r, \tilde{q}, \tilde{q}_0^{\mathrm{w}}) + W^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}}) \\ &= \mathrm{CS}(\tilde{q}) + \mathrm{PS}(r, \tilde{q}) + \mathrm{PS}^*(\tilde{q}_0^*) + g(r, \tilde{q}, \tilde{q}_0^*) - Z(r, \tilde{q}) \qquad (26) \\ &\equiv G(r, \tilde{q}, \tilde{q}_0^*). \end{aligned}$$

Consider now the efficient policy choices in this environment. As before, in addition to the regulatory standard r, efficiency ties down only the sum of τ and τ^*, not their individual levels. Using the expression for joint welfare given in equation (26), the efficient policy choices must satisfy the following two first-order conditions:

$$\begin{aligned} W_{\tilde{q}} \frac{d\tilde{q}}{d\tau} + W^*_{\tilde{q}_0^*} \frac{d\tilde{q}_0^*}{d\tau} &= 0, \\ W_r + W_{\tilde{q}} \frac{d\tilde{q}}{dr} + W^*_{\tilde{q}_0^*} \frac{d\tilde{q}_0^*}{dr} &= 0. \end{aligned} \qquad (27)$$

To facilitate comparison with the Nash conditions, it is helpful to rewrite the conditions for efficiency contained in equation (27) in a slightly different form. To this end, consider the changes in τ and r that would hold fixed $\tilde{q}_0^*$—and with τ^* unchanged, also hold fixed $\tilde{q}_0^{\mathrm{w}}$ according to equation (3). Using equation (23), we have

$$\frac{d\tau}{dr}\Big|_{d\tilde{q}_0^*=0} = \frac{-d\tilde{q}_0^*/dr}{d\tilde{q}_0^*/d\tau} = \frac{\phi'(r)}{2} = \frac{-d\tilde{q}_0^{\mathrm{w}}/dr}{d\tilde{q}_0^{\mathrm{w}}/d\tau} = \frac{d\tau}{dr}\Big|_{d\tilde{q}_0^{\mathrm{w}}=0}. \qquad (28)$$

Solving the top expression in equation (27) for $W^*_{\tilde{q}_0^*}$, substituting this into the bottom expression in equation (27), and using equation (28) allows the conditions for efficiency to be reexpressed as

$$\begin{aligned} W_{\tilde{q}} \frac{d\tilde{q}}{d\tau} + W^*_{\tilde{q}_0^*} \frac{d\tilde{q}_0^*}{d\tau} &= 0, \\ W_r + W_{\tilde{q}} \left(\frac{d\tilde{q}}{dr} + \frac{d\tilde{q}}{d\tau} \frac{d\tau}{dr}\Big|_{d\tilde{q}_0^{\mathrm{w}}=0} \right) &= 0. \end{aligned} \qquad (29)$$

The bottom condition in equation (29) can be interpreted as the (domestic) "national" condition for efficiency (see Bagwell and Staiger 2001): it describes the choices of τ and r that maximize domestic welfare, holding fixed $\tilde{q}_0^{\mathrm{w}}$—and with τ^* unchanged, holding fixed as well $\tilde{q}_0^*$ and hence $W^*(\tilde{q}_0^*, \tilde{q}_0^{\mathrm{w}})$. The top condition in equation (29) then ties down the trade volume and can be interpreted as the "international" condition for efficiency.

We now turn to the Nash policy choices. The Nash policy choices

satisfy the first-order conditions that define the domestic and foreign best-response policies:

$$\begin{aligned} W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\tau} &= 0, \\ W_r + W_{\tilde{q}}\frac{d\tilde{q}}{dr} + W_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{\mathrm{w}}}{dr} &= 0, \end{aligned} \tag{30}$$

and

$$W^*_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^*}{d\tau^*} + W^*_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\tau^*} = 0. \tag{31}$$

With analogous steps to those described just above, we may rewrite the conditions for the domestic best-response policies contained in equation (30) in a slightly different form:

$$\begin{aligned} W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{\mathrm{w}}}{d\tau} &= 0, \\ W_r + W_{\tilde{q}}\left(\frac{d\tilde{q}}{dr} + \frac{d\tilde{q}}{d\tau}\frac{d\tau}{dr}\Big|_{d\tilde{q}\tilde{0}=0}\right) &= 0. \end{aligned} \tag{32}$$

Nash policies satisfy equations (31) and (32).

Notice that the top condition in equation (32), when added to equation (31), implies, after some simplification, that

$$W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W^*_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^*}{d\tau} + S^{*\mathrm{N}} = 0,$$

which is different from the top condition in equation (29), which must be satisfied by efficient policies; but the bottom conditions in equations (29) and (32) are the same. This confirms the feature noted above in our earlier analysis, that the inefficiency of the Nash equilibrium can be traced to a single source: Nash tariffs are higher than is efficient, and Nash trade volumes are correspondingly too low; conditional on Nash trade volumes, however, the domestic standards are set efficiently in the Nash equilibrium (that is, they satisfy the national condition for efficiency expressed in the bottom condition of equation [29]).

We can now ask, Will nondiscriminatory standards remain undistorted when countries agree to eliminate tariffs if the consumption tax t is not available to the domestic government in the industry under consideration? To answer this question, notice that binding the domestic tariff at free trade (or any level below the best-response level) but per-

mitting the domestic government to choose its best-response regulatory standard implies the two conditions

$$W_{\tilde{q}}\frac{d\tilde{q}}{d\tau} + W_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{w}}{d\tau} > 0,$$
$$W_r + W_{\tilde{q}}\frac{d\tilde{q}}{dr} + W_{\tilde{q}\tilde{0}}\frac{d\tilde{q}_0^{w}}{dr} = 0. \tag{33}$$

The top condition of equation (33) says simply that, as it is bound below its best-response tariff level, the domestic country would (by definition) benefit from a unilateral increase in its tariff. But then, with similar steps to those described above, we may derive that

$$W_r + W_{\tilde{q}}\left(\frac{d\tilde{q}}{dr} + \frac{d\tilde{q}}{d\tau}\frac{d\tau}{dr}\Big|_{d\tilde{q}\tilde{0}=0}\right) < 0. \tag{34}$$

As a comparison of equation (34) and the bottom condition for efficiency in equation (29) confirms, eliminating tariffs induces the domestic country to distort upward its nondiscriminatory standard r relative to the efficient level.

Intuitively, when the domestic government loses the ability to use its tariff as a means of reducing $\tilde{q}_0^{w}$ and thereby manipulating the terms of trade to its advantage, it will search for other means of doing so. Raising its nondiscriminatory regulatory standard r is one such means, as the bottom expression of equation (23) confirms; and when adjustments in a product-level consumption tax are not possible, as we have assumed here, upward distortions in regulatory standards become attractive for the domestic government in this setting once it commits to a policy of free trade, because a portion of the cost of compliance with these higher standards is shifted onto foreign producers in the form of a lower $\tilde{q}_0^{w}$.

3.4. A Market-Access Preservation Rule

We next briefly explore an alternative approach to preventing the prospect of international cost shifting from distorting domestic tax and regulatory policy choices. To this end, let us return to the situation considered in Section 3.1, in which countries agree to eliminate tariffs and also agree not to impose discriminatory consumption taxes on imported goods, but where national treatment in regulation is not required. Instead, suppose that the trade agreement includes the following rule: if, subsequent to the agreement, a nation alters its nontariff policies, then it will simultaneously adjust its tariff so that its combined tariff and nontariff policy adjustments do not alter the volume of imports it de-

mands at the existing terms of trade. If we use the phrase "market access" to denote the volume of imports demanded at given terms of trade, then we can think of this as a market-access preservation rule. The question we wish to ask is whether countries could achieve efficient policies under the described agreement in the presence of such a rule. The answer turns out to be yes, and the logic is simple to describe (see Bagwell and Staiger [2001] for a related discussion).

Specifically, with the agreed elimination of tariffs ensuring that tariffs are set at their efficient (and politically optimal) free-trade level, we need only check that the domestic government would have no incentive to alter its tax and regulatory policies from their Nash and efficient (and politically optimal) levels under the terms of the market-access preservation rule. Under this rule, however, the allowable adjustments in the domestic country's policies cannot alter the volume of imports it demands at the existing terms of trade $\tilde{q}_0^w$; and as the volume of exports offered by foreign producers is also unchanged at the existing terms of trade, it follows that the market-clearing terms of trade $\tilde{q}_0^w$ cannot itself be affected by the policy adjustments available to the domestic government under this rule. But then, employing arguments similar to those made in rewriting the efficiency conditions of the previous section, it can be shown that in selecting its preferred levels of t, r, and ρ, the domestic government is induced to satisfy the middle three conditions for political optimality contained in equation (17), with the first and last conditions in equation (17) then being satisfied by the negotiated commitment to free trade. Hence, the described tariff agreement, in combination with the market-access preservation rule, implements the politically optimal policies and therefore achieves the efficiency frontier.[18]

A notable feature of the market-access preservation rule in this environment is that, to deliver its desirable impact, it must be defined with respect to the world price of the unregulated good $\tilde{q}_0^w$ rather than with respect to $\tilde{q}^w$, the world price of the version of the good actually being

18. A simple way to see that this must be true is to note that efficiency will be achieved under the free-trade agreement if only the domestic government does not alter its domestic tax and regulatory policies from their Nash levels. Note as well that the market-access preservation rule, by preserving $\tilde{q}_0^w$, must also preserve the level of foreign welfare $W^*(\tilde{q}_0^*,\tilde{q}_0^w)$, because τ^* and hence $\tilde{q}_0^*$ must also be unchanged; but then, with the elimination of tariffs and beginning from the Nash domestic tax and regulatory policies, the efficiency of this starting point ensures that it is impossible for the domestic government to find alternative domestic tax and regulatory policies to the Nash policies that would satisfy the market-access preservation rule (and thereby preserve the level of foreign welfare) and yet make itself better off.

imported by the domestic country under its chosen standard. The reason is simple to understand in light of the above analysis: a rule that prevents the domestic country from altering the foreign exporter price of the unregulated good as it considers various levels of domestic taxes and regulatory standards ensures that the domestic country pays the full price of higher standards and taxes and—as it also enjoys the full benefits—therefore makes internationally efficient policy choices.

3.5. A Note on Regulatory Prohibitions

Thus far we have focused on identifying the problems that arise absent a trade agreement, and we have evaluated the efficacy of various GATT/WTO rules in serving the purpose of addressing these problems. To this end, our formal analysis has emphasized circumstances where Nash taxes and regulatory standards are set at nonprohibitive levels with regard to trade flows for the product under consideration (so that $S^{*N} > 0$). Yet many of the actual WTO disputes that we list in the introduction and discuss further in our legal analysis below involve outright prohibitions on certain categories of imports. It is therefore important to consider the extent to which our conclusions apply to regulatory prohibitions.

We first observe (as we hint at in our beef hormones illustration in the introduction) that our formal analysis can be interpreted naturally in a way that applies to such situations directly. In particular, we can interpret a higher standard in the model as implying a longer list of banned substances and therefore corresponding to an import prohibition on a greater number of varieties of the product (that is, varieties that are substitutable in the eyes of consumers but contain banned substances).[19] For example, with reference to the asbestos case involving a French prohibition on imports of concrete construction forms reinforced with asbestos fibers, the product we have considered could be interpreted as concrete forms, and the regulatory standard could be interpreted as a maximum allowable health risk associated with the use of the product. Then, a particular choice of this standard could have the effect of prohibiting the importation into the domestic market of concrete forms that contain asbestos (because such concrete forms would exceed the maximum allowable health risk set by the domestic-country regulatory standard) without having the effect of prohibiting all imports of concrete

19. Indeed, recall that in our formal model there are a continuum of varieties of the product that are perfectly substitutable in the eyes of consumers but differ in their pollution-generating characteristics.

forms into the domestic country (because it is possible to produce varieties of concrete forms using reinforcing fibers other than asbestos—and therefore to meet the domestic regulatory standard—at a cost that, while higher, still allows some positive level of trade). If the effect of the standard is to lower the world price of the unregulated (asbestos-containing) concrete forms, and if exporters of compliant concrete forms to the domestic country charge a price that reflects this price plus the added cost of achieving regulatory compliance (that is, the added cost of substituting other reinforcing fibers for asbestos), then the price paid by the domestic country for imports of concrete forms that are compliant with the standard will not rise by the full cost of compliance (as in our illustration in the introduction), and the regulatory cost-shifting analysis in the model applies directly.

Hence, our formal analysis applies naturally in the case of regulatory prohibitions, provided only that these prohibitions do not have the effect of eliminating all imports of the product and its close substitutes. This characterization would seem to apply to most if not all of the cases of regulatory prohibitions that have been the subject of WTO disputes.

Nevertheless, if the domestic country were to choose a regulatory standard and tax policies for a product that did have the effect of completely eliminating trade in (all varieties of) the product in the Nash equilibrium, an implication of our model is that these unilaterally chosen policies would be efficient and there would be nothing for a trade agreement to do (this is easy to see from a comparison of equations [12] and [16] under the assumption that $S^{*N} = 0$). Intuitively, in the Nash equilibrium with no trade agreement, the importing nation could always replace its complete ban on imports with a very high tariff and/or regulatory standard that permits a very small amount of import volume. If it rejects this option and chooses instead to increase its tariff or standard to completely eliminate imports, the terms-of-trade consequences to the importing nation cannot be important for this choice (recall that the gain from terms-of-trade manipulation is proportional to the import volume); the choice to completely eliminate imports must (according to the model) be efficient.

This is a striking result, but in applying it to real-world situations it is important to keep in mind that the smooth trade volume adjustments described just above may be unavailable to real-world governments given the constraints under which they operate, and in such situations the result need not apply. In particular, what if a trade agreement already exists in the background that constrains the use of other policy instru-

ments? For example, again with reference to the asbestos case, suppose that France has committed itself to free trade in concrete forms. Subsequently, it receives new information about the health hazards of asbestos and wants to reduce its exposure to the health risks associated with imports of asbestos-containing concrete forms, but the costs of renegotiating to remove its tariff commitment with all affected trading partners are great. Likewise, suppose that a domestic consumption tax on the asbestos-containing products is unavailable, perhaps because it is administratively infeasible. As a consequence, suppose France views itself as having only one policy instrument at its disposal—a potential regulatory prohibition on the asbestos-containing products. And finally, suppose that producing concrete forms without asbestos is simply not feasible, so that a ban on asbestos-containing concrete forms amounts to a complete prohibition on imports of concrete forms (and let us suppose as well that there are no close substitutes for concrete forms).

Such constraints may be particularly relevant for the regulatory choices of real-world governments, and this leads to our second observation: in this situation, the overregulation problem we have identified can still arise even though the noncooperatively chosen regulatory standard does prohibit all trade in the product under consideration. The source of the inefficiency is analogous to the regulatory cost-shifting inefficiency identified in previous sections and can be attributed to the fact that the domestic government ignores the cost that its decision imposes on foreign suppliers.[20] But the possibility of overregulation arises here, despite the complete elimination of trade under noncooperative policy choices, because tariff and tax policies are by assumption not an option, and regulatory choices exhibit significant discontinuities—by hypothesis, France either allows free importation of asbestos-containing concrete forms or prohibits the importation of concrete forms altogether, and it thus faces a choice that is discrete (dichotomous) with regard to

20. Our description of the inefficiency here corresponds to a slightly different but equivalent way of stating the point made formally in the earlier sections. To see the equivalence, recall that in the setting analyzed in the earlier sections where the regulatory choice is treated as continuous, in the Nash equilibrium the domestic government fails to take account of $W^{*}_{\bar{q}\theta}$, the impact of a marginal change in domestic-country policies on foreign welfare that travels through the terms of trade $\tilde{q}^{w}_{0}$, and similarly for the foreign government. If each government did take account of this impact, then, since $W^{*}_{\bar{q}\theta} + W_{\bar{q}\theta} = 0$, as we have noted, each country would be led not to value the terms-of-trade implications of its policy choices, and so its policies would correspond to the efficient politically optimal policies derived earlier.

trade volume of the product under consideration rather than marginal (smooth or continuous).

To confirm this second observation, we suppose now that the domestic country does not produce any of the product, so that the issue of national treatment does not arise. And, in addition to the assumption that $t \equiv 0$ as in Section 3.3, we assume that the domestic government is now limited to just two possible regulatory standards on the imported product, one (ρ_0) that is sufficiently lax as to be nonbinding on foreign producers in the industry under consideration, and the other (ρ_1) sufficiently stringent that it shuts down all trade in the industry. And finally, we assume that the domestic and foreign trade policies τ and τ^* are constrained to zero by an existing agreement.

In this environment, the possibility of inefficient overregulation of imported products can be seen very simply. In particular, observe from equation (7) that domestic welfare in this industry is given by the sum of consumer surplus and the cost of the eyesore pollutant generated by consumption (there is no producer surplus because by assumption there are no domestic producers in this industry, and there is no tax revenue because by assumption all taxes are constrained to zero); similarly, by (8), foreign welfare in this industry is just producer surplus. Hence, under the regulatory choice ρ_1, which by assumption amounts to a total prohibition on foreign exports, domestic welfare and foreign welfare are each zero in this industry, and therefore joint domestic and foreign welfare in the industry is also zero.

Now consider the regulatory choice ρ_0, which amounts to a laissez-faire regulatory standard. Domestic welfare in the industry is now given by (free-trade) consumer surplus minus the utility cost of the eyesore pollution. Clearly, for a range of parameterizations of the model this magnitude will be negative, implying that the domestic government acting unilaterally would choose ρ_1 and shut down trade in this industry (and achieve a domestic welfare payoff in the industry of zero) over the regulatory standard of ρ_0 (which delivers a negative domestic welfare payoff in the industry). Of course, the domestic government's unilateral regulatory choice does not take into account the cost that this choice imposes on the foreign country, which is the lost producer surplus. And it is easy to see that the lost foreign producer surplus could be larger than the domestic-country gain from shutting off trade with ρ_1 for a range of model parameters, which is to say that the joint domestic and foreign welfare under the regulatory choice ρ_0 could be positive. In these circumstances, then, the domestic country's unilateral choice is ineffi-

cient: starting from the unilateral import prohibition implied by ρ_1, if the two governments were to come together and negotiate, they could implement the nonprohibitive regulatory standard ρ_0 and both enjoy gains from an appropriate distribution of the larger joint surplus.[21]

Hence, as the above discussion suggests, our formal analysis applies naturally in the case of regulatory prohibitions. And indeed, once a number of further constraints are introduced that may be particularly relevant for the regulatory choices of real-world governments, the incentive to overregulate imported products may extend to an even wider set of circumstances than our formal analysis indicates.

3.6. Summary and Interpretation

We now provide a summary and further interpretation of the results to aid in the legal analysis below. Consider first the symmetric benchmark case where the domestic and foreign producers have identical externality-generating and compliance-cost functions. Under the assumption that both governments are national income maximizers, the efficient trade policy is free trade. The efficient regulatory standard for imported and domestic goods equates the marginal benefit of an increase in the standard (which reduces the externality) with the marginal increase in compliance cost. The optimal standard will be the same for both imported and domestic goods (given the technological symmetry assumption). The efficient consumption tax is equal to the marginal social cost of the externality produced per unit of the good consumed.

In the Nash equilibrium, however, an international externality arises because governments fail to take account of the impact of their decisions on foreign (producer) surplus. With unconstrained trade policy instruments, the result is inefficiently high tariffs and export taxes much as in the classic model of Johnson (1953–54). Absent constraints on border

21. It is now also easy to see that dichotomous regulatory policies alone, without the addition of constraints on border measures, cannot create this possibility, because if the home government has unconstrained tariff choices it could always do at least as well with a unilateral choice of the lax regulation ρ_0 and a (possibly prohibitive) tariff as it could with the prohibitive regulatory choice ρ_1, and so it would never (strictly) prefer to adopt the prohibitive regulation as a unilateral act. And beginning with the regulation ρ_0, if the home government still chooses to shut down trade completely with its tariff choice, the marginal conditions associated with that decision must then apply, and the marginal cost to the foreign exporting country of eliminating the last unit of trade (and hence completely eliminating trade) is zero, thereby ensuring that on the margin no foreign costs are ignored by the home government's unilateral decision to block all trade, which then ensures the efficiency of this decision.

instruments, however, there is no reason to distort domestic taxation or regulation—the externality flows entirely through trade policy. This result follows from the fact that the most direct way to exploit national market power over foreign exporter prices is the tariff or export tax.

If the importing and exporting nations enter a trade agreement to eliminate the distortion of trade policies in Nash equilibrium, however, the potential for other distortions arises. Most obviously, a constraint on tariffs is meaningless if the importing nation can substitute a discriminatory consumption tax. Thus, one would expect a trade agreement constraining tariffs also to prohibit discriminatory consumption taxes. If such discrimination is barred but regulatory policies remain unconstrained, a discriminatory regulatory standard will emerge that disfavors imported goods. Like the tariff or discriminatory consumption tax, the discriminatory regulatory standard exploits the fact that foreign suppliers will reduce their prices (for the unregulated good) in response to it, thus externalizing costs of regulatory compliance.

If the trade agreement also prohibits discrimination through regulatory standards, the analysis changes but the possibility of inefficiency remains. If both consumption taxes and regulatory standards must obey a nondiscrimination rule, then consumption taxes will tend to exceed the efficient level because they can still extract surplus from foreign suppliers. Consumption taxes are an inferior instrument for this purpose compared to a tariff because they also tax domestic products, but they will still be used to some degree if tariffs are infeasible. Regulatory standards are not distorted in this scenario, however, a result that is best understood by analogy with the discussion above: if both consumption taxes and regulatory standards must obey a nondiscrimination rule, then the consumption tax again dominates the regulatory standard for purposes of exploiting national market power over foreign exporter prices, just as in the case where tariffs or discriminatory consumption taxes and discriminatory regulatory policies are allowed. Finally, if the ability of the importing nation to use (nondiscriminatory) consumption taxes at the product level is for some reason constrained, as we believe to be the case often in practice, an upward distortion of the (nondiscriminatory) regulatory standard will arise because foreign suppliers absorb part of the regulatory compliance cost.

The potential distortions that arise despite the imposition of nondiscrimination requirements on both taxes and regulation can be addressed in principle through a legal rule that prohibits the importing nation from imposing any domestic tax or regulatory policy that lowers the price of

the imported good (net of regulatory compliance costs) received by foreign exporters—what we term the market-access preservation rule. Under such a rule, domestic measures that affect the net prices received by exporters are permissible but their effects on those prices must be undone through offsetting changes in trade policy. This rule effectively ensures that the importing nation will internalize the externality on foreign suppliers from changes in tax and regulatory policies, and it will induce efficient policy choices.

The analysis is more complicated when the foreign and domestic industries are asymmetrical. If their respective externality and compliance-cost functions differ, the efficient policy will not in general involve the same regulatory standard for both industries, or even produce the same marginal externality for each unit of imported and domestic goods. Likewise, a role for border instruments (tariffs or subsidies) survives to the degree that imported goods cause greater or lesser external harm per unit than domestic goods. The asymmetrical case thus suggests some justification for deviation from nondiscrimination requirements under appropriate circumstances, depending on exactly what is meant by "nondiscrimination." Whether useful deviations can be identified in practice, however, and can be insulated from protectionist capture is another matter.

As noted, our results are derived from a model in which governments maximize the traditional measure of economic welfare (net of the utility costs of pollution). Much of the recent trade policy literature, by contrast, including Grossman and Helpman (1994) and Bagwell and Staiger (2001), assumes instead that governments maximize a function that depends on distribution as well as efficiency. Grossman and Helpman provide microfoundations for the introduction of "political economy weights" into the welfare function, reflecting the notion that some interest groups are better organized than others. Bagwell and Staiger allow the welfare function to depend in a very general way on local prices, which also implies that certain interest groups may be favored. The introduction of such considerations into our framework would afford other incentives for policy intervention and, among other things, would potentially alter the result that free trade is (politically) efficient in the symmetrical case. But a more general political economy approach would not alter the basic insights from our model. As long as governments may be presumed to ignore the harm to foreign surplus associated with their policy decisions in Nash equilibrium, the same externalities that drive

our results would remain and the same tendencies toward policy distortion would arise.[22]

Finally, we wish to address a critique of the terms-of-trade framework for modeling trade agreements provided by Regan (2006). Formally, our modeling approach posits that when governments formulate their policies unilaterally, they "take account" of the effects of their policy decisions on the terms of trade for their own welfare (but ignore the impact of their decisions on foreign surplus, as we have indicated in the text above and in note 20). As we have demonstrated, this phenomenon gives rise to a reason for governments to constrain their tariff levels through a trade agreement and at the same time indicates that domestic regulatory policies—even nondiscriminatory ones—may be distorted away from efficient levels when tariffs are constrained. Regan objects to the analysis of such models, arguing that government decision makers do not in fact "take account" of terms-of-trade effects at all (or even appreciate their existence) when formulating public policy.

Regan then combines his objection to the modeling approach with an implication of the modeling approach—that governments would make internationally efficient (politically optimal) policy choices if they did not consider the terms-of-trade effects of their policy choices—to support the following proposition: because governments do not consciously seek to manipulate the terms of trade, their (nondiscriminatory) regulatory choices will be internationally efficient, and so "dispute settlement tribunals should give substantial deference to" these choices (Regan 2006, p. 955). We view this reasoning as mistaken. It is true according to the terms-of-trade theory that regulatory choices would be internationally efficient if all governments made their policy choices without regard to the terms-of-trade consequences. But if all governments behaved in this way without the constraints imposed by a trade agreement, as Regan argues, there would be no reason for a trade agreement to exist at all according to the terms-of-trade theory and hence no reason for dispute settlement tribunals. In the world that Regan posits,

22. This can be confirmed by noting that the introduction of political economy or distributional concerns would change the way governments feel about movements in local prices, but would still allow us to express the government objectives as functions of prices and standards as we have done here and would not change the properties of these functions with respect to the world price, which is the feature that underlies all of our results (see Bagwell and Staiger [2001] for an analogous point).

all national policy choices will be efficient, including the choice of tariffs in Nash equilibrium.[23]

Regan's error, in our view, is his failure to appreciate the fact that policy makers need not engage in conscious "terms-of-trade manipulation" for international inefficiency to arise. Even if conscious manipulation does not occur, unilaterally imposed trade restrictions injure foreign exporters if the trade restrictions cause them to earn less on their export sales than otherwise. This is precisely the injury that terms-of-trade theory captures. Terms-of-trade models may thus be interpreted to capture inefficiencies attributable to a political process in which domestic interest groups are represented and foreign interests are not. The resulting political equilibrium will then naturally tend to select policies that impose inefficient harms on foreign interest groups, and in particular harm due to the fact that tariffs, consumption taxes, regulatory standards, and the like may force foreign exporters to reduce their prices to remain competitive. As long as governments ignore such harm to foreign interests, they will tend to behave "as if" they were consciously manipulating their terms of trade.

4. IMPLICATIONS: THE STRUCTURE OF WTO OBLIGATIONS AND DISPUTES

We now turn to the implications of the model for understanding the WTO legal system. We argue that the core obligations of the system, and at least the bulk of the disputes that have arisen, are a response to the incentives for regulatory discrimination that arise when tariffs are restricted and consumption taxes are made subject to a nondiscrimination obligation. The more subtle issue is whether some parts of the system can be interpreted as going beyond the imposition of a nondiscrimination norm to deal with the distortions that may arise even from nondiscriminatory regulation.

4.1. The Original GATT

The central objective of GATT, which was concluded in 1947, was to reduce tariffs that had risen dramatically prior to World War II. The negotiated tariff ceilings were termed "bindings."

The drafters of GATT anticipated that two potential distortions of

23. Of course, some other (non-terms-of-trade) explanation for trade agreements to exist might be introduced (though it is not in Regan's analysis), but unless that alternative reason is articulated it is impossible to evaluate whether it would provide an incentive for governments to distort their regulatory policies.

domestic policy might result from tariff bindings, both of which are highlighted in our formal analysis. First, they recognized that discriminatory consumption taxes are a ready substitute for tariffs. Accordingly, paragraph 2 of GATT Article III, the "national treatment" article, provides that imported goods "shall not be subject, directly or indirectly, to internal taxes or other internal charges of any kind in excess of those applied, directly or indirectly, to like domestic products." In addition, internal taxes and other internal charges may not be applied across "directly competitive or substitutable products" in a manner "so as to afford protection to domestic production." The obvious intention of these provisions is to disable the use of discriminatory internal taxation for protective purposes, while recognizing that tax differentials for other purposes—particularly when imposed on products that are not in a competitive relationship—may be justified.[24]

Second, the drafters anticipated that tariff bindings coupled with a nondiscrimination principle for internal product taxes might lead member states to use regulatory measures for protective purposes. Thus, Article III, paragraph 4, provides that imported products "shall be accorded treatment no less favourable than that accorded to like products of national origin in respect of all laws, regulations and requirements affecting their internal sale." The evident intention once again is to disable the use of regulatory and related legal measures for protection, while allowing regulators the flexibility to respond to differences across products that justify varying regulatory treatment. The rather crude mechanism devised for this purpose was a limitation of the nondiscrimination rule to imported and domestic "like products." The treaty text also couched the nondiscrimination rule as an obligation to afford "treatment no less favourable," impliedly recognizing that formally identical treatment is neither necessary nor sufficient.

It is noteworthy that GATT did not go beyond the creation of nondiscrimination norms. Nothing in its text specifically addresses the po-

24. We note in passing one potentially worrisome "loophole" in the structure of Article III. Although discriminatory taxation is prohibited, Article III(8)(B) provides that subsidies to domestic producers are not a violation of the national treatment obligation. Thus, in principle, a nation might mimic the effects of discriminatory taxes—and indeed, mimic an import tariff—by enacting a nondiscriminatory tax and then using the proceeds to fund domestic producer subsidies. If such a policy were transparent, we conjecture that it might be deemed to violate Article III as a disguised form of discriminatory taxation. Interestingly, precisely such an arrangement was deemed unconstitutional in the United States under the "dormant commerce clause" in *West Lynn Creamery v. Healy*, 512 U.S. 186 (1994). See generally Sykes (2010).

tential distortions that may arise even with nondiscriminatory policies (we will address the possibility of "nonviolation" claims in a moment).

One small puzzle in the original GATT is the fact that the national treatment obligations of Article III apply to all products, irrespective of whether they are the subject of a negotiated tariff binding. Absent a binding, why should domestic tax and regulatory policies be constrained? An answer to this puzzle is also suggested by our model—before tariff bindings are negotiated, an importing nation has no reason to adopt discriminatory domestic tax and regulatory policies. If measures that violate the national treatment obligation will only arise in response to the negotiation of tariff commitments, a general prohibition on discriminatory policy has no effect except on products covered by bindings.[25]

Moreover, moving beyond our model, and as we observed earlier (see note 15), it is clear that the regulatory cost-shifting motives that we have highlighted in our two-country setting will extend naturally to a many-country version of our model, where discrimination among different foreign suppliers (with tariffs if possible, or with domestic tax and regulatory policies if tariffs are constrained) may be attractive. This observation suggests that the most-favored-nation obligation in GATT Article I, which prohibits tariff discrimination irrespective of whether the tariffs in question are the subject of a negotiated tariff binding, also places constraints on the ability of governments to use tariffs for cost-shifting purposes. This situation may create incentives for domestic tax and regulatory cost shifting that exists even in the absence of tariff bindings and hence may help to explain why domestic tax and regulatory policies are subject to a national treatment obligation even absent a tariff binding.

4.2. The Nonviolation Doctrine

Article XXIII of GATT contained the dispute resolution provisions. Interestingly, it did not simply focus on breach of obligations. Rather, it introduced the concept of a "nullification or impairment" of obligations

25. This position is strengthened if general equilibrium effects are taken into account, because a tariff binding in one sector will generally introduce incentives to distort domestic tax and regulatory policies in other sectors as well once the (general equilibrium) effects of the tariff binding spread to the rest of the economy. On the other hand, a caveat to this position arises in the case of asymmetric technologies, though as we discuss in the previous section the case for discriminatory tax and regulatory treatment of imports on the basis of such asymmetries seems weak.

as a basis for disputes and provided that nullification or impairment could result, among other things, from "the application by another contacting party of any measure, whether or not it conflicts with the provisions of this Agreement." This provision was understood to reflect the possibility that GATT commitments might be undermined by measures that did not violate the letter of GATT but that nevertheless impaired market access. Claims of nullification or impairment that rest on measures not inconsistent with GATT are known as "nonviolation" claims. They represent the closest analogue in the WTO system to the "market-access preservation" rule that we consider in our formal analysis.

Even if GATT Article III is limited to situations involving some demonstrable discrimination ("less favourable treatment"), might a nonviolation claim be employed to challenge nondiscriminatory regulation that impairs market access? The matter is subject to some uncertainty, but we suspect that the answer is no.

Over the history of the WTO/GATT system, only three nonviolation claims have been successful (resulting in panel reports adopted by the membership). None of these cases involved domestic regulation; instead they involved unanticipated changes in subsidies programs or tariff reclassifications.[26] The touchstone of these cases has been a change in

26. In the first, Chile brought a claim against Australia over a change in farm subsidy policy. Chile had negotiated a tariff concession on its exports to Australia of a type of fertilizer that competed with another type of fertilizer. At the time, Australia subsidized the purchase of both types by farmers. Subsequently, Australia discontinued the subsidy on the type exported by Chile while maintaining the subsidy on the competing product. The working party found that the change in policy by the Australian government would impair benefits owing to Chile if the change in policy "could not reasonably have been anticipated by the Chilean government . . . at the time it negotiated (the tariff commitment)" (*Australian Subsidy on Ammonium Sulphate*, II Basic Instruments and Selected Documents [BISD] 188, 193 [1952]; working party report adopted April 3, 1950). In the second case, Germany had negotiated a tariff concession on sardines imported from Norway. At the time of the negotiation, competing species of fish were classified under the same tariff heading and given the same tariff treatment. Germany subsequently changed the tariff classification system to distinguish among species, however, resulting in a higher tariff on the Norwegian product than on its competitors (*Treatment by Germany of Imports of Sardines*, 1st Supp. BISD 53 [1953]; panel report adopted October 31, 1952). In the third case, the United States secured duty-free treatment for its exports of oilseeds to the European Union in 1962. Some years later, the EU introduced agricultural subsidy programs that encouraged the production of oilseeds within the EU. The panel ruled that GATT members must "be assumed to base their tariff negotiations on the expectation that the price effect of the tariff concessions will not be systematically offset." The unanticipated subsidy program for domestic producers upset those expectations (*EEC—Payments and Subsidies Paid to Processors and Producers of Oilseeds and Related Animal-Feed Proteins*, par. 148, 37th Supp. BISD 86; panel report adopted January 25, 1990).

policy by the importing nation that could not have been anticipated by the complainant at the time of tariff negotiations and that significantly impairs export opportunities.

Only one challenge to domestic regulation has been brought forth in a nonviolation claim. The French regulation at issue in *EC—Asbestos* prohibited Canadian exports of concrete forms reinforced with asbestos fibers. Canada claimed that such products were "like" concrete forms reinforced with other fibers and hence that the regulation afforded "less favourable treatment" to imported (asbestos-containing) products relative to domestic like products, in violation of GATT Article III, paragraph 4. The dispute panel agreed[27] (a finding later overturned by the Appellate Body[28]), but nevertheless held that the French regulation was permissible under the "exception" to GATT obligations contained in Article XX(b) regarding measures "necessary" to protect human health.

Canada then argued that even if the regulation did not violate GATT, it nevertheless upset Canada's reasonable expectations of market access and should be deemed the basis for a nonviolation finding. The panel rejected that claim in a finding that was not overturned by the Appellate Body. The reasoning of both the panel and the Appellate Body casts serious doubt on the prospect of successful nonviolation claims relating to domestic regulation in the future.

Among other things, the Appellate Body emphasized (as had various panels) that the nonviolation claim "should be approached with caution and should remain an exceptional remedy" (Appellate Body report, par. 186). And in a part of its opinion not addressed by the Appellate Body, the panel remarked, "By creating the right to invoke exceptions in certain circumstances [through Article XX], Members have recognized a priori the possibility that the benefits they derive from certain concessions may eventually be nullified or impaired at some future time for reasons recognized as being of overriding importance. This situation is different from that in which a Member takes a measure of a commercial or economic nature such as, for example, a subsidy or a decision organizing a sector of its economy, from which it expects a purely economic benefit." It further stated, "[W]e consider that in view of the time that elapsed between [the tariff] concessions and the adoption of the [French] Decree (between 50 and 35 years), Canada could not assume that, over such a

27. See *European Communities—Measures Affecting Asbestos and Asbestos-Containing Products*, WT/DS135/R, panel report adopted (as modified) April 5, 2001.

28. See *European Communities—Measures Affecting Asbestos and Asbestos-Containing Products*, WT/DS135/AB/R, Appellate Body report adopted April 5, 2001.

long period, there would not be advances in medical knowledge with the risk that one day a product would be banned on health grounds." Accordingly, the panel ruled that a complainant bears a greater burden of proof in a case involving a challenge to a regulation that is permitted by Article XX. Likewise, despite the tariff commitment covering the products at issue, Canada had no "legitimate expectation" that France would refrain from regulating asbestos-containing products for health reasons.

To be sure, the ruling in *Asbestos* does not foreclose the possibility of a nonviolation claim based on a change in regulatory policy. But the passages quoted above strongly suggest that changes in regulatory policy, particularly if they are motivated by genuine concerns for matters such as public health, will be deemed foreseeable and thus do not frustrate the legitimate expectations associated with tariff concessions.

There is yet another obstacle to a successful nonviolation claim based on changes in regulatory policy. *Japan—Film* involved a claim by the United States that certain governmental measures in Japan had contributed to the exclusion of U.S. film producers (Kodak) from the Japanese retail film market. In a decision that was not appealed, the panel ruled against the United States[29] and along the way rejected the U.S. nonviolation claim. Relying on earlier nonviolation cases, the panel held that the complainant in a nonviolation case must "prove that the governmental measures that it cites have upset the competitive relationship between domestic and imported" products. It is not enough that the measure has affected "trade flows" (panel report, pars. 10.83–10.88). Thus, in the view of the panel, a successful nonviolation claim in effect requires a showing that the regulatory measure produces some discrimination, de jure or de facto, between imported and domestic products. The *Asbestos* panel also accepted this proposition, but found discrimination on the premise that Canadian products that were "like" French products had been banned.

Thus, the pertinent nonviolation decisions to date all seem to suggest that the measure in question must somehow favor domestic over imported goods. A regulatory measure that disadvantages them equally (in nondiscriminatory fashion) seems outside the scope of the doctrine.

Should nonviolation cases be limited in this fashion? Our formal analysis raises some question about the wisdom of this limitation given

29. *Japan—Measures Affecting Consumer Photographic Film and Paper*, WT/DS44/R, panel report adopted April 22, 1998.

that compliance cost externalization by large countries may, in some circumstances, lead to economically excessive regulation that is nondiscriminatory. Yet, if nondiscriminatory changes in regulatory policy could be expected to trigger an entitlement to compensation or retaliation under WTO law, other problems would likely arise. Among other things, new information can develop over time that changes the apparent need for regulation. The degree of market access that is negotiated at one point in time may no longer be politically optimal later. If nations were nevertheless required to preserve market access in the face of new information justifying stricter regulation or else face retaliation from their trading partners, a disincentive to economically desirable regulation might develop.[30] Further, any effort to devise a rule that distinguished between sound and unsound changes in regulatory policy would likely be fraught with error and uncertainty. In the face of such challenges, perhaps it makes sense to embrace a presumption that nondiscriminatory changes in regulatory policy would normally fall outside the strictures of the nonviolation doctrine, while leaving open the possibility that a nonviolation claim could be brought in exceptional circumstances (to ward off cases of obvious abuse).

4.3. The Technical Barriers Agreements

Over time, GATT members became dissatisfied with the national treatment obligation of GATT Article III as the sole textual basis for disciplining regulatory policies that adversely affect international trade. During the Tokyo Round of GATT negotiations in the 1970s, the first supplementary agreement on regulatory matters emerged, the Agreement on Technical Barriers to Trade, popularly known as the Standards Code. The Standards Code was a plurilateral agreement to which 46 GATT members ultimately acceded. During the Uruguay Round, further negotiations on technical barriers went forward in two different negotiating groups—the technical barriers group and the agriculture group. These negotiations resulted in two new agreements, the WTO Agreement on Technical Barriers to Trade (TBT) and the WTO Agreement on Sanitary and Phytosanitary Measures (SPS), both of which were accepted by all

30. In principle, this disincentive could be reduced through calibration of allowable foreign retaliation to a level that cannot exceed a reciprocal withdrawal of concessions and therefore to a level that might approximate a system of efficient breach (see Schwartz and Sykes 2002; Howse and Staiger 2006). In practice, of course, such calibration would be hard to achieve in light of the difficulty of assessing the trade impacts of domestic regulatory reform.

WTO members. Roughly speaking, the SPS Agreement applies to measures adopted to protect human, animal, or plant health from the spread of pests and from dangerous additives, contaminants, toxins, and disease-causing organisms contained in foodstuffs.[31] The TBT Agreement applies to all "technical regulations" and "standards" not covered by the SPS Agreement.[32]

Why was GATT Article III alone perceived to be inadequate? The main problem, in our view, was that regulatory discrimination can take subtle and nontransparent forms and can arise even if regulations are nondiscriminatory on their face. For the most part, therefore, the two technical barriers agreements serve to elaborate on the concept of "less favourable treatment" and thus to clarify and strengthen the nondiscrimination norm of the original GATT. It is possible to interpret aspects of the agreements as going beyond nondiscrimination principles, however, and we consider below whether that interpretation is convincing.

4.3.1. Elaborating Principles of Nondiscrimination. Many provisions of the TBT and SPS agreements have straightforward interpretations as corollaries of the nondiscrimination norm in GATT.[33] For example, both agreements require that regulatory measures be published through "enquiry points" that are made known to the WTO membership (TBT Agreement, art. 10.1; SPS Agreement, annex B, par. 3).[34] These requirements ensure that foreign firms seeking to do business in the market of a WTO member can readily ascertain what regulations are applicable and are not placed at a competitive disadvantage by their lack of information. Similarly, both agreements provide that new regulations must be publicized in advance of their effective dates absent emergency.[35] Such

31. See SPS Agreement, annex A. The full text of the agreement may be downloaded at http://www.wto.org/english/docs_e/legal_e/legal_e.htm.

32. See TBT Agreement, art. 1. The full text of the agreement may be downloaded at http://www.wto.org/english/docs_e/legal_e/legal_e.htm.

33. See Sykes (1995, 1999) for more extensive discussion of the legal provisions in both agreements.

34. Developed-country members also have an obligation to make all pertinent information available in English, French, and Spanish if requested to do so by another member (TBT Agreement, art. 10.5; SPS Agreement, annex B, par. 8). For good measure, a specific nondiscrimination rule prohibits charging more for such information when it is sold to foreign firms than when it is sold to domestic firms (TBT Agreement, art. 10.4; SPS Agreement, annex B, par. 4).

35. Any time a new regulation would depart from an established international standard, or would address an issue on which no international standard exists, advance notice must be given in the form of "notice in a publication at an early appropriate stage, in such a manner as to enable interested parties in other Members to become acquainted with it"

advance notice requirements protect foreign firms, which are less likely to have participated in the regulatory process, against unexpected changes in regulation that may require a considerable lead time for compliance.

Both agreements also embody an obligation to devise regulations that achieve their objectives with minimum disruption to trade—in legal parlance, an obligation to employ the "least restrictive means."[36] The least restrictive means requirement recognizes that regulatory objectives can often be achieved in a variety of ways, and firms may well differ as to which method is the cheapest for them. Regulations that require their objectives to be achieved in particular ways that are cheaper for domestic firms than for their foreign competitors are equivalent to regulatory discrimination. The least restrictive means principle avoids this problem. Thus, for example, a regulation governing fire doors in commercial buildings may be drafted to require a certain "burn-through" time for every door, but should not be drafted to require the use of particular materials (which may be chosen to favor domestic firms) where satisfactory performance can be achieved without them. Similarly, a regulation concerning emissions from automobiles may be drafted to require that emissions of particular pollutants fall below certain levels, but should not be drafted to require the use of a particular emissions control technology.

As a final example (our list here is by no means exhaustive), subtle and not so subtle forms of discrimination can creep into the process by which regulators certify compliance with their regulations, generally known as "conformity assessment." To illustrate, regulations that re-

(TBT Agreement, art. 2.9.1). Substantially equivalent language in the SPS Agreement may be found in annex B, paragraph 5(a). Direct notice must also be provided to the WTO Secretariat, indicating what products would be covered by the proposed regulation and how it would depart from any relevant standards promulgated by international agencies (TBT Agreement, arts. 2.9.2–2.9.3; SPS Agreement, annex B, pars. 5[b], [c]). Exceptions exist, as one might expect, where urgent matters of health, safety, or national security preclude this advance notice. All regulations must also be "published promptly" when they are adopted (TBT Agreement art. 2.11; SPS Agreement, annex B, par. 1).

36. The TBT Agreement provides that "technical regulations shall not be more trade-restrictive than necessary to fulfill a legitimate objective. . . . Such legitimate objectives are, inter alia, national security requirements, the prevention of deceptive practices, protection of human health or safety, animal plant life or health, or the environment" (art. 2.2). Article 2.8 further requires that regulations be drafted in terms of performance requirements rather than design requirements. The SPS Agreement's version of these principles requires members to "ensure that any sanitary or phytosanitary measure is applied only to the extent necessary to protect human, animal or plant life or health" (art 2.2). On the operation of the least restrictive means principle in WTO law, see Sykes (2003).

quire goods to be tested at a particular laboratory or by a particular method when equally good alternatives are available for certifying foreign products can inflate the costs of conformity assessment unnecessarily. Accordingly, the technical barriers agreements embody a number of principles designed to prevent explicit or implicit discrimination in the conformity assessment process. A national treatment obligation applies, a general least restrictive means requirement is in place, nations are prohibited from requiring information not reasonably necessary to conformity assessment, nations must process imported goods as expeditiously as they process domestic goods, the siting of testing facilities is not to be used to disadvantage foreign goods, and notice and publication requirements apply to the adoption of new conformity assessment procedures.[37]

4.3.2. Beyond Nondiscrimination? Our formal analysis indicates that nondiscrimination obligations alone may be inadequate to address all of the distortions that may arise in domestic tax and regulatory policies when tariffs are constrained. Can aspects of the technical barriers agreements be interpreted as addressing these additional externality problems? Our answer is "maybe."

With particular reference to consumption tax policy, nothing in the technical barriers agreements or elsewhere in WTO treaty text prevents importing nations from employing nondiscriminatory domestic consumption taxes as they see fit, even if a significant portion of the resulting tax revenue reflects an extraction of producer surplus from foreign suppliers. This observation hints that the system may be inattentive to the potential for surplus extraction through nondiscriminatory measures. Indeed, as our formal analysis suggests, taxes are likely the preferred method of surplus extraction (relative to product standards) because they enhance revenue for the importing nation. As long as product-specific consumption taxes are feasible and unconstrained except for a nondiscrimination rule, any extraction of surplus from foreign suppliers will tend to occur through taxation rather than through product regulation. Hence, given the WTO rules for consumption taxes, it is unclear whether the phenomenon of excessive (nondiscriminatory) regulation is

37. See, respectively, TBT Agreement, art. 5.1.1, and SPS Agreement, annex C, par. 1(a); TBT Agreement, art. 5.1.2, and SPS Agreement, annex C, par. 1(e); TBT Agreement, art. 5.2.3, and SPS Agreement, annex C, par. 1(c); TBT Agreement, art. 5.2.1, and SPS Agreement, annex C, par. 1(a)–(b); TBT Agreement, art. 5.2.6, and SPS Agreement, annex C, par. 1(g); TBT Agreement, art. 5.6, and SPS Agreement, annex C, par. 1(b).

an important one. We would expect it to arise only when product-specific consumption taxation is for some reason administratively or politically infeasible.

Nevertheless, certain aspects of the technical barriers agreements might be interpreted to go beyond the elaboration of a nondiscrimination norm. We will focus on four of them here—obligations to employ international standards, scientific evidence requirements, mutual recognition requirements, and consistency requirements.

International Standards. A number of international institutions develop and publish product standards of various kinds (including standards relating to quality, health, and safety).[38] The technical barriers agreements impose an obligation to employ international standards as the basis for regulation in appropriate circumstances (TBT Agreement, art. 2.4; SPS Agreement, art. 3.1). International standards, one might argue, represent a global "consensus view" on the appropriate extent of regulation. If a nation chooses to regulate more stringently even in a nondiscriminatory fashion, the argument might run, that fact is evidence that regulation is excessive and perhaps reflects the externalization of regulatory compliance costs. An obligation to employ international standards, therefore, might be seen as a mechanism for policing excessive regulation that might result from cost externalization.

But the obligation to use international standards is a limited one. Under the TBT Agreement, nations are free to adopt more stringent standards when international standards "would be an ineffective or inappropriate means for the fulfillment of the legitimate objectives pursued" by regulation (see art. 2.4). The TBT Agreement further recites in its preamble that "no country should be prevented from taking measures necessary" to achieve its regulatory objectives "at the levels it considers appropriate" as long as it complies with the agreement. Under the SPS Agreement, members may depart from international standards "if there is a scientific justification" or if a member determines that a higher level of protection is "appropriate" after conducting a "risk assessment" (art. 3.3). Collectively, these provisions suggest that WTO

38. The International Organization for Standardization (ISO) has jurisdiction to address design, safety, and quality concerns in product markets across the board and publishes thousands of standards as a result of its work. The Codex Alimentarius, affiliated with the United Nations, focuses mainly on food safety issues. A miscellany of other entities with standard-setting functions includes the International Labor Organization, the International Telecommunications Union, the International Institute on Refrigeration, the International Commission on Illumination, and others. See Sykes (1995).

members enjoy considerable freedom to select a target level of risk regardless of the costs of achieving the regulatory target, or the fact that the incidence of those costs may fall heavily on foreign exporters.

Scientific Evidence Requirements. The SPS Agreement contains a requirement that regulation be "based on scientific principles" and "not maintained without sufficient scientific evidence" except in cases of scientific uncertainty (arts. 2.2, 5.7).[39] A departure from international standards under the SPS Agreement also requires a "scientific justification" or a "risk assessment." These "scientific evidence requirements" might also be interpreted as limiting the ability of importing nations to regulate excessively, even if they do so in a nondiscriminatory fashion.

But their capacity to police excessive regulation is quite limited. The requirements of the SPS Agreement seem to state only that some scientific foundation must exist for the regulation that is undertaken—they do not require a balancing of the scientifically identified risk with the costs of eliminating it. In the "beef hormones" dispute between the United States and Europe, for example, the European prohibition on the sale of hormone-raised beef was found to violate the SPS Agreement because Europe could not point to scientific studies establishing a risk to human health from the low residues found in imported beef or to studies establishing a risk due to the failure of exporters to follow sound veterinary practices in the administration of growth hormones.[40] Had such studies been present, the scientific evidence requirements would have afforded no basis for rejecting Europe's zero-risk-tolerance policy, even if it had been a source of considerable regulatory cost shifting.

Mutual Recognition Requirements. The strongest mutual recognition requirement is contained in the SPS Agreement: "Members shall accept the sanitary or phytosanitary measures of other members as equivalent . . . if the exporting Member objectively demonstrates to the importing Member that its measures achieve the importing Member's appropriate level of sanitary or phytosanitary protection" (art. 4.1). The TBT Agreement is softer, requiring that "Members shall give positive consideration to accepting as equivalent technical regulations of other Members . . . provided they are satisfied that these regulations adequately fulfil the objectives of their own regulations" (art. 2.7). This language amounts

39. The TBT Agreement merely provides that in assessing the risks that are the subject of regulation, available scientific information is a "relevant consideration" (art. 2.2).

40. See WTO, *EC Measures Concerning Meat and Meat Products (Hormones)*, WT/DS26 and DS48/AB/R, report of the Appellate Body adopted February 13, 1998.

at least to an obligation to give reasons for refusing to accept foreign regulations as equivalent.

In principle, mutual recognition might be used to attack excessively stringent regulations that result from regulatory cost shifting—if less stringent regulatory standards abroad must be "recognized" as adequate, more stringent regulatory policies cannot be applied to imports. But a quick look at the language above makes clear that the mutual recognition requirements of the WTO do not require the "recognition" of less stringent standards in general. Rather, they carefully preserve the right of importing nations to choose their own "level of protection" and regulatory "objectives." And because mutual recognition is not required when foreign standards are inadequate to achieve the importing nation's regulatory objectives, these elements of WTO law can likely do little to police overly stringent regulatory policies.

Consistency Requirements. Finally, the SPS Agreement includes a "consistency requirement." Each member is obligated to "avoid arbitrary or unjustifiable distinctions in the levels [of protection] it considers appropriate in different situations" (art. 5.5). Consistency requirements might also in principle be used to police excessive regulation that results from the externalization of compliance costs—if the same type of hazard is regulated more stringently in settings where imports have a large share of the market than in settings where most of the goods are produced domestically, one might infer that the stricter regulation results from cost externalization.

Yet the consistency requirements of the SPS Agreement apply only to "arbitrary and unjustifiable distinctions" that "result in discrimination or a disguised restriction on international trade" (art. 5.5). This language suggests that they may be used sparingly, and the beef hormones dispute again provides a useful illustration. Although the complainants prevailed in that dispute based on the absence of an adequate scientific risk assessment, the Appellate Body nevertheless reversed a finding by the dispute panel that the consistency requirements were violated because Europe failed to regulate the consumption of products containing natural hormone residues (such as eggs) that contained higher hormone residues than the prohibited imports. The regulatory distinction between artificially added hormones and naturally occurring hormones was not "arbitrary and unjustifiable" in the view of the Appellate Body. It thus remains to be seen whether the consistency requirements of the

SPS Agreement will ultimately do much to address cases where the burdens of stiff regulatory standards fall heavily on foreign exporters.

In sum, like the nonviolation doctrine, the technical barriers agreements may ultimately do little to address inefficient but nondiscriminatory regulation. As noted in the introduction, the empirical importance of the problem is uncertain, although recent empirical research suggests that it cannot be dismissed out of hand. Likewise, the task of identifying excessive regulation seems enormously difficult. How can the law sensibly distinguish situations in which a nation is "overregulating" because it externalizes compliance costs from situations in which the nation has a bona fide interest in stringent regulation because of, for example, a higher implicit value of life or health? An international system that second-guessed the cost-benefit determinations of national regulators might intrude heavily on notions of national sovereignty and meet considerable political resistance. Although existing law leaves open the door to excessive product regulation in some scenarios, therefore, perhaps the problem cannot be solved in a manner that does more good than harm.

5. CONCLUSION

This paper employs a terms-of-trade framework to study the choice of regulatory policies in "large" open economies. We show how the standard terms-of-trade externality that affords a rationale for trade agreements to limit protection through border instruments can also lead to distortion of regulatory policies. In particular, and unlike existing "race-to-the-bottom" models, we show how terms-of-trade externalities may lead to discriminatory regulatory policies that inefficiently impose higher regulatory burdens on imports. A nondiscrimination rule applicable to domestic regulation is thus a useful legal principle for a trade agreement to incorporate. A nondiscrimination rule does not eliminate the danger of excessively stringent regulation, however, at least if product-specific consumption taxes are administratively infeasible. The task of identifying and policing inefficient, nondiscriminatory regulation is nevertheless surely a difficult one, which may explain why the WTO legal system does not do much to address it.

We emphasize that our analysis has been carried out under the assumption that the externality that generates the efficiency rationale for policy intervention is a purely domestic externality (that is, it does not cross international borders). To the extent that (nonpecuniary) externalities exist that have global reach (for example, global climate change),

the international cost-shifting problems that we have identified here are still relevant, but additional forces also come into play. In particular, cost-shifting motives aside, as a general matter unilateral attempts to address such international externalities (where other nations share in the benefits) would likely result in too little intervention and underregulation relative to efficient policy outcomes. How these opposing forces would play out in such a setting is an important question that we leave for future work.

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