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The Agreement on Subsidies and Countervailing Measures: Tying One's Hand through the WTO.

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THE AGREEMENT ON SUBSIDIES AND COUNTERVAILING MEASURES:

TYING ONE'S HANDS THROUGH THE WTO

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Abstract

Why would governments agree to restrict their own discretion in setting domestic policies as part of a trade agreement? This paper examines the welfare consequences of the GATT's Agreement on Subsidies and Countervailing Measures (SCM). If countries which join a trade agreement are given free reign over the use of domestic production subsidies, then after negotiating tariff reductions, governments could undermine the agreement by introducing production subsidies to import-competing producers that effectively act as trade barriers. The SCM restricts the use of domestic subsidies by countries which have joined the WTO. Specifically, governments may not use sector-specific subsidies (agriculture is an exception) but they may subsidize their producers if they offer the same subsidy to all producers in their economies. I show that through an agreement like the SCM, governments can better achieve their goals of maximizing domestic welfare. This occurs because

terms-of-trade concerns lead to subsidies in import-competing sectors that are higher than globally optimal and in export sectors that are lower than globally optimal. Therefore, a rule to require that subsidies be the same in all sectors forces a country to partially internalize these terms of trade externalities (by reducing subsidies to import-competing sectors and increasing subsidies to export sectors).

1   Introduction

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT 1994) introduced landmark trade liberalizations into key sectors of the world trading system. Among the achievements of the Round were agreements[1] to restrict the use of sector-specific government subsidies to production and exportation of almost all internationally traded goods. During the Uruguay Round, governments defined three types of subsidies - export subsidies, production subsidies, and R&D subsidies - and agreed to prohibit the use of all export subsidies. Recognizing the R&D subsidies play an important role in technological progress, governments agreed to allow countries to use R&D subsidies. Interestingly, with regard to the use of domestic production subsidies, the governments took a mixed approach. Wanting to give countries freedom with regard to domestic industrial policies, they decided to permit the use of production subsidies, but only if they are not sector-specific. In essence, governments maintain their freedom in setting domestic production subsidies, but they are constrained in that they must offer the same subsidy to all sectors in the economy.

With an active debate developing over whether or not the GATT should expand its role to include agreements over various domestic policies like labor and environmental standards, it is important to first understand the consequences of the GATT's existing restrictions on domestic policy. In this paper I ask: why does the agreement prohibit the use of industry-specific production subsidies, essentially requiring that governments equalize their industrial policy across all sectors? I show that an agreement to equalize production subsidies, that is, set production subsidies in all sectors equal to each other, improves worldwide-welfare. When governments set their production subsidies unilaterally, terms-of-trade considerations lead them to choose subsidies for the import-competing sector that are too high and to choose subsidies for the export sector that are too low relative to globally politically-efficient policies. A simple rule that governments equalize their subsidies across sectors forces them to partially internalize these terms-of- trade externalities, yielding worldwide welfare gains.

Following Bagwell and Staiger (2001a, 2001b), I develop a two-country, two-good model

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[1]The Agreement on Subsidies and Countervailing Measures and the Agreement on Agriculture.

in which each country produces a relatively low-cost export good and a relatively high-cost import-competing good. I begin by developing two results similar to Copeland (1990) and Bagwell and Staiger (2001a). First, when countries are free to set both tariffs and production subsidies, an agreement to reduce tariffs will improve welfare even when there are no restrictions on the use of subsidies. Second, although this represents a welfare improvement, an equilibrium with zero tariffs and unilaterally-set production subsidies is inefficient because the subsidies embody terms-of-trade distortions.

I then examine a simple rule which constrains a government's freedom in setting production subsidies and show that it can bring about further welfare gains. Specifically, when politically-biased governments value redistribution to import-competing and export sectors equally, the no sector-specific subsidies rule improves two different measures of worldwide-welfare - a social planner's definition of welfare as the total surplus in an economy and a politically- weighted measure of welfare in which the surplus of producers is weighted more heavily than that of consumers. When the political weights of different sectors are equal, the globally politically efficient policy is to offer the same subsidy to both sectors. The subsidy rule brings govern-ments closer to the global political optimum, but it does not achieve full political efficiency. Although the globally politically efficient policy could be achieved through direct negotiation over subsidy levels, historically governments have not taken this approach. Why? One expla-nation is that governments wish to maintain their sovereignty in setting domestic policies, even if they're willing to abide by broad restrictions like an agreement to eliminate sector-specific production subsidies. An alternative explanation suggested by the model in this paper is that if governments are concerned about the redistributive distortions within their economies that arise from their own political biases, the subsidy rule can bring them to a higher level of social welfare. Intuitively, when governments face domestic political pressure to introduce subsidies that will benefit producers, the institution of a rule to equalize production subsidies across sectors reduces distortions associated with (1) manipulation of the terms-of- trade and (2) domestic redistribution.

When governments place different weights on redistribution to import-competing and ex-port sectors, the rule to equalize production subsidies improves the social planner's measure of

welfare but will reduce political welfare if the political value placed on the export sector is sufficiently large relative to that placed on the import-competing sector. In this case, the subsidy rule doesn't allow production subsidies to achieve enough redistribution within an economy to meet the government's political goals. However, it does improve social welfare. This suggests that governments may be using the rule to free themselves from domestic political pressure.

Lastly, I turn to the question of enforcement. I show that a simple rule can facilitate enforcement of the agreement to equalize production subsidies. I show that a rule that allows an importing country to use a countervailing duty (CVD) - an import tariff used to offset the effect of a foreign government subsidy that benefits the producers of an export good - in retaliation against a sector-specific production subsidy will induce politically-motivated governments to institute an economy-wide production subsidy whenever governments value redistribution to the export sector more than they value redistribution to the import-competing sector. A weakness of using a CVD to enforce the agreement on subsidies is that it is inherently asymmetric. It can only be used to prevent governments from instituting export sector production subsides that are larger than import-competing sector subsidies. However, in response to symmetric tariff reductions it seems likely that a country would increase the subsidy to its import-competing sector because this policy gives the country a terms-of-trade gain. It is possible that the market access commitment implied by a tariff reduction may help enforce the agreement on production subsidies in this case.

The question of how trade agreements should deal with domestic policies has been previously addressed in Copeland (1990) and Bagwell and Staiger (2001a). Copeland (1990) emphasizes the point that in international trade agreements governments accept that some trade barriers (like tariffs) are negotiable and that some barriers (like domestic policies) are not. He shows that even a limited trade agreement with non-negotiable barriers is welfare-improving as long as the negotiable and non-negotiable policy tools are imperfect substitutes. Bagwell and Staiger (2001a) focus on how governments can attain an efficient outcome when domestic policies are chosen unilaterally. They show that including market access rights as part of an agreement on tariffs can achieve this.

Furthermore, this paper differs from previous work on subsidies and CVDs in both the

assumed market structure and the specific questions addressed. Previous papers (Dixit, 1988; Spencer, 1988; and Collie, 1991) examine CVDs in reciprocal markets models of oligopolistic firms. While these papers offer some interesting insights into when CVDs can effectively offset the negative effect a foreign subsidy has on the home market, their assumptions of segmented markets and a low degree of competition domestically and internationally mean that they are useful for analyzing industries like commercial aircraft but are inappropriate for analyzing the integrated world markets of more competitive industries like agriculture and steel.

The paper will proceed as follows. Section 2 presents the model. Section 3 describes and analyzes a trade agreement in which countries reduce tariffs and require that production subsidies to all industries be the same. Section 4 concludes.

2   The Model

The vast majority of trade disputes over subsidies arise in the agriculture, steel and food industries. This suggests a model of competitive world markets is most appropriate for studying the use of subsidies. I follow Bagwell and Staiger (2001b) and develop a partial equilibrium model in which two symmetric large countries trade in two goods. Each country produces and consumes each good and cost functions are such that each country will export one good and import the other. I begin by considering a world in which governments have three policy instruments: an import tariff, a production subsidy to the export good, and a production subsidy to the import-competing good.[2]

More formally, the two countries are of equal size and are denoted, $i = A, B$. They trade in two goods, denoted $j = x, y$. By assumption, country A exports good x and country B exports good y. Each country can provide a specific production subsidy to each good, $\sigma_{ij} \geq 0$, so that the price that consumers in country i pay for a good (p_{ij}^d) is less than the price producers in country i receive (p_{ij}^s). Domestic market equilibrium requires that $p_{ij}^s = p_{ij}^d + \sigma_{ij}$.

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[2]I find roughly the same results when export subsidies are included in a country's set of policy tools. However, this addition complicates the model without much added benefit. Further, Article 3 of the GATT's Agreement on Subsidies and Countervailing Measures prohibits the use of export subsidies and most disputes regarding the use of subsidies deal with production subsidies. For these reasons, I omit export subsidies from this paper.

Demand for each good in each country is denoted $D_{ij}(p_{ij}^d)$. For simplicity, demand is linear, $D_{ij}\left(p_{ij}^d\right) = 1 - p_{ij}^d$ for $i = A, B$, $j = x, y$. Production costs are convex and denoted $C_{ij}(Q_{ij})$. The cost of producing a given quantity of the natural export good of any country is lower than the cost of producing the same quantity of its import-competing good. Country A's natural export is the good x, while country B's natural export is good y. For simplicity, cost functions have the following specific functional forms: $C_{ij}(Q_{ij}) = \frac{1}{2}(Q_{ij})^2$ for $ij = Ax, By$ and $C_{ij}(Q_{ij}) = Q_{ij}^2$ for $ij = Ay, Bx$. These cost functions imply linear supply functions, $Q_{ij}(p_{ij}^s) = p_{ij}^s$ for each country's natural export good (i.e., $ij = Ax, By$) and $Q_{ij}(p_{ij}^s) = \frac{1}{2}p_{ij}^s$ for each country's import-competing good (i.e., $ij = Ay, Bx$) and convex profit functions $\pi_{ij} = \frac{1}{2}(p_{ij}^s)^2$ for the natural export $ij = Ax, By$ and $\pi_{ij} = \frac{1}{4}(p_{ij}^s)^2$ for the import-competing good $ij = Ay, Bx$.

In addition to the production subsidies, each country can impose a specific tariff on imports τ_i for $i = A, B$. Equilibrium in world markets implies $p_{ij}^d = p_j^w + \tau_i$. Note that with no export subsidies, for each country, the local demand price of its export good is equal to the world price (i.e., $p_{Ax}^d = p_x^w$ and $p_{By}^d = p_y^w$). Markets clear when the worldwide supply of a good, $j = x, y$, is equal to its worldwide demand, $\sum_{i=A,B} D_{ij}(p_{ij}^d) = \sum_{i=A,B} Q_{ij}(p_{ij}^s)$.

Exploiting symmetry, I denote export-sector variables with the subscript ex (i.e., $ex = ij$ for $ij = Ax, By$) and denote import-competing sector variables with the subscript m (i.e., $m = ij$ for $ij = Ay, Bx$). Thus, I simplify notation by denoting the production subsidy to each country's export good σ_{ex}, denoting the production subsidy to each country's import good σ_m, and denoting each country's tariff τ. Market-clearing local prices are given by (1) - (4) and the world price is equal to the local demand price in the exporting country ($p^w = p_{ex}^d$).

$$p_{ex}^d = \frac{1}{7}\left(4 - 3\tau - 2\sigma_{ex} - \sigma_m\right) \tag{1}$$

$$p_{ex}^s = \frac{1}{7}\left(4 - 3\tau + 5\sigma_{ex} - \sigma_m\right) \tag{2}$$

$$p_m^d = \frac{1}{7}\left(4 + 4\tau - 2\sigma_{ex} - \sigma_m\right) \tag{3}$$

$$p_m^s = \frac{1}{7}\left(4 + 4\tau - 2\sigma_{ex} + 6\sigma_m\right) \tag{4}$$

Equation (1) shows us the effects that domestic production subsidies and the tariff have on the world price of a good. If the importing country increases either its tariff or the subsidy to its import-competing good, this will depress the equilibrium world price of the good and improve the importing country's terms-of-trade. Paradoxically, if the exporting country increases its subsidy to its export good, although this will increase the prices its producers receive (2), it will depress the world price of its own export good, worsening its terms-of-trade. Figure 1 depicts iso-world and local price lines in σ_m-σ_{ex} space for a given tariff. This graph shows the combinations of domestic production subsidies that keep local supply prices and the world price constant. Importantly, this graph shows us how one country's domestic policy distorts the local price in the other country. A policy to redistribute surplus in one country via a production subsidy distorts not only world prices, but also local prices in foreign markets. From figure 1, we can see that an increase in the production subsidy to the export good, holding the subsidy to the import-competing good and the tariff constant, causes the local supply price of the export good to increase and the world price of the good to fall.

Given market clearing world prices and assuming that tariffs are non-prohibitive, then imports of good y into country A and of good x into country B are given by $M(p_m^d) = D(p_m^d) - Q(p_m^s)$. Exports of good x by country A and of good y by country B are given by $E(p_{ex}^w) = Q(p_{ex}^s) - D(p_{ex}^w)$.

2.1   Government Objective Functions

In each country, the government's objective is to maximize the sum of welfare in sectors x and y. In export sectors, welfare is a weighted sum of consumer's surplus and producer's surplus less the government's production subsidy expenditures. In import-competing sectors, welfare is a weighted sum of producer's surplus, consumer's surplus, and tariff revenue, less the cost of the production subsidy. The political economy parameters γ_e and γ_m reflect the political bias that politicians have for producers over consumers in exporting sectors and import-competing sectors respectively.[3] Politicians' biases are such that they would like to redistribute surplus

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[3]This set-up is consistent with the model of political- economy-motivated government preferences in Baldwin (1987) and Grossman and Helpman (1994). Goldberg and Maggi (1999) find empirical support for the assertion

from consumers to producers. To ensure that governments do not choose policies that prohibit trade in the Nash equilibrium, I assume that governments' biases fall in the range $1 \leq \gamma_e \leq 2$, $1 \leq \gamma_m \leq 2$, and $\gamma_m < \frac{\gamma_e}{2} + 1$. Essentially, this condition says that trade volumes will be positive in equilibrium as long as governments don't value redistribution to producers in the import-competing sector substantially more than they value redistribution to producers in the export sector.

The politically-biased government objective function is given by the following. Throughout this paper, I will refer to this measure of welfare as political- welfare. Note that a social planner's measure of country i's welfare is given by (5) when $\gamma_m = \gamma_e = 1$. I will refer to the social planner's measure of welfare as social-welfare.

$$\max_{\sigma_{ex}, \sigma_m, \tau} W_i = W_{i,ex} \quad + \quad W_{i,m} \qquad \text{where} \tag{5}$$

$$W_{i,ex}(p_{ex}^w, p_{ex}^s) = \int_{p_{ex}^w}^{1} D(p)dp + \gamma_e \pi_{ex}(p_{ex}^s) - \left(p_{ex}^s - p_{ex}^w\right) Q_{ex}(p_{ex}^s) \tag{6}$$

$$W_{i,m}(p_m^d, p_m^s, p_m^w) = \int_{p_m^d}^{1} D(p)dp + \gamma_m \pi_m(p_m^s) - \left(p_m^s - p_m^d\right) Q_m(p_m^s) + \left(p_m^d - p_m^w\right) M(p_m^d) \tag{7}$$

2.1.1 Unilateral noncooperative policy setting

When each government chooses its policy unilaterally, it maximizes the sum of welfare across sectors with respect to its import tariff and production subsidies. When governments set their domestic subsidy policies unilaterally, they choose a subsidy for each sector to maximize total welfare. With respect to a country's production subsidy for its export sector, its first order condition is as follows:

$$\frac{dW_i}{d\sigma_{ex}} = \left\{(\gamma_e - 1)Q_{ex}(p_{ex}^s) - \sigma_{ex}Q_{ex}'(p_{ex}^s)\right\} \frac{\partial p_{ex}^s}{\partial \sigma_{ex}} + E(p_{ex}^w) \frac{\partial p_{ex}^w}{\partial \sigma_{ex}} = 0 \tag{8}$$

that policymakers' political economy concerns are reflected in their choices of trade policies.

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The first term in (8) reflects the change in welfare for the exporting country associated with the increase in the price producers receive due to the subsidy policy. The second term reflects the change in welfare associated with the subsidy's terms-of-trade effect. In the first term, the first part of the expression in curly brackets is positive and reflects the government's political bias for producers. It can be thought of as the marginal value of redistribution to producers. The second part of the expression reflects the marginal cost of the subsidy program and is negative. In a closed economy, the welfare maximizing subsidy would equate the marginal cost of the program with the marginal value of redistribution. However, in an open economy, a production subsidy to the export good has the perverse effect of driving down the world price of the good and worsening the country's terms-of-trade. The last term reflects the welfare cost associated with this decline in the terms of trade. Because the subsidy program reduces the value of exports, the government chooses a subsidy that redistributes less to producers in the export sector than it would in the absence of a terms-of-trade effect. Moreover, any level of subsidization will result in a transfer from consumers in the exporting country (who fund the subsidy program through taxes) to both producers in the country's export sector and to consumers in the importing country.

Turning to the problem a country faces in setting the tariff and production subsidy for its import-competing sector, we have the following first order condition where $r = \tau, \sigma_m$.

$$\frac{dW_i}{dr} = \left\{ (\gamma_m - 1)Q_m(p_m^s) - \sigma_m Q_m'(p_m^s) \right\} \frac{\partial p_m^s}{\partial r} + \left\{ \tau \frac{\partial M}{\partial p_m^d} \right\} \frac{\partial p_m^d}{\partial r} - M(p^w) \frac{\partial p_m^w}{\partial r} = 0 \quad (9)$$

I begin by considering the first order condition for the subsidy to the import- competing sector. As in the first order condition for the export sector subsidy (8), the first term in (9) reflects the welfare change associated with an increase in the price producers receive for the import-competing good and the third term captures the welfare effect of a change in the terms of trade. The second term reflects the efficiency cost of the import-reducing tariff policy. The first term summarizes the government's redistributional trade-off. In a closed economy the welfare-maximizing subsidy would equate the expressions in curly brackets in the first term,

the marginal value of redistribution to import-competing sector producers and the marginal cost of the subsidy program. However, in an open economy, a subsidy to the import- competing good generates additional small welfare gains. Turning to the second term in (9), we see that because the subsidy to the import- competing good actually depresses the local demand price of the import-competing good, it has a small positive effect on welfare in that it slightly offsets the domestic efficiency cost of the tariff. Finally, turning to the third term in (9), the terms-of-trade component, we see that a production subsidy to the import-competing good has a positive effect on welfare because it slightly reduces the world price of the country's import-good. Thus, the government will subsidize production of the import-competing good beyond the level at which it would in a closed-economy because it can shift some of the cost of this program onto foreigners through manipulation of the terms-of-trade.

When $r = \tau$, (9) is the country's first order condition with respect to its tariff. In addition to the production subsidy to the import- competing good, the government can use its import tariff to achieve its redistributive objective. Again, the first term in (9) balances the benefits of redistribution with the cost of the subsidy policy, the second term is the marginal domestic efficiency cost of the tariff and the third term is the terms-of-trade component. The tariff raises the domestic supply and demand price of the import-competing good, conferring a benefit to producers and a cost on consumers. Relative to the domestic production subsidy, the tariff has a large depressive effect on the world price ($\frac{\partial p^w}{\partial \tau} = -\frac{3}{7}$ and $\frac{\partial p^w}{\partial \sigma_m} = -\frac{1}{7}$) and, consequently, has a larger terms-of-trade component. Although the tariff is a less efficient instrument for redistributing surplus to producers than a production subsidy, it has a larger terms-of-trade effect and, hence, enables the importing country's government to shift a greater fraction of the cost of the policy onto foreigners.

Overall, the production subsidy in the import-competing industry and the tariff are imperfectly substitutable policies, both of which can help the government achieve its redistributional goals. The production subsidy can more efficiently redistribute surplus, but because it has a relatively small effect on the world price, it involves a relatively large cost for the domestic government. On the other hand, because the tariff drives down the world price, it involves a relatively small cost to the domestic government, but it is a crude instrument for redistribution

and introduces domestic efficiency costs in the form of a lower import volume. In equilibrium, when both policies are available to the government, it will use both.

Solving (8) yields the reaction curve for the production subsidy to each country's export good.

$$\sigma_{ex}^{R} = \frac{1}{(66 - 25\gamma_e)}\left((20\gamma_e - 22) + (5\gamma_e - 9)\left\{-3\tau - \sigma_m\right\}\right) \tag{10}$$

We can see from the reaction curve (10) that the production subsidy to the export sector is increasing in both its opponent's tariff and import- competing production subsidy as long as the government's political bias for producers is not too large ($\gamma_e < 1\frac{4}{5}$).

Solving (9) for the tariff yields the importing country's tariff reaction curve where σ_{ex} is the other country's production subsidy to its export good and σ_m is the importing country's production subsidy to its import-competing good.

$$\tau^{R} = \frac{1}{4(17 - 2\gamma_m)}\left((8\gamma_m - 5) + (13 - 4\gamma_m)\sigma_{ex} + 4(3\gamma_m - 8)\sigma_m\right) \tag{11}$$

The tariff is increasing in the production subsidy of the exporting country and is decreasing in the production subsidy offered to its own import- competing sector for all $1 \leq \gamma_m \leq 2$. This means that the tariff and production subsidy to the import-competing sector are substitute policies. If a country were to reduce its production subsidy to the import-competing sector for any reason, then the government's optimal response would be to increase its own tariff.

The production subsidy to the import-competing good is obtained by solving (9) when $r = \sigma_m$.

$$\sigma_m^{R} = \frac{1}{41 - 8\gamma_m}\left((12\gamma_m - 11) + 4(3\gamma_m - 8)\tau + 3(3 - 2\gamma_m)\sigma_{ex}\right) \tag{12}$$

The production subsidy to the import-competing good is an imperfect substitute for the import tariff for all $1 \leq \gamma_m \leq 2$. Note that the production subsidy is decreasing in the import tariff. This is important because it means that any cooperative agreement to increase

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trade through symmetric tariff reductions would be partially offset by protectionist increases in the production subsidy to the import-competing sector. This import-competing production subsidy is increasing in the other country's production subsidy to its export good for all $1 \leq \gamma_m \leq 1\frac{1}{2}$.

Solving (10), (11), and (12) simultaneously yields the Nash equilibrium tariff and production subsidies.

$$\tau^N = \frac{5(2 + \gamma_e - 2\gamma_m)}{315 - 138\gamma_m - 115\gamma_e + 50\gamma_m\gamma_e} \tag{13}$$

$$\sigma_{ex}^N = \frac{105\gamma_e + 58\gamma_m - 50\gamma_e\gamma_m - 117}{315 - 138\gamma_m - 115\gamma_e + 50\gamma_m\gamma_e} \tag{14}$$

$$\sigma_m^N = \frac{2(25\gamma_e + 59\gamma_m - 25\gamma_e\gamma_m - 59)}{315 - 138\gamma_m - 115\gamma_e + 50\gamma_m\gamma_e} \tag{15}$$

When $\gamma_e = \gamma_m = 1$, governments have no redistributive preferences for producers over consumers and tariff and subsidy policies embody a pure terms-of-trade effect. With no preference for producers, in the Nash equilibrium, governments choose a positive tariff, a zero production subsidy for the import-competing sector, and a negative production subsidy (a tax) for the export sector. This reflects the fact that when there is no value associated with redistribution to producers, the tariff is the preferred instrument in the import-competing sector for manipulating the terms-of-trade. The negative production subsidy in the export sector arises because the government wants to use the policy to improve its terms-of-trade. As γ_e increases, the redistributive concerns of the government come to dominate the terms-of-trade effect and the policy in the export sector becomes a positive production subsidy. As γ_m increases, the subsidy to the import-competing sector increases. Although the tariff is a more effective policy tool for manipulating the terms-of-trade in the importing country's favor, the subsidy will also incorporate a terms-of-trade component. The general pattern that emerges when governments have redistributive preferences is a production subsidy in the import-competing sector that is higher than it would be in a closed economy and a subsidy in the export sector that is lower than it would be in a closed economy.

In the analysis that follows, I restrict my attention to parameter values at which the reaction curves of both countries are upward sloping ($1 \leq \gamma_e \leq 1\frac{4}{5}$ and $1 \leq \gamma_m \leq 1\frac{1}{2}$). Intuitively, when governments place very high value on redistribution to a particular sector, these policies introduce large distortions that become very costly in welfare terms. Thus, by restricting my range of parameters, I focus on policies that introduce relatively small distortions into each country's economy.

2.1.2 Cooperative policy setting

In this section, I characterize the set of politically-efficient trade and industrial policies. Politically-efficient policies are those polices that maximize global political-welfare, the sum of both governments' politically biased objective functions. That is, these policy choices are those that maximize worldwide welfare while taking into account the domestic re-distributive preferences of governments for producers over consumers.

Consider the joint objective function of governments who wish to obtain a politically-efficient outcome in the j-sector where j is the export good of country i and the import-competing good of country $-i$ for $i = A, B$. Because prices in this partial equilibrium model are independent across sectors, worldwide political-efficiency requires political- efficiency in each sector.

$$\max_{(\tau, \sigma_{ex}, \sigma_m)} W_j^w = W_{i,ex}(\cdot) + W_{-i,m}(\cdot) \tag{16}$$

for $i = A, B$, $j = x, y$, where $W_{i,ex}$ is country i's welfare in its export sector for good j and is given by (6) for $ij = Ax, By$ and $W_{-i,m}$ is country i's opponent's welfare in its import-competing sector for good j is given by (7) for $ij = Ay, Bx$.

Maximizing world-wide political welfare with respect to each policy $r = \sigma_{ex}, \sigma_m, \tau$ yields the following first order condition.

$$\frac{dW^w}{dr} = \left\{(\gamma_e - 1)Q_{ex}(p_{ex}^s) - \sigma_{ex}Q'_{ex}(p_{ex}^s)\right\}\frac{\partial p_{ex}^s}{\partial r}$$

$$+\left\{(\gamma_m - 1)Q_m(p_m^s) - \sigma_m Q'_m(p_m^s)\right\}\frac{\partial p_m^s}{\partial r} + \left\{\tau\frac{\partial M}{\partial p_m^d}\right\}\frac{\partial p_m^d}{\partial r} = 0 \qquad (17)$$

Comparing (17), the first order condition for global political welfare to (8) and (9), the first order conditions for a single country's political welfare, we see that when countries jointly maximize welfare, the optimal policies internalize the externality associated with manipulation of the terms-of-trade. Moreover, (17) internalizes the negative effect that one country's production subsidy has on the other country's efforts to redistribute surplus to its producers in the same sector. Recall from price equations (2) and (4) that an increase in one country's production subsidy to good j causes the local supply price in the other country to fall.

$$\tau^{PE} = \frac{24\gamma_e(2 - \gamma_e - 2\gamma_m + \gamma_e\gamma_m)}{(3\gamma_e + 49)(10\gamma_m + 9\gamma_e - 4\gamma_m\gamma_e - 22)} \qquad (18)$$

$$\sigma_{ex}^{PE} = \frac{4(6\gamma_e^2\gamma_m - 9\gamma_e^2 + 40\gamma_e\gamma_m - 86\gamma_e - 49\gamma_m + 98)}{(3\gamma_e + 49)(10\gamma_m + 9\gamma_e - 4\gamma_m\gamma_e - 22)} \qquad (19)$$

$$\sigma_m^{PE} = \frac{196(2 - \gamma_e - 2\gamma_m + \gamma_e\gamma_m)}{(3\gamma_e + 49)(10\gamma_m + 9\gamma_e - 4\gamma_m\gamma_e - 22)} \qquad (20)$$

When a government places equal weight on consumer's and producer's welfare ($\gamma_e = \gamma_m = 1$), the politically-efficient objective function reduces to the standard objective function of a social planner who wants to maximize worldwide welfare. The social planner's objective function doesn't take into account the re-distributive preferences that a government has for producers over consumers. A social planner maximizes worldwide welfare by choosing a tariff and production subsidies in all sectors equal to zero. I call this the socially-efficient outcome and refer to the social planner's objective function as socially-efficient welfare.

When governments place some re-distributive preferences on producers in the export and import-competing sectors ($\gamma_e > 1$ and $\gamma_m > 1$), the politically-efficient policies consist of a production subsidy to exporters that is larger than the subsidy to exporters in the Nash equi-

librium, and a tariff and production subsidy to import-competing producers that are smaller than those in the Nash equilibrium. Intuitively, the globally politically efficient outcome involves redistributing surplus to producers in both the export and import competing sector through prices. Comparing prices in the Nash equilibrium with politically efficient prices, in the Nash equilibrium the world price is too low, the price that producers in the export sector receive is too high, the price that the import-competing sector producers receive is too high, and the price that consumers in the importing country pay is too high. The politically efficient policies increase the world price and the producer's price in the export sector and lower the remaining prices. Essentially, the globally political optimum involves reducing the transfer to import-competing sector producers and increasing the transfer to export-sector producers.

Summarizing the results from this section, we have the following proposition.

Proposition 1 *Comparing the globally politically-efficient policies with unilaterally-chosen Nash equilibrium policies, I find that the Nash equilibrium policies embody an inefficiency associated with governments' efforts to distort the terms-of-trade in their favor. This terms-of-trade externality causes the production subsidy to the export sector to be lower than the globally politically-efficient policy, the Nash equilibrium production subsidy to the import-competing sector to be higher than the jointly efficient policy and the Nash equilibrium tariff to be larger than politically efficient.*

Furthermore, the results in this section imply the following.

Proposition 2 *Symmetric tariff reductions below Nash equilibrium values improve worldwide political-welfare even when there are no rules regarding the use of production subsidies.*

Proof:

The change in political-welfare under a tariff reduction can be written:

$$dW^w = \left[\overset{(-)}{\frac{\partial W^w}{\partial \tau}} + \overset{(+)}{\frac{\partial W^w}{\partial \sigma_{ex}}} \overset{(+)}{\frac{\partial \sigma_{ex}}{\partial \tau}} + \overset{(-)}{\frac{\partial W^w}{\partial \sigma_m}} \overset{(-)}{\frac{\partial \sigma_m}{\partial \tau}} \right] \overset{(-)}{d\tau} > 0 \qquad (21)$$

When all governments symmetrically reduce tariffs, $d\tau < 0$. Thus, $dW^w > 0$ if $\left(\frac{\partial W^w}{\partial \tau} + \frac{\partial W^w}{\partial \sigma_{ex}} \frac{\partial \sigma_{ex}}{\partial \tau} + \frac{\partial W^w}{\partial \sigma_m} \frac{\partial \sigma_m}{\partial \tau} \right) < 0$. A symmetric tariff reduction is welfare- improving if the direct effect on welfare of the tariff reduction dominates the second-order effect of changes in the production subsidies.

Previously in this section, I showed that terms of trade distortions embodied in unilateral policy-setting caused a politically inefficient outcome. Because the tariff creates the largest terms of trade distortion ($\frac{\partial p^w}{\partial \tau} = -\frac{3}{7}$, $\frac{\partial p^w}{\partial \sigma_{ex}} = -\frac{2}{7}$, and $\frac{\partial p^w}{\partial \sigma_m} = -\frac{1}{7}$), it introduces the greatest inefficiency. Furthermore, because reductions in the tariff create relatively small changes in the productions subsidies ($\frac{\partial \sigma_{ex}}{\partial \tau} < 1$ and $\frac{\partial \sigma_m}{\partial \tau} < 1$ for all $1 \leq \gamma_e \leq 2$, $1 \leq \gamma_m \leq 2$, and $\gamma_m < \frac{\gamma_e}{2} + 1$), the political welfare gain associated with symmetric tariff reductions dominate the small welfare losses associated with the consequent increase in the subsidy to the import-competing sector and decrease in the subsidy to the export sector. Thus, $dW^w > 0$. QED

3 Second-best trade agreements

Having shown in section 2.1 that unilateral policy setting leads to a suboptimal outcome for worldwide political welfare, that fully cooperative policy setting can lead to a globally politically-efficient outcome and that symmetric tariff reductions improve political welfare, in this section I analyze the welfare consequences of limited trade agreements in which governments cooperate over some areas of their policies but act non-cooperatively in others. I begin by examining an agreement over tariff policies that imposes no restrictions on domestic policies and then turn to an agreement that includes restrictions on both tariffs and domestic policies.

3.1 Non-cooperative production subsidies when tariffs are zero

What are the welfare consequences of an agreement in which governments agree to reduce their tariffs to zero, but non-cooperatively choose their production subsidies for each sector. With tariffs equal to zero, domestic consumer prices are now equal to world prices in both countries ($p_{Aj}^d = p_{Bj}^d = p_j^w$ for $j = x, y$). Furthermore, in the government's objective function

the tariff revenue component in the import-competing sector drops out $((p_m^d - p_m^w) M(p_m^d) = 0)$. Thus, with zero tariffs, the government's problem is given by the following.

$$\max_{\sigma_{ex}, \sigma_m} W_i = W_{i,ex} \quad + \quad W_{i,m} \qquad \text{where} \tag{22}$$

$$W_{i,m}(p_m^s, p_m^w) = \int_{p_m^w}^1 D(p)dp + \gamma_m \pi_m(p_m^s) - \left(p_m^s - p_m^w\right) Q_m(p_m^s) \tag{23}$$

and where $W_{i,ex}$ is given by (6).

The government's first order condition for the production subsidy in the export sector is still given by (8), but now world and local prices are no longer distorted by the tariff policy.

Turning to the problem a country faces in setting the production subsidy for its import-competing sector when the tariff is zero, we have the following first order condition:

$$\frac{dW_i}{d\sigma_{i,m}} = \left\{ (\gamma_m - 1) Q_{i,m}(p_{i,m}^s) - \sigma_{i,m} Q'_{i,m}(p_{i,m}^s) \right\} \frac{\partial p_{i,m}^s}{\partial \sigma_{i,m}} - M(p_m^w) \frac{\partial p_m^w}{\partial \sigma_{i,m}} = 0 \tag{24}$$

Comparing (24) to the first order condition in the presence of a tariff, we see that the domestic efficiency distortion associated with the tariff has been removed, but the terms of trade distortion remains. Thus, even if the government has no redistributive preference for producers in the import- competing sector, it will choose a positive production subsidy because this will lower the world price of the import good, yielding a welfare gain.

Reaction curves for the exporting country's production subsidy to its export sector and the importing country's subsidy to the import-competing sector are given by (10) and (12) with the tariff equal to zero. Figure 2 presents a graph of the reaction curves for $\gamma_e = \gamma_m > 1$.

Solving (10) and (12) simultaneously for $\tau = 0$ yields the Nash equilibrium production subsidies.

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$$\sigma_{i,ex}^N = \frac{-(143 + 60\gamma_e\gamma_m - 72\gamma_m - 125\gamma_e)}{375 - 162\gamma_m - 140\gamma_e + 60\gamma_m\gamma_e} \tag{25}$$

$$\sigma_{i,m}^N = \frac{-(132 + 60\gamma_e\gamma_m - 132\gamma_m - 65\gamma_e)}{375 - 162\gamma_m - 140\gamma_e + 60\gamma_m\gamma_e} \tag{26}$$

When political-biases that favor redistribution to producers are absent ($\gamma_m = \gamma_e = 1$), governments choose subsidy policies that embody a pure terms-of-trade effect. The subsidy to the import- competing sector is positive and the export sector is taxed. When the tariff is set to zero, the import-competing sector subsidy becomes the only instrument with which the importing country can manipulate its terms-of-trade and, thus, increases relative to the production subsidy when the tariff is chosen unilaterally. If the political- bias in favor of producers increases and is the same across sectors ($\gamma_m = \gamma_e > 1$), the subsidy to both sectors becomes positive, but the magnitude of the subsidy to the import-competing sector is always larger due to terms-of-trade considerations.

Comparing politically-biased welfare under the Nash equilibrium policies when tariffs are set to zero (i.e., $\tau = 0$, σ_{ex} is given by (25) and σ_m is given by (26)) with politically-biased welfare under Nash equilibrium policies when tariffs are set unilaterally (14) and (15), it follows from direct calculation that political welfare is always higher when tariffs are set to zero.

By negotiating tariffs to zero, governments eliminate the largest distortion in the trading system. Reductions in both countries' tariffs will lead to increases in the subsidies to the import-competing sectors, but because the production subsidy to the import-competing sector has a smaller impact on the terms-of- trade ($\frac{\partial p^w}{\partial \sigma_m} = -\frac{1}{7}$ compared to $\frac{\partial p^w}{\partial \tau} = -\frac{3}{7}$), the welfare cost of the increase in the production subsidy to the import-competing sector is small relative to the gain associated with the tariff reduction.

The results from this section can be summarized as follows:

Proposition 3 *Negotiated tariff reductions to zero ($\tau_i = 0$ for $i = a, b$) improve politically-biased welfare even when there are no rules governing the use of production subsidies.*

3.1.1 Cooperative production subsidies when tariffs are zero

Having identified the inefficiency associated with unilateral policy-setting, I now explore the other extreme and suppose that governments agree to set their tariffs to zero and to set their subsidies to maximize their joint welfare. With each country taking its trading partner's politically-biased welfare into account when choosing its subsidy policies, we have the following first order conditions for $r = \sigma_{ex}, \sigma_m$.

$$
\begin{aligned}
\frac{dW^w}{dr} &= \left\{(\gamma_e - 1)Q_{ex}(p_{ex}^s) - \sigma_{ex}Q'_{ex}(p_{ex}^s)\right\}\frac{\partial p_{ex}^s}{\partial \sigma_r} \\
&\quad + \left\{(\gamma_m - 1)Q_m(p_m^s) - \sigma_m Q'_m(p_m^s)\right\}\frac{\partial p_m^s}{\partial \sigma_r} + \left\{E(p^w) - M(p^w)\right\}\frac{\partial p^w}{\partial \sigma_r} = 0 \quad (27)
\end{aligned}
$$

In both expressions, exports are equal to imports $(E(p_j^w) = M(p_j^w))$, so that the last term drops out. With cooperative policy-setting, the terms-of- trade considerations are neutralized. Neither country attempts to shift the terms-of-trade in its favor. Further, each country internalizes the negative externality its subsidy policy has on producers in its trading partner. When selecting export-sector subsidies, the exporting country no long worries about the negative terms-of-trade consequences and hence, increases its subsidy. This results in a politically-efficient level of redistribution to export sector producers and a net transfer to the importing country that is reflected in the lower world price. As for the import-competing sector, internalizing the terms- of-trade distortion leads to lower subsidies that reflect the politically- efficient level of subsidization when tariffs are zero.

Solving (27) for $r = \sigma_m, \sigma_{ex}$ simultaneously yields the politically-efficient production subsidies.

$$
\sigma_{i,ex}^{PE} = \frac{4(2\gamma_e + \gamma_m - \gamma_e\gamma_m - 2)}{22 - 10\gamma_m - 9\gamma_e + 4\gamma_m\gamma_e} \tag{28}
$$

$$
\sigma_{i,m}^{PE} = \frac{4(2\gamma_m + \gamma_e - \gamma_e\gamma_m - 2)}{22 - 10\gamma_m - 9\gamma_e + 4\gamma_m\gamma_e} \tag{29}
$$

When governments have no political biases that favor redistribution to producers ($\gamma_m = \gamma_e = 1$), (28) and (29), reduce to the socially-efficient production subsidies which are equal to zero. When governments place the same re-distributive preferences on producers in the export and import-competing sectors ($\gamma_e = \gamma_m > 1$), the politically-efficient policies are production subsidies in the export and import-competing sectors that are identical. Here, the politically-efficient outcome involves removing the terms of trade distortion component and using domestic policy tools to address redistributive concerns. However, when governments value producers in the export sectors more than those in the import-competing sectors ($\gamma_e \gg \gamma_m > 1$), the politically efficient production subsidies to the export sector are larger than those to the import-competing sector. Similarly, when governments value producers in the import-competing sectors more than those in the export sectors ($\gamma_e > \gamma_m > 1$), the politically efficient production subsidies to the import-competing sectors are larger than those to the export sectors.

Governments that have implemented unilaterally chosen Nash equilibrium production subsidies could improve global politically-biased welfare through a negotiated agreement to set production subsidies at the politically efficient levels (28) and (29). Alternatively, if politicians who succumb to political pressure in setting policies unilaterally wanted to maximize global social-welfare, governments could negotiate an international agreement to set production subsidies at zero. Figure 2 depicts the politically efficient policies and the socially-efficient policies in $\sigma_{ex} - \sigma_m$ space.

3.2 An agreement to constrain the use of production subsidies

In this section I show how an agreement among governments to constrain their use of sector-specific subsidies brings about improvements in two measures of welfare: (1) global politically-biased welfare and (2) global social welfare. The WTO's GATT of 1994 includes an agreement on the use of production subsidies that can be viewed as a game that mixes cooperative and non-cooperative strategies. Governments cooperatively agree to equalize production subsidies across all sectors of their economies. Each government then non-cooperatively chooses the overall level of the subsidy for its economy. Denote the equalized subsidy as σ_e. Then, under

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this agreement, $\sigma_{ex} = \sigma_m = \sigma_e$, and the government's problem is given by the following.

$$\max_{\sigma^h} W_i = W_{i,ex}(\cdot) + W_{i,m}(\cdot) \tag{30}$$

where $W_{i,ex}$ is given by (6) and $W_{i,m}$ is given by (23).

Maximizing country i's welfare with respect to σ_e yields the following first order condition.

$$
\begin{aligned}
\frac{dW_i}{d\sigma_e} &= \left\{(\gamma_e - 1)Q_{ex}(p_{ex}^s) - \sigma_e Q_{ex}'(p_{ex}^s)\right\}\frac{\partial p_{ex}^s}{\partial \sigma_e} \\
&\quad + \left\{(\gamma_m - 1)Q_m(p_m^s) - \sigma_e Q_m'(p_m^s)\right\}\frac{\partial p_m^s}{\partial \sigma_e} + E(p_{ex}^w)\frac{\partial p_{ex}^w}{\partial \sigma_e} - M(p_m^w)\frac{\partial p_m^w}{\partial \sigma_e} = 0 \quad (31)
\end{aligned}
$$

Recall that equation (27) presents the first order condition for maximizing worldwide welfare with respect to σ_{ex} and σ_m. That expression demonstrated that the globally optimal policies fully internalize the terms of trade distortions associated with unilateral policy setting. Comparing a single country's first order condition for its equalized subsidy (31) with the first order condition on each subsidy for worldwide welfare (27), we can observe the following. First, in (31), although the marginal cost of the subsidy to each sector is now the same, the marginal value of redistribution to each sector ($(\gamma_e - 1)$ and $(\gamma_m - 1)$) may not be. Thus, optimal redistribution under the constrained subsidy will involve averaging the marginal benefit of redistribution across sectors. More importantly, the third and fourth terms in (27) capture the terms of trade effects of a equalized subsidy. In the third term, the equalized subsidy depresses the world price for the export good, and has a negative effect on country i's welfare. However, in the fourth term, the equalized subsidy depresses the world price for the import good, and therefore improves the welfare of country i. Overall, the negative effect of the equalized subsidy on the export sector is larger. This implies that the equalized subsidy is smaller than the politically efficient subsidies when $\gamma_e = \gamma_m$ and that the corresponding world prices are higher.

Solving (31) for country i and $-i$ simultaneously yields the Nash equilibrium equalized subsidy for each country.

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$$\sigma_e = \frac{20\gamma_e + 12\gamma_m - 33}{89 - 20\gamma_e - 12\gamma_m} \tag{32}$$

Figure 2 depicts the equalized subsidy in $\sigma_{ex} - \sigma_m$ space when $\gamma_e = \gamma_m > 1$. The difference between equalized subsidies and politically efficient subsidies arises because with equalized subsidies, each country internalizes the cost that its policy has on its own consumers whereas with politically efficient policies, in each sector there is a large transfer from consumers in the exporting country to the importing country. This is politically efficient because each country wants to make a large transfer to its producers at the lowest possible cost. With equalized subsidies, a greater fraction of the welfare transfer is taking place within a country whereas with politically efficient policies, a greater fraction of the welfare transfer occurs internationally. This movement can be tracked by observing that world prices are lower under equalized subsidies than they are under politically efficient policies.

Having defined the subsidies implied by an agreement to eliminate sector- specific subsidies, I now consider the welfare effects of this agreement.

Proposition 4 *Equalizing production subsidies across sectors improves political-welfare if the value governments place on producers in the export sector is not too large relative to that governments place on producers in the import-competing sector ($\gamma_e < \gamma_m + \frac{11}{60}$).*

Proof: For all parameter values under consideration (i.e., $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, $\gamma_m \leq \frac{\gamma_e}{2} + 1$), when the political strength of the export sector is not too large, $\gamma_e < \gamma_m + \frac{11}{60}$, the Nash equilibrium subsidy to the export sector is smaller than that to the import-competing sector, $\sigma_{ex}^N < \sigma_e < \sigma_m^N$. Thus, moving from Nash equilibrium policies to equalized policies involves a decrease in the subsidy to the import- competing sector ($d\sigma_m < 0$) and an increase in the subsidy to the export sector ($d\sigma_{ex} > 0$). From (27) we know increases in σ_{ex} and decreases in σ_m improve political welfare when starting from Nash equilibrium policies ($\frac{\partial W}{\partial \sigma_{ex}} > 0$ and $\frac{\partial W}{\partial \sigma_M} < 0$) because of the large terms of trade distortions associated with the Nash equilibrium policies..

Therefore, the change in political-welfare associated with Equalizing subsidies is given by:

$$dW^w = \frac{\overset{(+)}{\partial W^w}}{\partial \sigma_{ex}}\overset{(+)}{d\sigma_{ex}} + \frac{\overset{(-)}{\partial W^w}}{\partial \sigma_m}\overset{(-)}{d\sigma_m} > 0$$

When the export sector has a relatively lower degree of political power, $\gamma_e > \gamma_m + \frac{11}{60}$, $\sigma_{ex}^N > \sigma_e > \sigma_m^N$. Thus, moving from Nash equilibrium policies to equalized policies involves a decrease in the subsidy to the export sector ($d\sigma_{ex} < 0$) and an increase in the subsidy to the import-competing sector ($d\sigma_m > 0$). Therefore, over this range of parameters, the change in political welfare associated with equalized subsidies is given by:

$$dW^w = \frac{\overset{(+)}{\partial W^w}}{\partial \sigma_{ex}}\overset{(-)}{d\sigma_{ex}} + \frac{\overset{(-)}{\partial W^w}}{\partial \sigma_m}\overset{(+)}{d\sigma_m} < 0$$

Finally, at $\gamma_e = \gamma_m + \frac{11}{60}$, $\sigma_{ex}^N = \sigma_e = \sigma_m^N$. Because equalized subsidies are equal to Nash equilibrium subsidies, there is no welfare change associated with an agreement to equalize production subsidies. QED.

Intuitively, this tells us that equalizing production subsidies will improve worldwide political welfare as long as producers in the export sector are not too politically powerful. When the welfare of export sector producers carries a very high weight in the government's objective function, a policy change that ends their special treatment will reduce the government's politically-biased definition of national welfare.

Next, I turn to the social planner's measure of welfare.

Proposition 5 *Equalizing production subsidies across sectors improves social-welfare regardless of the political weights placed on different sectors of the economy.*

Proof:

Recall that the first order condition to maximize social welfare is given by (27) when $\gamma_e = \gamma_m = 1$. Thus, relative to the Nash equilibrium policies, the socially optimal policies eliminate the distortions associated with unilateral terms of trade manipulation by governments and domestic redistribution to producers. Direct calculation shows that over all parameters

under consideration (i.e., $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, $\gamma_m \leq \frac{\gamma_e}{2} + 1$), moving from Nash equilibrium policies to equalized policies improves social welfare or leaves it unchanged.

To understand this result, recall that decreases in σ_{ex} and decreases in σ_m improve social welfare ($\frac{\partial W^{sp}}{\partial \sigma_{ex}} < 0$ and $\frac{\partial W^{sp}}{\partial \sigma_M} < 0$). Thus, the change in social welfare associated with instituting equalized subsidies can be written

$$dW^{sp} = \frac{\partial \overset{(-)}{W}^{sp}}{\partial \sigma_{ex}} d\sigma_{ex} + \frac{\partial \overset{(-)}{W}^{sp}}{\partial \sigma_m} d\sigma_m$$

where moving from Nash equilibrium subsidies to equalized subsidies implies that $d\sigma_{ex}$ and $d\sigma_m$ have opposite signs and different magnitudes. This implies that equalization will improve social welfare if the gain from reducing one subsidy outweighs the loss associated with increasing the other. These gains and losses will arise from the effect each subsidy change has on the terms of trade and the degree of domestic distortion.

To distinguish between the various effects of the subsidy changes over the parameter space under consideration, divide the parameter space into 4 regions: A, B, C and D. Let A be the region where $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, and $\gamma_e > \gamma_m + \frac{11}{60}$; B be given by γ_e, γ_m such that $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, and $\gamma_e = \gamma_m + \frac{11}{60}$; C be the region $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, $\gamma_e > \frac{6}{5}\gamma_m - \frac{1}{5}$ and $\gamma_e < \gamma_m + \frac{11}{60}$; and D be the region $1 \leq \gamma_e < 2$, $1 \leq \gamma_m < 2$, $\gamma_e < \frac{6}{5}\gamma_m - \frac{1}{5}$ and $\gamma_m \leq \frac{\gamma_e}{2} + 1$. See figure 3 for a graph of the different regions.

Moving from Nash equilibrium subsidies to equalized subsidies involves the following changes in each parameter region. In A, $d\sigma_{ex} < 0$ and $d\sigma_m > 0$. In B, $d\sigma_{ex} = 0$ and $d\sigma_m = 0$. In both C and D, $d\sigma_{ex} > 0$ and $d\sigma_m < 0$. It immediately follows that there is no change in social welfare associated with an agreement to equalize subsidies when political weights fall in region B.

From the social planner's point of view, at all parameter values, in the Nash equilibrium, world prices of export goods are inefficiently low and a movement from Nash policies to equalized policies will deliver a terms of trade improvement to both countries if $\sigma_e < \frac{2}{3}\sigma_{ex} + \frac{1}{3}\sigma_m$. In regions A and D, this condition holds. Moreover, in region A, the domestic distortion asso-

ciated with the Nash equilibrium subsidy to the export sector is large relative to the domestic distortion associated with the Nash equilibrium subsidy to the import-competing sector. Thus, in region A, the gain associated with reducing σ_{ex} dominates the loss associated with increasing σ_m and improves social welfare. Similarly, in region D, the domestic distortion associated with the Nash equilibrium subsidy to the import-competing sector is large relative to the domestic distortion associated with the Nash equilibrium subsidy to the export sector. Thus, in region D, the gain associated with reducing σ_m dominates the loss associated with increasing σ_{ex} and improves social welfare.

Finally, in region C, there is a significant domestic distortion associated with the subsidy to the import-competing sector, but only a relatively small distortion associated with the subsidy to the export sector. Although moving to equalized policies in this region will worsen the terms of trade, the terms of trade effect is small relative to the gain associated with reducing the domestic distortion in the import-competing sector. On net, moving to equalized subsidies will yield a small gain to social welfare. QED.

An interesting implication of propositions 4 and 5 is that together they suggest that governments which place a high value on the welfare of producers may be using an international trade agreement to bind their own hands in domestic policy-setting in order to achieve a higher level of social welfare. Although this agreement does not achieve a fully socially efficient outcome, it does represent a strict improvement in social welfare over an agreement in which governments directly negotiate their domestic policies as part of a trade agreement.

3.3 Enforcement

In this section I show that a countervailing duty can be used to enforce an agreement in which governments set tariffs to zero and equalize production subsidies whenever the political bias favoring export sector producers is sufficiently large ($\gamma_e > \gamma_m + \frac{11}{60}$).

Define a countervailing duty as an import tariff used to offset the effect of a foreign government production subsidy. The GATT of 1994 authorizes importing countries to impose CVDs that are no greater than "the subsidy found to exist, calculated in terms of subsidization per

unit of subsidized and exported product (Art. 19.4)." In addition, the GATT only allows CVDs to be used in response to sector-specific subsidies (Art. 2). Economy-wide subsidies cannot be countervailed. From these institutional constraints, define the countervailing duty, τ^{CVD}.

$$\tau^{CVD} = \begin{cases} \sigma_{ex} - \sigma_m & \text{if } \sigma_{ex} > \sigma_m, \\ 0 & \text{otherwise.} \end{cases} \tag{33}$$

where σ_{ex} and σ_m are the Nash equilibrium sector-specific policies given by (25) and (26).[4]

Enforcement of the agreement with a CVD is inherently asymmetric. Tariffs can only be applied against imports. Hence, a CVD is a relevant punishment for a violation of the agreement to equalize subsidies if the violation takes the form of a production subsidy in the export sector that is higher than that in the import-competing sector. Recall that the Nash equilibrium production subsidy to the export sector is larger than the subsidy to the import-competing sector only if the government places a significantly larger weight on the export sector ($\gamma_e > \gamma_m + \frac{11}{60}$).

Proposition 6 *A CVD rule induces governments to choose equalized production subsidies whenever the political weight of the export sector is significantly higher than that of the import-competing sector ($\gamma_e > \gamma_m + \frac{11}{60}$).*

Proof:

A politically motivated government will abide by the agreement to equalize production subsidies if its political welfare under the equalized subsidies is higher than its political welfare under sector-specific production subsidies and a countervailing duty. First, note that the countervailing duty can only be imposed if $\sigma_{ex}^N > \sigma_m^N$. This occurs if ($\gamma_e > \gamma_m + \frac{11}{60}$). In this parameter range, a politically-motivated government that violated the agreement to equalize subsidies would raise its production subsidy to its export sector, lower its production subsidy

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[4]An alternative way to define the magnitude of the CVD would be to set it equal to σ_{ex}. This strengthens my results.

to its import-competing sector and face an increase in its trading partner's import tariff. Moving from the policy choices specified by the trade agreement ($\tau = 0$, $\sigma_{ex} = \sigma_m = \sigma_e$) to sector-specific production subsidies and the associated CVD would yield the following welfare change.

$$dW^{CVD} = \overset{(-)}{\frac{\partial W_i}{\partial \tau}} \overset{(+)}{d\tau} + \overset{(+)}{\frac{\partial W_i}{\partial \sigma_{ex}}} \overset{(+)}{d\sigma_{ex}} + \overset{(-)}{\frac{\partial W_i}{\partial \sigma_m}} \overset{(-)}{d\sigma_m} < 0 \qquad (34)$$

From the world price for the export good (1), we see that an increase in the tariff imposed by an importing country has a large negative effect on an exporting country's terms of trade. In the case of a CVD, the welfare cost to the exporting country of this terms of trade change is large. Because the loss of welfare associated with a countervailing duty dominates the small welfare gains associated with setting different production subsidies in each sector, politically-motivated governments with a bias for producers in the export sector will always abide by the agreement to equalize production subsidies. QED

Somewhat ironically, the CVD effectively enforces the agreement to equalize production subsidies at precisely those parameter values at which abiding by the agreement reduces a country's political welfare. This could be interpreted as adding strength to the argument that governments use the agreement to restrict their discretion over domestic policies in order to achieve a higher level of social welfare.

With regard to enforcement of the agreement when the import-competing sector has greater political clout, the CVD is useless. This suggests that enforcement of an agreement to equalize production subsidies in this case may be difficult. One possible route for enforcing the agreement when import-competing sectors are powerful is through a non-violation complaint regarding market access. Bagwell and Staiger (1999) have argued that negotiated reductions in tariffs constitute a market access commitment on the part of an importing country. If an importing country negotiated a reduction in its tariff and subsequently instituted an increase in the production subsidy to its import-competing sector, this would reduce the exporting country's access to the importing country's market. The exporting country could then seek compensation by filing a non-violation complaint with the WTO. Unfortunately, on a practical

level, market access rights are somewhat difficult to enforce. This suggests that we may observe more violations of the agreement to equalize subsidies by countries that place a high political value on producers in the import-competing sector than by countries that place a high political value on producers in the export sector.

4   Conclusion

This paper analyzed the GATT's subsidy restrictions and the role that CVDs play in a trade agreement. I showed that governments can improve a politically- unbiased measure of national welfare by signing an agreement to restrict their discretion in setting domestic production subsidies. Because terms-of-trade concerns lead to subsidies in import-competing sectors that are higher than globally optimal and in export sectors that are lower than globally optimal, a rule to equalize subsidies across sectors forces a country to partially internalize these terms of trade externalities, reducing a significant distortion in world trade. Lastly, I showed that this agreement can be enforced with countervailing duties when governments place a higher value on the welfare of producers in export sectors than they place on the welfare of producers in import-competing sectors.

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Figure 1:   Iso-world and local supply prices
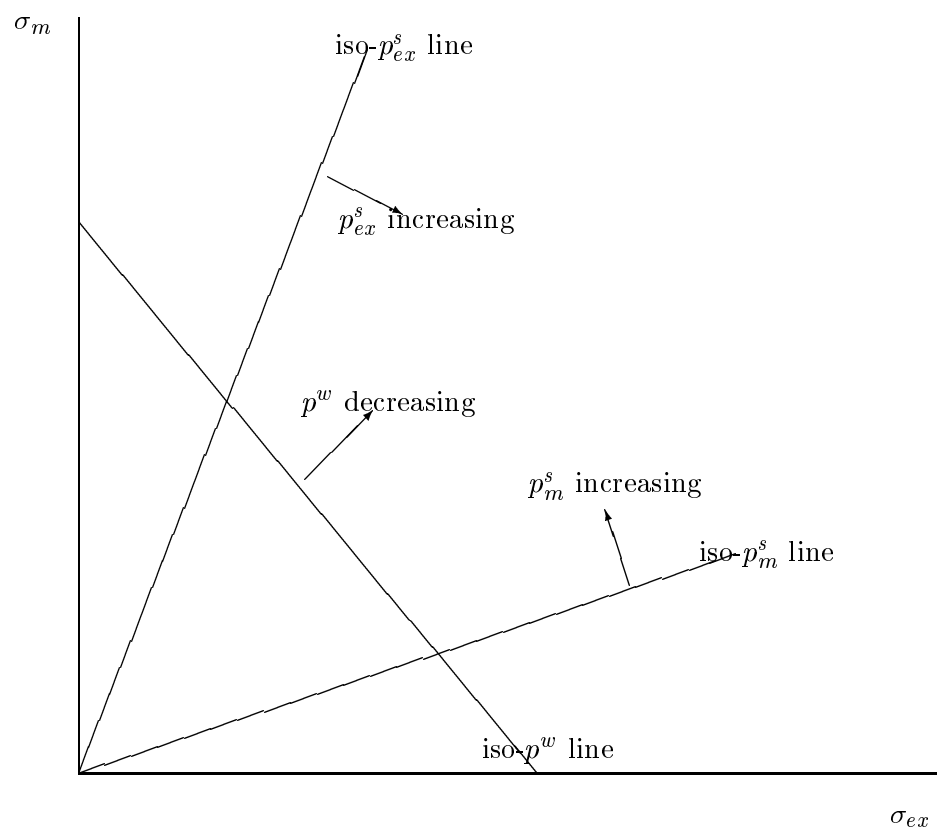
Figure 2: Reaction curves when $\tau = 0$ for $\gamma_m = \gamma_e > 1$
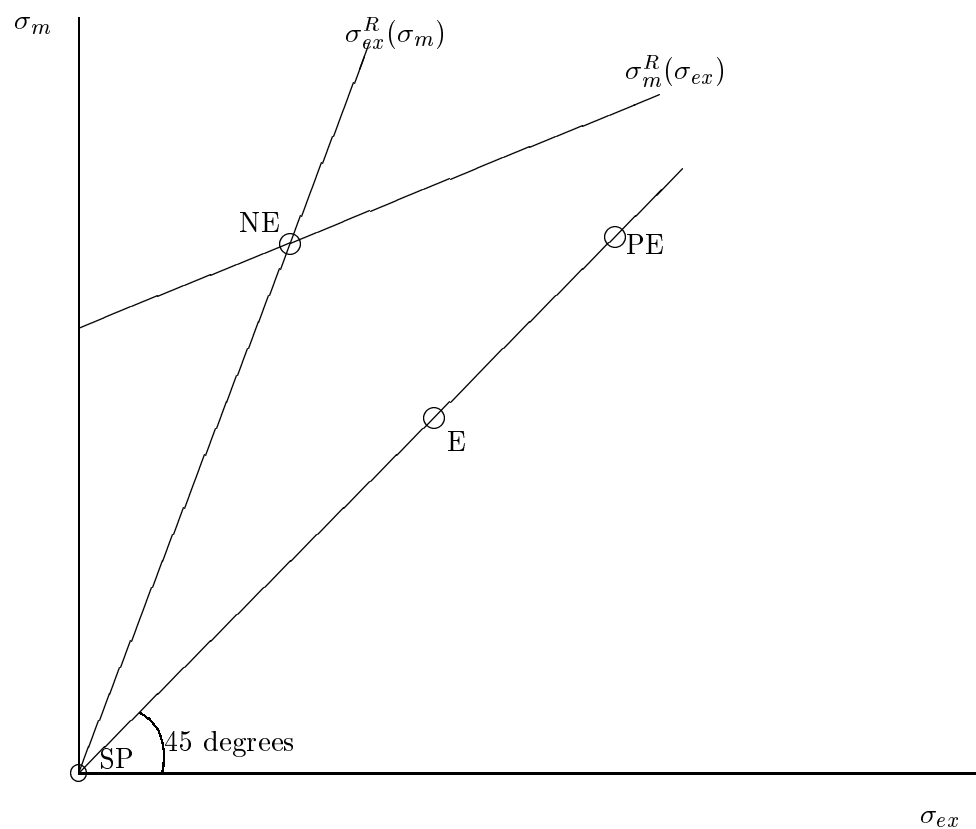
NE: Nash equilibrium production subsidies

PE: Politically-efficient production subsidies

SP: Socially-efficient production subsidies

E: Equalized production subsidies

Figure 3: **Social welfare at different parameter values**
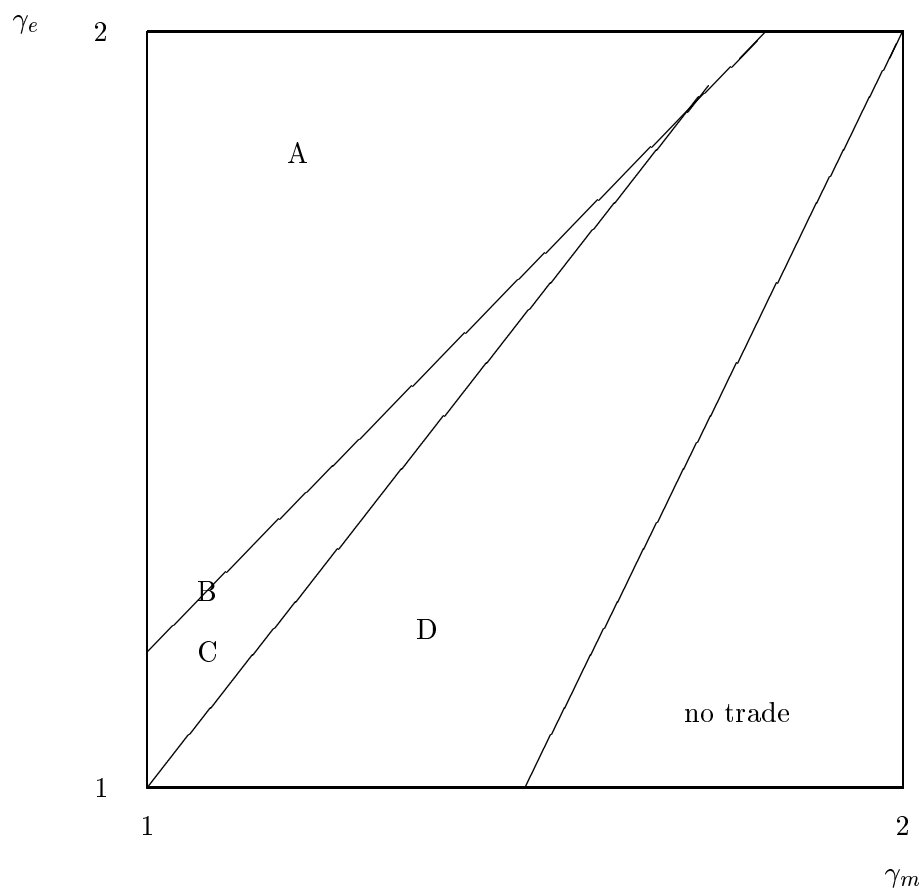
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