Self-Protection: Antidumping Duties, Collusion and FDI[*]

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Abstract: It is well established that the threat of antidumping duties can help sustain collusion between a foreign firm and its domestic counterpart. However, when the foreign firm is a multinational, its subsidiary will fight against a new duty, potentially making this threat hollow and collusion less likely. We show that the multinational may therefore choose to submit to a tariff even under collusion since evidence indicates that duties are more difficult to remove than initiate. In this way, it is possible to obtain a greater degree of commitment, although it comes at a cost. Nevertheless, we show that this can be a more profitable strategy than those previously explored. In fact, we find several cases where subsidiaries of multinational firms have indeed filed for protection from their own parents.

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1. Introduction

In recent decades, economists have sought to uncover the more subtle channels through which trade protection influences competitive behavior. While protection imparts obvious short-run advantages to domestic industries by raising import costs or limiting import quantities, Krishna (1989), Lommerud and Sørgard (2001), and others have shown that, in some cases protection can benefit foreign rivals as well. The underlying motif in these results is that the threat (or even imposition) of protection decreases competition, causing output and/or prices to shift towards monopoly levels. As a result, profits rise for foreign and domestic firms alike. This possibility has been of particular interest in the realm of antidumping (AD) legislation. Prusa (1992), Veugelers and Vandenbussche (1999), and Zanardi (2000) all note that because domestic firms can request protection should collusion break down, with AD there is a resulting increase in the set of collusive outcomes which potentially benefits all firms. One possible problem with this strategy arises when the foreign exporter is also a domestic producer, that is, when one or more of the firms is a multinational enterprise (MNE). Under WTO rules, the domestic industries must prove to trade authorities that existing AD orders are worthy of continuation.[1] Because the MNE can work to stop the imposition of an AD duty after collusion breaks down, this reduces the viability of the domestic firms' threat and decreases the commitment power afforded to the MNE from antidumping legislation.

In this paper, we demonstrate that there exists an alternative use of AD legislation that can improve the MNE's ability to commit and yields higher profits for all firms. Under this alternative, AD duties are imposed before collusion breaks down, that is, they are imposed even during the cooperative stage. This strategy is clearly more costly than those in which duties are

[1] The US initiated its "sunset review" policy in July 1998. In the first two years of the policy, all orders implemented before 1995 were reviewed by the Department of Commerce (DOC) and the US International Trade Commission (ITC). WTO legislation requires the cancellation of AD orders five years from the date of implementation unless domestic industries can successfully argue that the removal of protection will lead to a return to unfair trading conditions. See section 751(c) of the Tariff Act of 1930 (19 U.S.C. § 1675(c)).

only imposed after collusion breaks down, since in the sustainable agreements studied by Prusa (1992) and others the duty is never imposed. However, since the evidence indicates that it is much more difficult to have existing duties removed than to have new duties imposed, this costly strategy can buy a greater punishment should the MNE deviate.[2] Therefore, if the gain from commitment power exceeds the cost of the duty (which is mitigated in part by the MNE's ability to tariff jump), then as seen in the earlier papers, this changes the set of collusive outcomes to include agreements that benefit all firms. To illustrate this possibility, we use a dynamic model in which a foreign MNE and a domestic firm engage in Cournot competition in the domestic market to illustrate how the set of self-enforcing collusive quantities changes with the introduction of AD duties, and how this in turn can increase the profits of both firms.

One curious artifact of our alternative use of AD duties is that it requires the MNE's subsidiary to seek protection from its own parent, both during the initial decision to impose AD duties and during the sunset reviews that renew existing AD duties. Failure by these subsidiaries to seek duties can ultimately undermine the drive for lasting protection for at least two reasons. First, in order for US trade authorities to even consider imposing dumping duties, at least one-quarter of the domestic industry (in terms of output) must actually seek protection and no more than one-half of the domestic industry can protest the petition.[3] Second, policy makers become increasingly hesitant about enacting legislation that harms employers of U.S. workers, even if they happen to be non-U.S. firms.[4] Therefore, imposing or maintaining protection is more tenuous if foreign subsidiaries or their parent firms react to dumping measures with sufficient opposition. In fact, we have found several cases in which U.S. subsidiaries of foreign firms have

[2] According to Lindsey and Ikenson (2002), approximately 61 percent of initial petitions that are ruled upon result in duties. Compare this with sunset reviews where the DOC and ITC ruled in favor of continuing duties in 98 percent and 72 percent of cases respectively.

[3] The ITC considers whether domestic producers are "related parties" of foreign subsidiaries and may choose to exclude these firms when it records testimony and analyzes the "domestic industry". In most cases, however, purely domestic firms do not argue for the exclusion of foreign subsidiaries, and the ITC rarely exercises its discretion to separate such subsidiaries when it considers the domestic industry.

[4] This was witnessed recently when a proposal was made by South Carolina legislators to bar French imports after France refused to cooperate with US war efforts in Iraq. When it was realized how many local workers were actually employed by French subsidiaries, the proposition was quickly dropped.

either actively sought duties or remained passive while purely domestic U.S. firms pursued protection. In the sunset review involving various antifriction bearings imports from Europe and Asia, many of the targeted foreign firms were affiliated with US producers. In the ball bearings industry, most or all targeted German, Italian, Japanese and Singaporean producers had U.S. affiliates. Ultimately, the Department of Commerce and the International Trade Commission decided to maintain dumping orders against six out eight foreign ball bearing industries, including Germany, Italy, France, Japan, Singapore and the U.K. Interestingly, orders against Sweden and Romania, which had fewer US affiliates, were cancelled. Similar conditions existed in the concrete roller bearings, taper roller bearings and spherical roller bearings industries, leading one ITC Commissioner to state that, "the [affiliated] parties account for a substantial portion of US sales in all four [bearings] industries."[5]

An equally relevant case involves the Japanese forklift industry, in which all targeted firms had established US subsidiaries prior to the sunset review. Significantly, no attempts were made on the part of these subsidiaries to have the order cancelled.[6] It is important to note that since these firms already had subsidiaries in place, the "protection-building trade" story of Blonigen and Ohno (1997) is not applicable. In that paper, they analyze a phenomenon in which a foreign firm chooses to increase the likelihood that trade barriers will be erected against its own industry. The authors show that this can be an optimal strategy if the firm can then shift production to the protected country and tariff jump which gives it an edge over competing foreign firms that are unable to engage in FDI. In particular, this strategy relies on asymmetries between firms since if firms are identical, either all or none will tariff jump, implying no gain from seeking protection. However, in the Japanese forklift case, all foreign firms tariff jumped, implying comparable costs. As a second example, consider the market for Anhydrous Sodium

[5] See ITC Publication No. 3309 at ftp://ftp.usitc.gov/pub/reports/opinions/PUB3309.PDF, which discusses sunset review determinations regarding certain bearings from China, France, Germany, Hungary, Great Britain, Italy, Japan, Romania, Singapore and Sweden.
[6] See USITC publication No. 3287 at ftp://ftp.usitc.gov/pub/reports/opinions/PUB3287.

Metasilicate, in which the sole French producer, Rhodia, was affiliated with U.S. producer Crosfield. Despite the non-existence of additional French competitors, neither Crosfield nor Rhodia made an attempt to have the order cancelled.[7] The likelihood of collusion between the two was even noted by Commissioner Askey, who in her dissenting opinion to revoke the order wrote that due to the affiliation between Rhodia and Crosfield "it therefore seems unlikely that Rhodia will begin importing large quantities of ASM, selling them in direct competition with Crosfield's product." As such, the protection-building trade story cannot always explain the continued support for AD duties.[8]

In Section 2, we review the existing literature on AD and collusion, noting the difficulties of extending that work to a setting with significant multinational investment. Our model is presented in Section 3. Section 4 concludes.

2. Antidumping and Collusion

We are not the first paper to recognize that AD legislation, now the most widely used form of protection in the U.S., can increase the likelihood of international collusion. Staiger and Wolak (1992) present a model in which a competitive domestic industry fights the periodic flow of imports from a foreign monopolist by petitioning for dumping protection. The authors solve for conditions under which the foreign monopolist agrees not to export its excess production in exchange for commitment by domestic industry not to file dumping charges. Prusa (1992) sees evidence of collusion in the fact that withdrawn antidumping cases lead to an almost equal reduction of imports as those cases in which duties are implemented. Moreover, Prusa points to a legal doctrine known as Noerr-Pennington, which facilitates collusive behavior by exempting firms from antitrust charges. The author develops a model of oligopolistic price competition in

[7] See USITC Publication No. 3235 at ftp://ftp.usitc.gov/pub/reports/opinions/PUB3235.PDF.
[8] We recognize that despite the ability of Japanese forklift producers to avoid duties by shifting production to their US subsidiaries, protection continues to be a drawback by hindering production flexibility. Our theory is that the gain from collusion facilitated by the presence of antidumping protection can outweigh the costs brought on by a loss of production flexibility or the imposition of duties.

which foreign and domestic firms can always find a settlement that increases the profits of all firms involved. Unlike our model, Prusa (1992) does not consider the payoff in a deviation phase in which one firm surprises the other, but instead simply compares the settlement payoff to the expected payoff if the case moves forward.[9] Furthermore, neither of these papers suggests that AD duties will be used in equilibrium. In a model similar to Prusa's, Zanardi (2000) does find that AD may be used, depending on the cost of coordination and the relative bargaining strength of the two firms. However, again, he finds that the imposition of duties represents a failure of the collusive process.

Using a slightly different approach, Veugelers and Vandenbussche (1999) investigate the effect of AD legislation on collusion between two domestic firms as well as between the foreign exporter and the domestic producers. Using simulation results, they find that depending on the degree of product heterogeneity and cost asymmetry between foreign and domestic firms, introducing AD can lead to a full cartel between all three firms, cooperation only between domestic firms, or straight competition. However, they do not consider a dynamic model with self-enforcing agreements, but instead only show how trade policy affects firm preferences over collusive structures. Furthermore, none of these papers consider the role of foreign direct investment (FDI). While the gain from introducing duties in our model can still hold if the foreign firm is a pure exporter, this market structure also makes it easier to get duties imposed after a deviation, making that a less-costly method of achieving a comparable degree of commitment power. Finally, all of these papers model price competition, indicating that our model's second contribution is to confirm that the collusive power of AD legislation does not require Bertrand competition.

In addition to the work on AD legislation, other authors have analyzed the profit-enhancing effects of trade policy for foreign and domestic firms. Krishna (1989) shows that under

[9] An empirical study by Taylor (2001) fails to find evidence that withdrawn cases are a sign of collusion between foreign and domestic firms.

static duopolistic price competition, a quota enables foreign and domestic firms to circumvent the prisoner's dilemma result and achieve economic profits.[10] Under duty restrictions, however, Krishna's model only allows the domestic producer to experiences a rise in profits. Lommerud and Sørgard (2001) study two firms that collude by not exporting to one another's markets. They find that a reduction in trade barriers increases the gain from deviation and the punishment of reverting to the Nash equilibrium. For their functional forms, the first effect dominates for quantity competition, reducing the set of discount factors that sustain collusion, whereas the second effect dominates for price competition, increasing this set of discount factors. Two key factors differentiate their results from ours. First, they do not consider collusive outcomes other than abstention from exporting, indicating that trade costs are not paid during the cooperative phase. Second, both firms in Lommerud and Sørgard (2001) face trade costs when collusion breaks down, whereas only the foreign firm ever endures trade costs in our model.

Bulow, Geanakopolos and Klemper (1985) present a simple case in which a positive demand shock can ultimately lead to an overall decline in profits. In their model, one firm services two markets while a second firm competes with the first in only one market. When there is a positive demand shock in the monopoly market, firm 1 reallocates is sales away from the duopoly market. Firm 2 responds by increasing its sales in the duopoly market, which would then lead to an increase in sales by firm B. If this response is sufficiently aggressive, which requires asymmetries between firms, then the increase in firm 1's profits from the positive shock in the first market are overwhelmed by the decline in its profits from the second market. Translating this result to our model suggests that it is possible that a reduction in protection applied by the MNE's home country could also result in a decline in its profits as it increases imports from its subsidiary, although we do not address this possibility here. Finally, we note that the decision of a multinational to face protective barriers is analogous to the well-analyzed case of a monopolist

[10] Thus, while we consider how implementation of a tariff affects the set of collusive outcomes, she investigates how trade protection affects the Nash equilibrium.

that chooses an otherwise non-optimal capacity level in order to deter entry ((seminal papers include Spence (1977), Dixit (1979) and Fudenberg and Tirole (1983)).

3. The Model

Our goal is to present a simple model that demonstrates that introducing an antidumping duty that binds even under cooperation can be profitable for the importing firm. Consider a setting with two firms, 1 and 2. Firm 1 is wholly domestic and produces a quantity q_1 at a total cost $\beta(q_1)$.[11] Firm 2 is a multinational firm that produces overseas and domestically. Its domestic production is q_2 which comes at cost $\gamma(q_2)$. Firm 2's overseas production is q_2^* which is produced and imported at a cost $\phi(q_2^*) + \tau q_2^*$ where τ is the per-unit antidumping duty. Similar but more complicated results are found when using an ad-valorem duty. Define firm 2's total quantity as $Q_2 = q_2 + q_2^*$. All three cost functions are increasing, convex functions of their respective quantities, although our results only require that there is a cost to firm 2 to shifting production from abroad to its domestic subsidiary. Since anti-dumping duties are applied to narrowly defined product categories, we assume that all of these products are homogeneous and sell in the domestic market at the price $P(q_1 + q_2 + q_2^*)$ which is decreasing in the total quantity sold. As in most of the antidumping literature, we assume that all production is sold in the domestic market, although this could be relaxed without changing the underlying intuition of our results. Firms maximize the present discounted value of profits where profits in period t are:

$$\pi_{1,t} = P(q_{1,t} + q_{2,t} + q_{2,t}^*)q_{1,t} - \beta(q_{1,t}) \tag{1}$$

and

$$\pi_{2,t} = P(q_{1,t} + q_{2,t} + q_{2,t}^*)(q_{2,t} + q_{2,t}^*) - \gamma(q_{2,t}) - \phi(q_{2,t}^*) - \tau q_{2,t}^*. \tag{2}$$

[11] If firm 1 is also a multinational and the duty applies to it as well, the effects of an anti-dumping duty are more ambiguous since for each firm a rise in τ both loosens its incentive compatibility constraint as per firm 2 since deviations are less profitable and tightens it as per firm 1 since its opponent is now hampered if it deviates from the agreement. However, since the basic intuition remains the same, we use this simpler framework to outline the collusive effects of duties.

The first order conditions of these object functions are (suppressing time subscripts):

$$P'(q_1^B(Q_2)+Q_2))q_1^B(Q_2)+P(q_1^B(Q_2)+Q_2)-\beta'(q_1^B(Q_2))=0 \quad (3)$$

$$P'(q_1+Q_2^B(q_1))Q_2^B(q_1)+P(q_1+Q_2^B(q_1))-\gamma'(q_2^B(q_1))=0 \quad (4)$$

and

$$P'(q_1+Q_2^B(q_1))Q_2^B(q_1)+P(q_1+Q_2^B(q_1))-\phi'(q_2^B(q_1))-\tau=0 \quad (5)$$

where the superscript B denotes the best response given the other firm's quantity. We assume that the best responses $q_1^B(Q_2)$ and $Q_2^B(q_1)$ are downward sloping, and that there is a unique pure strategy stable Nash equilibrium.[12] We also assume that profit functions are quasi-concave in each firm's own quantities, leading to convex level sets for iso-profits.

If there is no collusive agreement, the Cournot Nash equilibrium results in quantities q_1^N, q_2^N, and q_2^{*N} which translate into per-period profits π_1^N and π_2^N.[13] These are derived from simultaneously solving (4), (5), and (6). Naturally, firms can increase profits through collusion. Denote the collusive quantities q_1^C, q_2^C, and q_2^{*C} which correspond to per-period profits π_1^C and π_2^C. With the above assumptions on profit functions, for both firms to gain from collusion each firm's total collusive output must be less than its Nash output. In addition to this self-rationality, the set of collusive agreements is also constrained by incentive compatibility, i.e. neither firm can profit from deviating and suffering the consequences. We assume that firms follow grim trigger strategies, that is, after a deviation they revert to Nash behavior forevermore. In the deviation period, the deviating firm switches to deviation quantities, either $q_1^D = q_1^B(Q_2^C)$ or q_2^D and q_2^{*D} where $q_2^D + q_2^{*D} = Q_2^B(q_1^C)$, while the surprise firm continues to produce its cooperative quantity.

[12] Chapter 5 of Tirole (1994) provides sufficient conditions for a unique, stable Nash equilibrium with quantity competition.

[13] The majority of papers on antidumping and collusion, including Prusa (1992) and Staiger and Wolak (1992), study Bertrand competition. Veugelers and Vandenbussche (1999) is an exception, however they do not examine the effect of duties on the set of sustainable collusive outcomes as we do. Thus, in addition to the paper's contributions regarding the effect of antidumping legislation in the presence of a multinational, our paper demonstrates that the wisdom regarding collusion in prices carries over to collusion in quantities.

Since best responses are downward sloping, these deviation quantities exceed both the Nash and cooperative quantities. Denote the deviation period payoff to the cheating firm i by π_i^D. By definition of the best response and self-rationality, $\pi_1^D \geq \pi_1^C \geq \pi_1^N$ and $\pi_2^D \geq \pi_2^C \geq \pi_2^N$ with equality only when firms collude at the Nash equilibrium. When the common discount rate is δ, incentive compatibility for firms 1 and 2 are given by:

$$\pi_1^C \geq (1-\delta)\pi_1^D + \delta\pi_1^N \tag{6}$$

and

$$\pi_2^C \geq (1-\delta)\pi_2^D + \delta\pi_2^N \,. \tag{7}$$

Note that these imply that any incentive compatible agreement is also self-rational. Thus, for $\delta < 1$ these constraints lie inside the respective firm's Nash equilibrium iso-profits with the exception of the Nash equilibrium itself, in which case they meet. This is illustrated by the IC curves in Figure 1. The contract curve denotes the set of quantities that translate to tangent iso-profits, i.e. the quantities for which, to increase one firm's profits it is necessary to reduce the other's profit. Under the standard Folk theorems, for a high enough δ, a portion of the contract curve may be incentive compatible.[14] For the moment, we assume that this is not the case, as illustrated by the CC line in Figure 1. We return to the alternative below. Note that the shape of the curves in Figure 1 are only intended to be illustrative; we do not require linearity of best responses or this particular shape of the contract curve.

When the contract curve lies outside the set of incentive compatible agreements, it seems reasonable to assume that any collusive agreement is going to involve at least one firm's incentive compatibility constraint binding since it is possible to move to one of these curves and improve at least one firm's profits without hurting the other. Thus, we restrict our attention to what happens when at least one firm's constraint binds. Although further gains are feasible, movement in this direction creates too great a temptation for the firm whose constraint binds to

[14] See Fudenberg and Tirole (1993) for details.

flood the market, capture a large one-period gain, and then revert to Nash behavior. If it were possible for this firm to gain some commitment power to not do so, then it could enjoy higher profits. The essence of our argument is that imposing a duty on firm 2's imports acts as just such a commitment device, although a costly one. Thus, if it is firm 2's incentive compatibility constraint that binds, then if imposition of the duty creates enough commitment power relative to its cost, then it is possible to impose a duty against its imports q_2^* yet increase its profits. We now examine under what conditions this possibility exists.

Suppose that a small tariff is added to imports. By (4) and (5), for a given q_1, firm 2 imports decrease while its domestic production increases. Since its marginal costs are increasing, this substitution is not perfect and firm 2's total quantity falls.[15] Thus, firm 2's best response curve moves inward. If $\gamma'(0) = 0$, this movement is a pivot about the q_1 that originally drove firm 2 from the market. As a result, firm 2's total output falls in both the Nash equilibrium and when it deviates:

$$\frac{dq_2^{*N}}{d\tau} < \frac{dQ_2^N}{d\tau} < 0 \tag{8}$$

and

$$\frac{dq_2^{*D}}{d\tau} < \frac{dQ_2^D}{d\tau} < 0\,. \tag{9}$$

Note that since the multinational firm can reallocate production to avoid the tariff that its profits are a decreasing at a decreasing rate in the tariff. If the marginal cost of overseas of production is also increasing, then these changes are larger in the deviation phase than at the Nash equilibrium since $Q_2^D > Q_2^N$. Since the purely domestic firm 1 does not pay the tariff, the only effect on its behavior is through the effect on Q_2. Since quantities are strategic substitutes, this implies that:

[15] Even if the domestic marginal cost is constant, as long as it exceeds the marginal cost of importing inclusive of the duty, $Q_2^B(q_1)$ is declining in the duty.

$$\frac{dq_1^N}{d\tau} > 0 . \tag{10}$$

By (8) and (10), this implies that for a given Q_2^C, the present discounted value of deviation rises for firm 1 tightening its incentive compatibility constraint. This shift is shown in Figure 2 by the movement of IC_1 from its dashed to its solid position. A similar result would be found in Prusa (1992) or Staiger and Wolak (1992) because the duty gives their domestic firms an edge. The primary difference is that this effect is smaller in our case since firm 2's ability to substitute domestic production for imports leads to a smaller decrease in Q_2 than would be found for a pure importer.

Using (8) through (10) implies that for a given q_1^C the value of deviation is falling for firm 2. While this seems to suggest that introducing antidumping legislation relaxes 2's incentive compatibility constraint, it is necessary to remember that this also reduces 2's payoff to collusion (assuming of course that it is importing without the duty). When (3) holds with equality, holding cooperative quantities constant and taking the derivative of (3) with respect to the tariff yields:

$$(1-\delta)(q_2^{*D} - q_2^{*C}) + \delta(q_2^{*N} - q_2^{*C}) - \delta P'(q_1^N + Q_2^N)Q_2^N \frac{dq_1^N}{d\tau} > 0 \tag{11}$$

since both the deviation and Nash equilibria involve higher production levels than the cooperative outcome.[16] Thus, by (11), the multinational firm 2's incentive compatibility constraint is loosened when the duty is imposed. This is represented in Figure 2 by the shift in IC_2 from its dashed to its solid position.

Because the duty relaxes firm 2's incentive compatibility constraint, if in the initial collusive agreement firm 1's incentive compatibility constraint was non-binding, then there exists a set of quantities that are incentive compatible with antidumping legislation that were not so before. Some of these quantities yield a higher cooperative profit for firm 1. For example, for the

[16] Note that derivation of this makes use of the envelope theorem with respect to deviation and Nash quantities.

firm 1 iso-profit illustrated in Figure 2, only one set of outputs was both self-enforcing and sufficient to reach this profit without the tariff, whereas the tariff creates a set of such quantities. Furthermore there are quantities to the south-east of this iso-profit that are self-enforcing and yield higher firm 1 profits.

In addition, some of these quantities also lie on higher initial iso-profits for firm 2 than the initial iso-profit. Because of this, it is tempting to assume that, as in Prusa (1992) or Staiger and Wolak (1992), this implies that introducing antidumping legislation will increase firm 2 profits as well. However, this is not always the case. In their model, duties were only paid in the punishment (Nash) phase. In our model, however, these duties are also paid in the cooperative and deviation phases. Because of this, not only do the incentive compatibility curves shift, but firm 2's cooperative iso-profits also move. It is therefore necessary to compare the gains from reducing firm 2's incentive to deviate with the cost of that commitment power. To do this, imagine a central planner who maximizes firm 2's cooperative profits subject to (7) and:

$$\pi_1^C \geq \bar{\pi}_1 \tag{12}$$

that, is the central planner maximizes firm 2's profits while keep firm 1 at least indifferent and minding firm 2's incentive to deviate. At her disposal, she has all three cooperative quantities and a tariff. The first order condition to her maximization problem with respect to τ is:

$$-q_2^{*C} + \lambda_2 \left((1-\delta)\left(q_2^{*D} - q_2^{*C}\right) + \delta\left(q_2^{*N} - q_2^{*C}\right) - \delta P'(q_1^N + Q_2^N) Q_2^N \frac{dq_1^N}{d\tau} \right) \tag{13}$$

where λ_2 is the Lagrange multiplier for firm 2's incentive compatibility constraint. The first term is negative and represents the reduction in profits as the tariff rises. The second term is positive as per (11) above. Whether the cost of the duty is outweighed by the shadow value of the commitment afforded by the tariff is in general ambiguous.

Naturally, the cost in equation (13) is increasing as more is imported. Thus, the likelihood of a profit-increasing antidumping duty is decreasing in the absolute level of cooperative imports.

Because of this, if firm 2's incentive compatibility constraint is non-binding and $\lambda_2 = 0$, there is no benefit to the tariff. When firm 2's constraint does bind, the benefit of the tariff is increasing in the shadow value of commitment. It is also increasing in the difference between the marginal effect of the tariff on profits in the deviation phase relative to cooperation (the first term in brackets) and in the difference between the marginal effect of the tariff on profits in the Nash equilibrium relative to cooperation (the final two terms). These effects are weighted by their relative importance in present discounted profits, hence the δ multiplier. As imports become more important in non-cooperative periods relative to the cooperative period, then profits in these periods decrease a great deal relative to cooperation, creating a large increase in the multinational firm's commitment power. This is likely to happen when the domestic cost function is very convex relative to the overseas production function since this implies that domestic production is a small share of firm 2's total output. The final term represents a second effect that reduces 2's profits in the Nash equilibrium, since the duty gives firm 1 a competitive edge in the Nash equilibrium. The steeper the demand curve and the more responsive 1's best response is, the greater this effect. Finally, as the discount rate δ rises, the effect of the tariff on the Nash payoffs becomes more important relative to its effect on the deviation period. Thus, as δ rises, commitment depends less on the one time gain from deviation and more on the losses under the Nash equilibrium, elevating their importance in sustaining collusion.

Thus, introducing an antidumping duty moves the frontier of incentive compatible profits. Figure 3 illustrates the profit possibilities frontier (the PPF line), which is directly related to the contract curve. Introducing a small duty pivots this in from the dashed to the solid line since it does not affect firm 1's monopoly profits but reduces firm 2's monopoly profits. Figure 3 also shows the movement in the set of self-enforcing profits. Since we assumed the contract curve was outside of this lens, this set lies in the interior of the frontier. When the duty is introduced, the Nash equilibrium moves from A to B and the set of self-enforcing profits moves. If the gain to

commitment is sufficiently large as detailed above, this movement is such that both firms can gain from introduction of the duty. Note that this gain is relative to one without any duty, either with or without collusion. If the multinationality of firm 2 makes reduces the probability of a tariff being imposed in the deviation period to zero, then this implies that our strategy dominates those of Prusa (1992) or Staiger and Wolak (1992). If the probability that the duty can be enforced following deviation is less than one, then the relative merits of these two uses of AD duties is ambiguous. The reason is that in ours, although the higher probability of duty imposition and the imposition of duties during the deviation period lead to greater reductions in the present discounted value to deviation, unlike their strategy this comes at a cost.

As in their models, our analysis does not say that one of these new collusive outcomes will actually occur. This depends on the equilibrium selection method imposed, such as the Nash bargaining solution (Nash, 1953). However, when new collusive agreements become possible in Figure 3, it is certainly feasible that this will work to the benefit of firm 2. Furthermore, depending on the equilibrium selection method, it is possible for firm 2 to gain even when the change illustrated in Figure 3 does not occur. Since selection rules can depend on the set of equilibria, altering the set of self-enforcing agreements can shift favor to firm 2, benefiting it even at a cost to firm 1. This possibility is especially intriguing since the multinational firm 2 can file for protection against itself even if firm 1 does not participate. Finally, because the duty shifts the set of collusive outcomes, again depending on the selection rule, this can work to the benefit of firm 2 even if firm 1's incentive compatibility constraint binds or a portion of the contract curve is self-enforcing.

Finally, note that the above analysis does not require FDI prior to the imposition of AD duties since the optimal value of q_2 may well be zero when $\tau = 0$. Additionally, an interesting scenario arises when there are fixed costs associated with investment. Prior to undertaking investment, the change in profits from imposing an AD duty and then engaging in FDI is:

$$-q_2^{*C} + \lambda_2 \left((1-\delta)\left(q_2^{*D} - q_2^{*C}\right) + \delta\left(q_2^{*N} - q_2^{*C}\right) - \delta P'(q_1^N + Q_2^N) Q_2^N \frac{dq_1^N}{d\tau} \right) - \xi \qquad (14)$$

where ξ is the fixed cost of FDI. If FDI has already happened, then the change in profits is again (13), where of course the values of q_1 and Q_2 may differ from (14). It is certainly possible that although (14) is negative, the corresponding (13) is positive. As such, an initially pure foreign exporter may prefer to fight AD duties, but after losing this fight, will undertake FDI and prefer to keep the duties imposed. This possibility is consistent with the Japanese forklift example discussed above.

4. Conclusion

In our paper, we show that even when the threat of antidumping duties is small due to the presence of a multinational, AD legislation can still be used to support profitable collusive outcomes. In particular, this offers an explanation for why certain U.S. subsidiaries pursue antidumping protection from the foreign industries containing their own parent firms. We use a dynamic game in quantities with trigger strategies to show that duties can loosen the incentive compatibility constraint of the foreign firm and allow collusive agreements to arise that were previously unsustainable. We note that our results work best if collusion under free trade is established such that the incentive compatibility constraint binds for the foreign but not the domestic firm. In order for duties to shift the set of collusive arrangements into mutually beneficial territory with initial constraints binding for all parties, costs must be borne by both foreign and domestic producers. Of course, when a market is truly global and no purely domestic firms remain, this very scenario can arise (i.e. protection is levied against foreign multinationals whose subsidiaries compose the entire domestic market). The ball bearing industry has almost reached this stage and other industries could follow suit in the not-too-distant future.

Overall, we find it perplexing that trade authorities allow foreign multinationals to potentially abuse U.S. antidumping law in this manner. Since it seems clear that it is not rational

for a multinational firm to injure itself through dumping, we find it surprising that subsidiaries are allowed to lobby for antidumping protection. Certain trade authorities are similarly puzzled.[17] On several occasions, particularly during the sunset review process, ITC commissioners have expressed doubt that multinationals would actually choose to threaten their US affiliates by dumping. In the sunset review involving sorbitol from France, Roquette America supported the continuation of duties against its parent, Roquette Freres. Additional support for the order came from US producer SPI, which had recently established a joint venture with French producer Amylum to produce sorbitol in France. A minority of ITC commissioners voted to cancel the order, declaring that "despite their affiliations, both Roquette America and SPI support continuation of the dumping order." The majority of commissioners, however, voted to continue the antidumping order against imports of French sorbitol. Perhaps the decision to maintain some of these orders is an indication of the political muscle currently wielded by foreign multinationals. Nevertheless, if the benefits of increased US subsidiary production are substantial enough, these protective orders may serve as a symbiotic mechanism that increases US welfare as well as foreign multinational profits.

[17] See USITC Publication 3165 at ftp://ftp.usitc.gov/pub/reports/opinions/PUB3165.PDF.

References

Blonigen, Bruce and Ohno, Yuka, "Endogenous Protection, Foreign Direct Investment and Protection-Building Trade," *Journal of International Economics*, 1998, 46(2): 205-27.

Bulow, Jeremy I., Geanakoplos, John D. and Klemperer, Paul D., "Multimarket Oligopoly: Strategic Substitutes and Complements," *Journal of Political Economy*, June 1985, 3: 488-511.

Dixit, A., "A Model of Duopoly Suggesting a Theory of Entry Barriers," *Bell Journal of Economics*, 1979, 10: 20-32.

Fudenberg, D. and Tirole J., "Capital as a Commitment: Strategic Investment to Deter Mobility," *Journal of Economic Theory*, 1983, 31: 227-50.

Krishna, Kala, "Trade Restrictions as Facilitating Practices," *Journal of International Economics*, 1989, 26: 251-270.

Lindsey, Brink and Ikenson, Dan, "Antidumping 101: The Devilish Details of "Unfair Trade" Law," *Trade Policy Analysis*, 2002, No. 20, Cato Institute.

Lommerud, Kjell Erik and Sørgard, Lars, "Trade Liberalization and Cartel Stability," *Review of International Economics*, 2001, 9(2): 343-355.

Prusa, Thomas J., "Why Are So Many Antidumping Petitions Withdrawn," *Journal of International Economics*, 1992, 33: 1-20.

Prusa, Thomas J., "On the Spread and Impact of Antidumping," *NBER Working Paper 7404*, October 1999.

Spence, A. Michael, "Entry, Capacity, Investment and Oligopolistic Pricing," *Bell Journal of Economics*, 1977, 8: 534-44.

Staiger, Robert W. and Wolak, Frank A., "The Effect of Domestic Antidumping Law in the Presence of Foreign Monopoly," *Journal of International Economics*, 1992, 32: 265-87.

Taylor, Christopher T., "The Economic Effects of Withdrawn Antidumping Investigations: Is there Evidence of Collusive Settlements," Federal Trade Commission Bureau of Economics Working Paper: 240, June 2000.

Veugelers, Reinhilde and Vandenbussche, Hylke, "European Antidumping Policy and the Profitability of National and International Collusion," *European Economic Review*, 1999, 43: 1-28.

Zanardi, Maurizio, "Antidumping Law as a Collusive Device," Boston College Working Paper No. 487, 2000

Figure 1

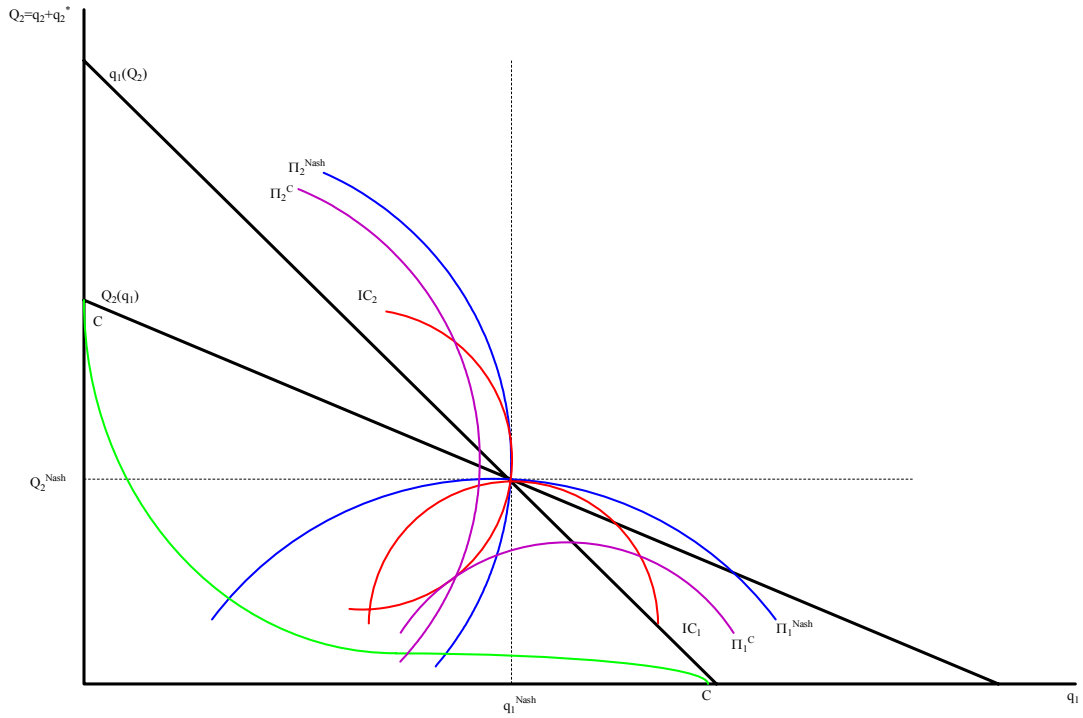

$Q_2=q_2+q_2^*$
$q_1(Q_2)$
Π_2^{Nash}
Π_2^C
$Q_2(q_1)$
C
IC_2
Q_2^{Nash}
IC_1
Π_1^C
Π_1^{Nash}
q_1^{Nash}
C
q_1

Figure 2

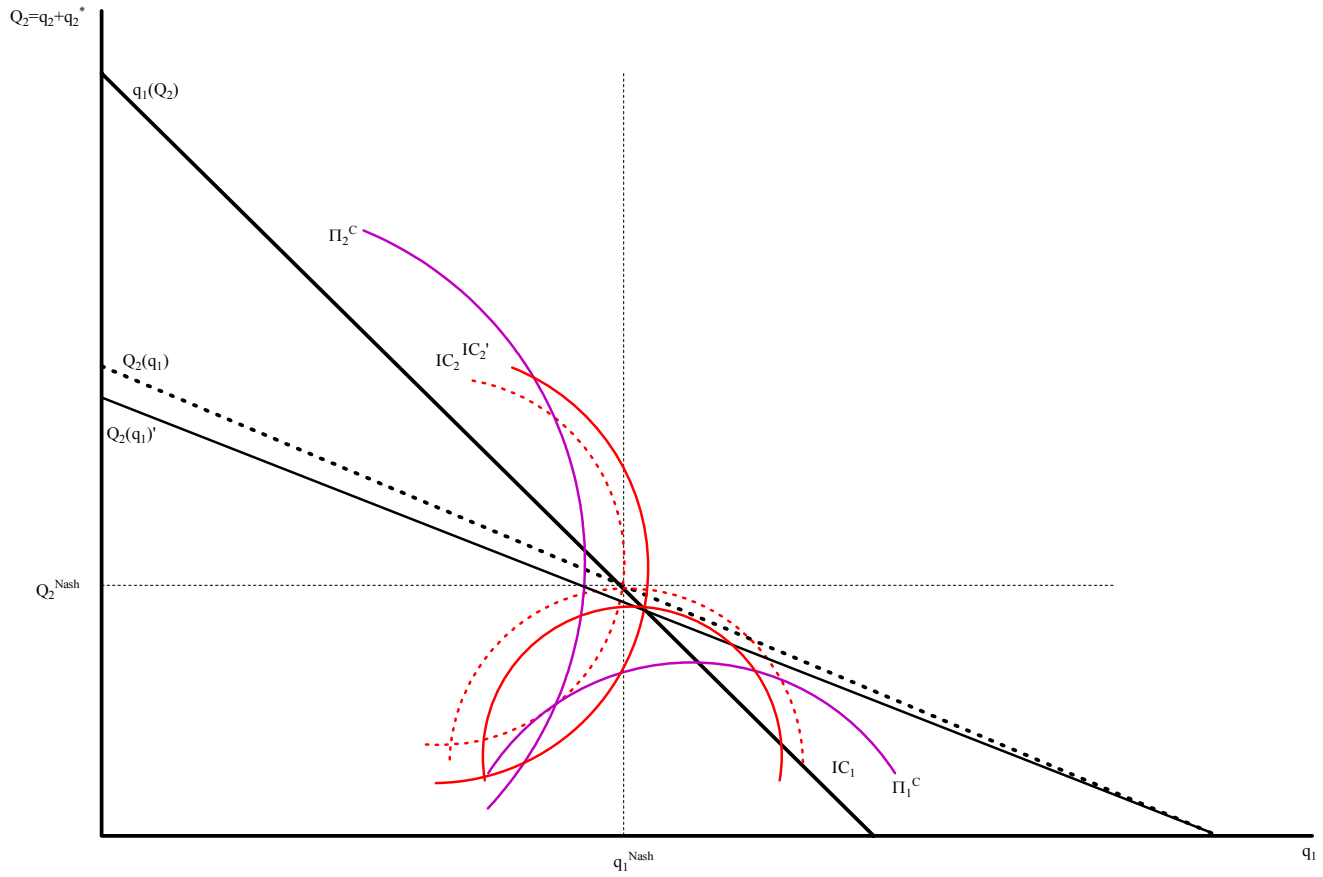
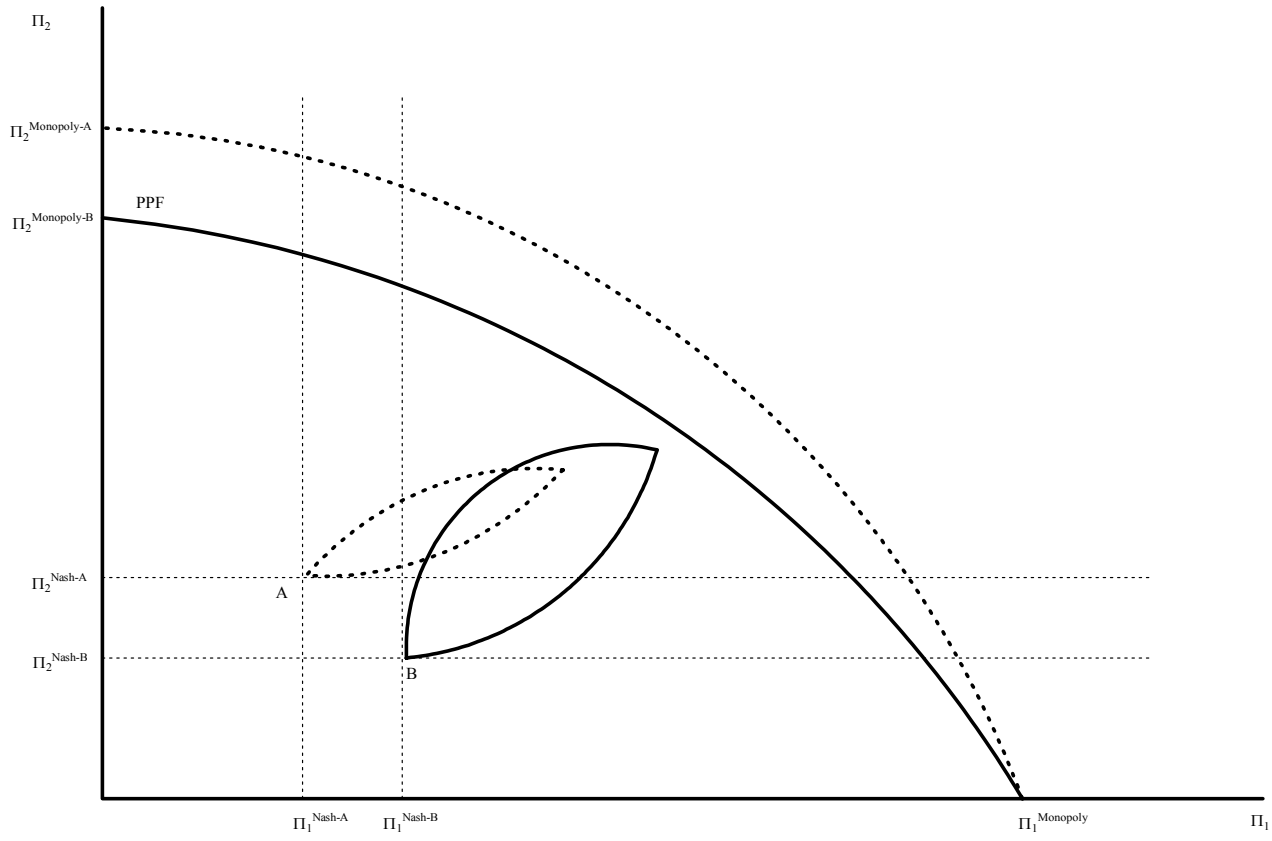


Figure 3


Π_2
$\Pi_2^{Monopoly-A}$
$\Pi_2^{Monopoly-B}$
PPF
Π_2^{Nash-A}
Π_2^{Nash-B}
A
B
Π_1^{Nash-A}
Π_1^{Nash-B}
$\Pi_1^{Monopoly}$
Π_1