

Antidumping Regulation and the Byrd Amendment

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1: Introduction

In 2000, Congress amended the US Antidumping Law so that the duty revenue is redistributed to those domestic producers who supported the petition that led to a finding of dumping, material injury to the domestic industry and imposition of an Antidumping (AD) duty. This system is formally known as the Continued Dumping and Subsidy Offset Act (CDSOA), but commonly referred to as the Byrd Amendment. The main objective in modifying the Law in this way was to give domestic firms harmed by dumped imports further relief in addition to the benefits they receive from the imposition of AD duties (Evenett, 2005). The rationale behind this, as claimed by Congress, was that domestic producers would be reluctant to reinvent or rehire while dumping was taking place (Olson, 2004). The outcome of the new law has been a substantial redistribution of revenue. As reported by Collie and Vandebussche (2005), the sums redistributed have been over US\$230 million in 2001; US\$330 million in 2002; US\$190 million in 2003; and US\$284 million in 2004..

Our aim here is to consider whether in fact the Byrd Amendment is likely to increase or reduce the incidence of dumping and the extent of the dumping margin. We do this as a straightforward extension of a simple model that we have used elsewhere¹ to investigate the links between dumping and market size. In that paper we considered the incentives that the existence of an Antidumping Law provides for strategic behaviour on the part of duopolistic firms selling in each other's segmented markets. Firms had identical costs, but were located in countries with different market sizes (maximum willingness to pay). In free trade the firm from the larger market dumped in the other market, providing incentives for both firms to manipulate their sales in the two markets to influence any future antidumping duty. We show that for small (large) differences in market size, the dumping (other) firm's strategic actions dominate, and the dumping margin is reduced (increased) relative to free trade².

We show below that including a Byrd Amendment-like redistributive mechanism strengthens the strategic incentives of the firm located in the dumped market,

¹ In Falvey and Wittayarungruangsri (2005).

particularly when the difference in market sizes is small. Unlike the case where the Byrd Amendment is absent, the firm in the dumped market always dominates the outcome; hence the dumping margin is widened compared to free trade. The difference between the free trade dumping margin and that with AD and the Byrd Amendment is greatest when the two market sizes are similar and becomes smaller when the market sizes differ more. Even though the dumping firm has an incentive to reduce the dumping margin, it is unable to do so because the other firm's incentive is always stronger.

The Byrd Amendment has been subject to limited academic analysis to date. Collie and Vandebussche (2005) are interested in the possibility that the Byrd Amendment could result in lower duties and higher welfare in the dumped market. They analyse it in the context of a duty-setting government with a political economy objective function that puts a higher weight on producer interests (profits) than on consumer interests or tax revenue. They remind us that the welfare maximising tariff can exceed the revenue maximizing tariff in a Cournot oligopoly, and then show that transferring the duty revenue from the government to firms may result in a lower tariff, if this generates more revenue and the weight on producer interests in the government objective function exceeds a critical value. Evenett (2005) notes the considerable bureaucratic discretion available in the calculation of the foreign market value (FMV) that import prices will be compared to in order to calculate duties owed after an AD order is put in place. He considers the extreme case where this value is determined independently of the dumping firm's pricing behaviour or cost levels, and then examines how the Byrd Amendment provisions and uncertainty over the FMV act independently and collectively to determine the equilibrium outcomes under an AD order. He finds that sometimes dumping is eliminated, sometimes the profits of importing firms increase and sometimes even the total value of imports increase.

In outline the remainder of this paper is as follows. In section 2, we set up a model where AD legislation is not adopted, solve for the equilibrium outcome, and identify the conditions under which one firm dumps in the other country. Section 3 analyses the incentives AD policy and the Byrd Amendment provide for competing firms. This

² These results are briefly reviewed in Section 3.1 below.

section is divided into two parts, one in the absence of the Byrd Amendment and the other in its presence. Finally, section 4 concludes.

2: Dumping in Free Trade

In this section, we set up a simple model that will show the conditions under which one firm dumps onto the other country. We will then identify the effects of firm strategic actions on equilibrium outcomes in the next section. Let there be two countries, home and foreign. Each has one firm. Both firms produce a homogeneous product and supply both markets. The markets are segmented so that there is no possibility of arbitraging by other economic agents. The firms are involved in a Cournot competition. For simplicity, both firms incur zero cost of production and there are no transport costs.

We assume linear demand in both countries. The demand functions for the home and foreign country are, respectively

$$D = A - p \quad \text{and} \quad D^* = A^* - p^* \quad (1)$$

where D denotes domestic demand, A denotes maximum willingness to pay and p denotes domestic price. The corresponding variables for the foreign country are indicated by an asterisk.

Considering a representative period, the profits function for two firms can be written as

$$\pi = px + p^* x^* \quad (2)$$

$$\pi^* = py + p^* y^* \quad (3)$$

where $x(y)$ denotes home (foreign) firm output sold in the home market, and $x^*(y^*)$ denote home (foreign) firm output sold in the foreign market. Differentiating (2) and (3) with respect to output quantities yields the following first order conditions

$$\frac{\partial \pi}{\partial x} = p - x = 0; \quad \frac{\partial \pi}{\partial x^*} = p^* - x^* = 0; \quad \frac{\partial \pi^*}{\partial y} = p - y = 0; \quad \frac{\partial \pi^*}{\partial y^*} = p^* - y^* = 0$$

which can in turn be solved for equilibrium outputs and prices

$$x = y = \frac{A}{3} = p; \quad x^* = y^* = \frac{A^*}{3} = p^* \quad (4)$$

The profits for the home and foreign firm are then

$$\pi = \pi^* = \left[\frac{A}{3} \right]^2 + \left[\frac{A^*}{3} \right]^2$$

In free trade, both firms sell the same amount in each market (but more in the larger market) and earn the same total profits. As demand curves are both linear, with the same slopes (normalised to unity) but different intercepts, consumers in the country with the larger intercept are willing to pay a higher price for any given quantity and will purchase more at any given price. Given that markets are segmented, this market will have the higher price and larger total sales in the free trade equilibrium. It can therefore be referred to as the “larger market” (Gupta, 1999). Since the price is higher in this market, this generates the possibility that the firm from the larger market could be subject to a claim of dumping in the smaller market. The dumping margin (DM), in this case the price difference, will depend on the difference in market size between the two markets (e.g. in free trade $DM = p - p^* = (A - A^*)/3$). Note that the two firms have identical (zero) costs and only differ in terms of their locations. The only reason that dumping occurs is that national markets are segmented and it is profit maximising for both firms to sell quantities that yield a higher price in the larger market.

[Figure 1 here]

In Figure 1, we plot the price outcome against the relative market size. Without loss of generality, we assume that the home market is larger (i.e. $A > A^*$) and fix A^* but let A vary. Then p^* does not change as A increases (a horizontal line), while p increases in the same proportion as A . The vertical distance between the two lines is the dumping margin. The larger the difference in market size, the larger the dumping margin.

3: Antidumping

Now consider a dynamic version of our model. We assume two periods, and for simplicity, assume that the demand functions are as above in both periods and agents do not discount the future. The foreign country has in place AD Legislation which provides that if the foreign firm files an AD petition and the home firm is found to have dumped in the present (period 1) it will be subject to a tax on its future (period 2) sales in the foreign market equal to the dumping margin (price difference) in the

present. In addition, the foreign AD legislation may provide that the filing firm not only gains profits from its sales but also receives any revenue collected from duty (the Byrd Amendment)³. Our specific interest is in how this redistribution affects the equilibrium outcomes.

We begin by determining the second period equilibrium when there is an AD duty of t in place. The second period profit-maximising problems of the two firms become, respectively

$$\max_{x_2, x_2^*} \pi_2 = p_2 x_2 + [p_2^* - t] x_2^* \quad (5)$$

$$\max_{y_2, y_2^*} \pi_2^* = p_2 y_2 + p_2^* y_2^* + x_2^* t \quad (6)$$

We can be solved for the second-period outputs and prices as

$$x_2 = y_2 = \frac{A}{3} = p_2; \quad x_2^* = \frac{[A^* - 2t]}{3}; \quad y_2^* = \frac{[A^* + t]}{3} = p_2^* \quad (7)$$

While profits are

$$\pi_2 = \left[\frac{A}{3} \right]^2 + \left[\frac{A^* - 2t}{3} \right]^2; \quad \pi_2^* = \left[\frac{A}{3} \right]^2 + \left[\frac{A^* + t}{3} \right]^2 + \frac{t[A^* - 2t]}{3}$$

In the first period, both firms maximise their lifetime profits, taking into account the future duty and any redistribution of duty revenue. The firms understand that their sales in the current period can affect the future duty and therefore their profits in both. Since our primary objective is to illustrate, as simply as possible, the role of the Byrd Amendment in determining the equilibrium outcomes when both firms behave strategically, we restrict attention to pure strategy equilibria. This simplifies the analysis considerably, but still leaves us with some constraints to be dealt with. These relate to the minimum level of sales of the dumping firm in the first period, and the fact that the AD duty cannot be negative nor act effectively above the prohibitive level. As noted above, the AD duty imposed on the home (dumping) firm's sales in the foreign market in the period 2 is equal to any dumping margin (price differential) found in period 1. However, regardless of this price differential, no duty will be

³ In practice, the government transfers all revenue to the qualifying producers but each firm receives only a portion of such duty revenue. In our analysis, there is only one supporting firm, so it receives the full amount.

imposed if the home firm makes no sales in the foreign country in the first period. Thus there are two circumstances under which no duty will be levied in the second period: (i) the home firm exports in the first period but the dumping margin is zero; and (ii) there is a positive dumping margin in the first period but there are no home firm exports. This second circumstance has the complication of generating a discontinuity in our functions at $x_1^* = 0$. As x_1^* approaches zero from above a finite dumping margin applies, but this drops to zero when first period exports cease. We can show that abandoning the foreign market in the first period is not a pure-strategy equilibrium outcome for the home firm. But reducing "dumped" foreign sales to a minimal level in the first period will be an equilibrium outcome for some differences in market size. To encompass this feature we therefore constrain $x_1^* \geq \varepsilon$ where ε is some arbitrarily small positive amount, which can be thought of as the minimum detectable level of dumping⁴. We can capture the requirement that the antidumping duty cannot be negative (i.e. cannot be a subsidy) by imposing the constraint that $p_1 - p_1^* \geq 0$ on the "dumping" firm (since the other firm has no incentive to take actions that reduce the duty).

The second period equilibrium outcomes are as in (7) above, and these solutions indicate a further constraint that must be imposed on the antidumping duty. These expressions for second period profits only apply if the antidumping duty is no greater than the prohibitive duty. From that point the home firm ceases to export in the second period, leaving the foreign firm to act as a monopolist in the foreign market. We can capture this requirement by imposing the constraint that $p_1 - p_1^* \leq A^*/2$ on the foreign firm (since the dumping firm has no incentive to take actions that raise the duty), and by restricting attention to the range of market sizes for which the free trade dumping margin would be less than the prohibitive duty (i.e. $A \leq 5A^*/2$) in the first instance. Since we show that the strategic actions of the firms lead to the prohibitive duty before we get to this upper bound, it is clear that the equilibrium will involve free trade in the first period generating a prohibitive duty in the second when $A > 5A^*/2$.

⁴ Details are available in an Appendix from the authors. Note that setting exports to zero may be a best reply for the home firm to some strategies of the foreign firm, and there may be a mixed strategy Nash

The respective profit maximisation problems for the home and foreign firm are then

$$\begin{aligned} \max_{x_1, x_1^*} \pi &= p_1 x_1 + p_1^* x_1^* + \pi_2 \\ \text{s.t. } x_1^* &\geq \varepsilon \quad \text{and} \quad p_1 - p_1^* \geq 0 \end{aligned}$$

$$\begin{aligned} \max_{y_1, y_1^*} \pi^* &= p_1 y_1 + p_1^* y_1^* + \pi_2^* \\ \text{s.t. } p_1 - p_1^* &\leq \frac{A^*}{2} \end{aligned}$$

We write the Lagrangean functions for the home and foreign firm as

$$\max_{x_1, x_1^*} \Pi = p_1 x_1 + p_1^* x_1^* + \left[\frac{A}{3} \right]^2 + \left[\frac{A^* - 2(p_1 - p_1^*)}{3} \right]^2 + \lambda [p_1 - p_1^*] + \eta [x_1^* - \varepsilon] \quad (8)$$

$$\begin{aligned} \max_{y_1, y_1^*} \Pi^* &= p_1 y_1 + p_1^* y_1^* + \left[\frac{A}{3} \right]^2 + \left[\frac{A + (p_1 - p_1^*)}{3} \right]^2 \\ &+ \left[\frac{(p_1 - p_1^*) \{A^* - 2(p_1 - p_1^*)\}}{3} \right] + \gamma \left[\frac{A^*}{2} - (p_1 - p_1^*) \right] \end{aligned} \quad (9)$$

Differentiating (8) and (9) with respect to first-period outputs yield the following derivatives

$$\frac{\partial \Pi}{\partial x_1} = \{p_1 - x_1\} + \left\{ \frac{4}{9} [A^* - 2(p_1 - p_1^*)] \right\} - \lambda \quad (10)$$

$$\frac{\partial \Pi}{\partial x_1^*} = \{p_1^* - x_1^*\} - \left\{ \frac{4}{9} [A^* - 2(p_1 - p_1^*)] \right\} + \lambda + \eta \quad (11)$$

$$\frac{\partial \Pi^*}{\partial y_1} = \{p_1 - y_1\} - \left\{ \frac{2}{9} [A^* + (p_1 - p_1^*)] \right\} - \left\{ \frac{1}{3} [A^* - 4(p_1 - p_1^*)] \right\} + \gamma \quad (12)$$

$$\frac{\partial \Pi^*}{\partial y_1^*} = p_1^* - y_1^* + \left\{ \frac{2}{9} [A^* + (p_1 - p_1^*)] \right\} + \left\{ \frac{1}{3} [A^* - 4(p_1 - p_1^*)] \right\} - \gamma \quad (13)$$

In the home firm's derivatives ((10) and (11)), we decompose the expressions on the right hand side into two terms. The first is the corresponding expression in free trade. The second shows the incentive for strategic behaviour produced by the existence of the foreign AD regulation. In the derivatives for the foreign firm ((20) and (21)), we have divided the strategic incentives into two parts, the second of which only appears

equilibrium that involves this firm abandoning the foreign market.

if the Byrd amendment applies. The presence of the Byrd Amendment has no direct impact on the home firm's incentive to behave strategically.

Before obtaining the explicit solutions, it is informative to consider what these derivatives reveal about the firms' incentives and the strengths of those incentives when the threat of AD action exists. As long as the dumping margin is below the prohibitive level (i.e. $p_1 - p_1^* < A^*/2$) the home firm has an incentive to sell more in its domestic market and to export less. This incentive is stronger, the larger the second period sales (i.e. the smaller the AD duty). The strategic effects in (10) and (11) are of equal magnitude but opposite sign, indicating that rather than changing total output, the firm would adjust its sales between markets⁵.

For the foreign firm, the AD incentives can have two components. In the absence of the Byrd Amendment, the foreign firm also has an incentive to sell more in its domestic market and to export less. This incentive becomes larger as the duty increases and its second period profits increase. Adding the Byrd Amendment reinforces this incentive, up to the point where the implied duty reaches the revenue maximum (i.e. $p_1 - p_1^* = A^*/4$). From that point on the presence of the Byrd Amendment reduces the strategic incentive of the foreign firm. Again note that, as for the home firm, the strategic effects in (12) and (13) are of equal magnitude but opposite sign, indicating a tendency to switch sales rather than changing total output.

Each firm's strategic action counters the other's. Which firm's behaviour dominates depends on the relative market size. If we suppose that the Byrd amendment does not apply and substitute the free-trade dumping margin ($p_1 - p_1^* = (A - A^*)/3$), into the strategic incentives for sales in the home market we find that, for the home firm

$$\frac{4}{9}[A^* - 2(p_1 - p_1^*)] = \frac{4}{27}[5A^* - 2A]$$

while for the foreign firm

$$\frac{2}{9}[A^* + (p_1 - p_1^*)] = \frac{2}{27}[2A^* + A]$$

⁵ This is true as long as exports are not at their minimum level (i.e. as long as $x_1^* > \varepsilon$ and $\eta = 0$).

As noted above, given the size of the foreign market, increases in the size of the home market increase the free trade dumping margin, which reduces the strategic incentive of the home firm, but strengthens that of the foreign firm. When $A = 8A^*/5$, the firm's strategic incentives are offsetting. This suggests that, for small differences in market sizes, we should expect to see the home firm's strategic actions dominate the equilibrium outcome, and observe a smaller dumping margin than in free trade. For larger market size differences, it is likely that the foreign firm's actions that dominate, leading to a larger dumping margin than in free trade.

When the Byrd Amendment applies, the two parts of the strategic incentive of the foreign firm are combined, and we have

$$\frac{\partial \Pi^*}{\partial y_1} = \{p_1 - y_1\} - \left\{ \frac{5}{9} [A^* - 2(p_1 - p_1^*)] \right\} + \gamma \quad (14)$$

$$\frac{\partial \Pi^*}{\partial y_1^*} = \{p_1^* - y_1^*\} + \left\{ \frac{5}{9} [A^* - 2(p_1 - p_1^*)] \right\} - \gamma \quad (15)$$

A comparison of (14) and (15) with (10) and (11) is particularly revealing of the strategic incentives facing the two firm. They are opposite in sign and that of the foreign firm is stronger over the entire range of non-prohibitive dumping margins. It is expected that this dominance of the foreign firm's strategic actions will be reflected in a higher dumping margin in the first period equilibrium. But note that both firms' strategic incentives fall as the difference in market sizes becomes larger.

The following subsections, present explicit solutions for these two cases. We begin by considering the AD Law without the Byrd Amendment.

3.1: Antidumping without the Byrd Amendment

As discussed above, compared with free trade, the dumping firm has an incentive towards higher domestic sales and smaller exports, in the first period, and the foreign firm's incentives are to do the opposite. Before discussing the outcomes when both firms behave strategically to influence the duty size, we first look at what the

outcomes would be if only one of the firms behaved strategically⁶ Figure 2 illustrates the first period price outcomes when only the dumping firm behaves strategically as compared to free trade. It is seen that the dumping margin is always lower than in free trade up to the point where the duty becomes prohibitive $A = 5A^*/2$. At larger market size differences, the dumping firm sells as in free trade in the first period and is taxed out of the foreign market in the second.

[Figure 2 here]

For small differences in market size ($A \leq 17A^*/9$), the outcome is *temporary market integration*, where the dumping margin is eliminated ($p_1 = p_1^*$). When the difference in market sizes gets larger, we have *moderated dumping*, where there is a positive dumping margin, but it is smaller than in free trade. Where this is the case, the home firm is subject to an AD duty in the second period.

If only the foreign firm acts strategically, the dumping margin is always larger than in free trade. The price outcomes are shown in Figure 3. When $A < 11A^*/6$ we have *aggravated dumping*, where the dumping margin has increased but the implied duty is not prohibitive. For larger market size differences, the implied duty is prohibitive⁷.

[Figure 3 here]

In Figure 4, we plot the outcome derived from the case where both firms behave strategically⁸. As expected, for small differences in market size, the home firm's actions dominate the outcomes. If $A < 25A^*/18$ we have temporary market integration and a zero dumping margin. Moderated dumping is observed when $25A^*/18 < A < 8A^*/5$. But after this point the foreign firm's strategic actions begin to dominate and the dumping margin is higher than in free trade. The duty becomes prohibitive at $A = 11A^*/6$ which is the same point as when only the foreign firm behaves strategically.

⁶ The other firm continues to act as a Cournot competitor in each period, ignoring the links between periods.

⁷ Note that the constraint that $p_1 - p_1^* \leq A^*/2$ is binding on the foreign firm over the range $11A^*/6 \leq A \leq 5A^*/2$.

⁸ Note that the constraints discussed earlier are binding over some ranges of market size differences as indicated by the equilibria shown in Table 1.

[Figure 4 here]

3.2: Antidumping with the Byrd Amendment

As seen above, the addition of the Byrd Amendment has no effect on the strategic incentives faced by the home firm. But the behaviour of the foreign firm will be affected by having any duty revenue redistributed in its favour. The likely influences are shown by comparing the cases where only the foreign firm behaves strategically, with and without the Byrd Amendment.

[Figure 5 here]

In Figure 5, the dashed lines represent the price outcomes without the Byrd Amendment (as in Figure 3) and the dotted lines the price outcomes with the Byrd Amendment. As one would expect the dumping margin is larger than in free trade in both cases.

The influence of the revenue redistribution on the foreign firm's behaviour is clear from Figure 5. When markets are similar in size, the revenue provides an incentive for greater strategic action by the foreign firm and the equilibrium dumping margin (DM_1^{BA}) is larger than it would be without the Byrd Amendment (DM_1^a) and always larger than in free trade (DM_1^f). Since

$$DM_1^{BA} - DM_1^f = \frac{10[5A^* - 2A]}{141}; \quad DM_1^{BA} - DM_1^a = \frac{43A^* - 36A}{1081}$$

we see that the difference between DM_1^{BA} and DM_1^f declines as the difference in market sizes becomes larger (i.e. as A becomes larger). The dumping margin eventually falls below what it would be without the Byrd Amendment once the revenue starts to decline with increases in market size (the equilibrium dumping margins are equal with and without the Byrd Amendment when $A = 43A^*/36$).

Further, one can show that

$$DM_1^a - DM_1^f = \frac{4[A + 2A^*]}{69}$$

Thus strategic action by the foreign firm only, in the absence of the Byrd Amendment, results in ever larger dumping margins relative to free trade as the difference in market size increases. Note further, that in the absence of the Byrd Amendment the

dumping margin reaches the prohibitive level at a smaller market size difference ($A = 11A^*/6$) than it does with the Byrd Amendment ($A = 5A^*/2$, which is the same as in free trade).

The implications of adding the revenue to the foreign firm's total profits are shown in Figure 6. Revenue is increasing in the duty until $t = A^*/4$, while second period profits are always increasing until the duty becomes prohibitive. The total benefits to the foreign firm are increasing in the duty all the way to the prohibitive level.

[Figure 6 here]

Finally we are in a position to consider and interpret the case where both firms behave strategically. Figure 7 plots the prices and compares them with the case when the Byrd Amendment is absent.

[Figure 7 here]

The broad pattern of outcomes is as predicted by the earlier results⁹. If the Byrd Amendment applies, then the foreign firm's strategic incentives dominate for all market size differences. The result is an increased dumping margin, relative to free trade, though the difference declines as the market size difference becomes larger. The comparison with and AD Law without the Byrd Amendment is also revealing. If revenue is not redistributed, then the AD Law actually eliminates dumping for small market size differences and moderates it over an additional range. It is only when the market size difference becomes so large that the foreign firm's strategic incentives dominate that the AD Law leads to an increased dumping margin. Interestingly this pattern is reversed once the Byrd Amendment is added. Then there is no range of temporary market integration or moderated dumping. But once the difference in market sizes is large enough, so that we are in the range where the foreign firm's strategic actions dominate even without the Byrd Amendment, then the revenue redistribution will result in a reduced dumping margin as the decline in revenue as the duty increases tempers the foreign firm's strategic actions. Only over this range can the Byrd Amendment be said to "discourage" dumping, even then only relative to the

⁹ Again there are ranges of market size differences where the constraints specified in (8) and (9) apply to the relevant firms. These are indicated in Table 2.

outcome without revenue redistribution. The dumping margin is always higher than in free trade.

4: Conclusion

This paper has examined the effects of the Byrd Amendment on the behaviour of firms engaged in an AD case, and the market outcome. To do this, we set up a simple model of two segmented national markets, differing only in terms of market size. There were two firms, one located in each country, producing identical goods and selling in both markets. It was found that the firm located in the country with a larger market dumps onto the other.

When the AD policy was implemented, the equilibrium outcome depended on the difference in market sizes. We considered first the case without the Byrd Amendment. The two firms had different incentives. The dumping firm attempted to reduce the dumping margin by switching sales between national markets while the other firm performed the opposite action. The outcome was dominated by the dumping firm when the relative market size difference was small. Thus we saw a smaller dumping margin relative to free trade. But when the market sizes differed more, it was the other firm that dominated the outcome and then the dumping margin was increased.

The addition of the Byrd Amendment into the model affected the outcome significantly. The revenue redistribution in the second period influenced the behaviour of the filing firm in the first period, although that of the dumping firm was unchanged from the case in its absence. Now the strategic behaviour of the firm in the dumped country always dominated the outcome. This resulted in a higher dumping margin relative to free trade. The incentive for the filing firm was stronger (weaker) than when the Byrd Amendment was absent if the difference in market sizes was small (large).

Hence over the range of sufficiently large relative market sizes, dumping was discouraged but only in comparison to the case with AD duty but without the revenue redistribution. The reason was that the filing firm did not want the duty to be prohibitive, so, when the difference in market sizes was large, its incentive to widen

the dumping margin was weakened, and the duty was prohibitive later in terms of market size differences.

In short, we conclude that the Byrd Amendment is likely to increase the incidence of dumping and the extent of the dumping margin. However, compared to the situation in which the duty revenue is not redistributed, the duty is less likely to be prohibitive.

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Table 1. Both Firms Behave Strategically (No Byrd Amendment)

	Temporary Market Integration	Temporary Market Integration [$x_1^* = \varepsilon$]	Moderated Dumping [$x_1^* = \varepsilon$]	Moderated Dumping	Prohibitive Dumping	Unconstrained Dumping
	$[1, \frac{4}{3}]$	$[\frac{4}{3}, \frac{25}{18}]$	$[\frac{25}{18}, \frac{3}{2}]$	$[\frac{3}{2}, \frac{11}{6}]$	$[\frac{11}{6}, \frac{5}{2}]$	$[\frac{5}{2}, \infty]$
p_1	$\frac{A + A^*}{6}$	$\frac{7A^*}{18}$	$\frac{24A - 17A^*}{42}$	$\frac{17A - 16A^*}{21}$	$\frac{2A + 5A^*}{12}$	$\frac{A}{3}$
p_1^*	$\frac{A + A^*}{6}$	$\frac{7A^*}{18}$	$\frac{41A^* - 6A}{84}$	$\frac{23A^* - 10A}{21}$	$\frac{2A - A^*}{12}$	$\frac{A^*}{3}$
$p_1 - p_1^*$	0	0	$\frac{18A - 25A^*}{28}$	$\frac{9A - 13A^*}{7}$	$\frac{A^*}{2}$	$\frac{A - A^*}{3}$
x_1	$\frac{6A - A^*}{9}$	$\frac{9A - 5A^*}{9}$	$\frac{5A^*}{6}$	$\frac{4A^* - A}{3}$	$\frac{2A + 5A^*}{12}$	$\frac{A}{3}$
x_1^*	$\frac{4A^* - 3A}{9}$	ε	ε	$\frac{2A - 3A^*}{3}$	$\frac{2A - A^*}{12}$	$\frac{A^*}{3}$
y_1	$\frac{3A - A^*}{18}$	$\frac{A^*}{6}$	$\frac{3A - 3A^*}{7}$	$\frac{11A - 12A^*}{21}$	$\frac{4A - 5A^*}{6}$	$\frac{A}{3}$
y_1^*	$\frac{3A + 7A^*}{18}$	$\frac{11A^*}{18}$	$\frac{6A - 43A^*}{84}$	$\frac{19A^* - 4A}{21}$	$\frac{7A^* - 2A}{6}$	$\frac{A^*}{3}$
p_2^*	$\frac{A^*}{3}$	$\frac{A^*}{3}$	$\frac{6A + A^*}{28}$	$\frac{3A - 2A^*}{7}$	$\frac{A^*}{2}$	$\frac{A^*}{2}$
x_2^*	$\frac{A^*}{3}$	$\frac{A^*}{3}$	$\frac{13A^* - 6A}{14}$	$\frac{11A^* - 6A}{7}$	0	0
y_2^*	$\frac{A^*}{3}$	$\frac{A^*}{3}$	$\frac{6A + A^*}{28}$	$\frac{3A - 2A^*}{7}$	$\frac{A^*}{2}$	$\frac{A^*}{2}$
λ	$\frac{13A^* - 9A}{18}$	$\frac{25A^* - 18A}{18}$	0	0	0	0
η	0	$\frac{3A - 4A^*}{3}$	$\frac{3A^* - 2A}{4}$	0	0	0
γ	0	0	0	0	$\frac{6A - 11A^*}{12}$	NA

Note. For convenience $\varepsilon \approx 0$ is used in this Table, except for where $x_1^* = \varepsilon$

Table 2. Both Firms Behave Strategically (With Byrd Amendment)

	Aggravated Dumping [$x_1^* = \varepsilon; y_1 = 0$]	Aggravated Dumping [$x_1^* = \varepsilon$]	Aggravated Dumping	Unconstrained Dumping
	$[1, \frac{7}{6}]$	$[\frac{7}{6}, \frac{17}{13}]$	$[\frac{17}{13}, \frac{5}{2}]$	$[\frac{5}{2}, \infty]$
p_1	$\frac{7A - 4A^*}{10}$	$\frac{7A + A^*}{22}$	$\frac{29A + 5A^*}{93}$	$\frac{A}{3}$
p_1^*	$\frac{A}{4}$	$\frac{5A + 7A^*}{44}$	$\frac{2A + 26A^*}{93}$	$\frac{A^*}{3}$
$p_1 - p_1^*$	$\frac{9A - 8A^*}{20}$	$\frac{9A - 5A^*}{44}$	$\frac{9A - 7A^*}{31}$	$\frac{A - A^*}{3}$
x_1	$\frac{3A + 4A^*}{10}$	$\frac{3A + 13A^*}{22}$	$\frac{65A^* - 5A}{93}$	$\frac{A}{3}$
x_1^*	ε	ε	$\frac{26A - 34A^*}{93}$	$\frac{A^*}{3}$
y_1	0	$\frac{6A - 7A^*}{11}$	$\frac{59A - 70A^*}{93}$	$\frac{A}{3}$
y_1^*	$\frac{4A^* - A}{4}$	$\frac{37A^* - 5A}{44}$	$\frac{101A^* - 28A}{93}$	$\frac{A^*}{3}$
p_2^*	$\frac{3A + 4A^*}{20}$	$\frac{13A^* + 3A}{44}$	$\frac{3A + 8A^*}{31}$	$\frac{A^*}{2}$
x_2^*	$\frac{6A^* - 3A}{10}$	$\frac{9A^* - 3A}{22}$	$\frac{15A^* - 6A}{31}$	0
y_2^*	$\frac{3A + 4A^*}{20}$	$\frac{3A + 13A^*}{44}$	$\frac{3A + 8A^*}{31}$	$\frac{A^*}{2}$
η	$\frac{16A^* - 13A}{20}$	$\frac{17A^* - 13A}{44}$	0	0

Note. For convenience $\varepsilon \approx 0$ is used in this Table, except for where $x_1^* = \varepsilon$

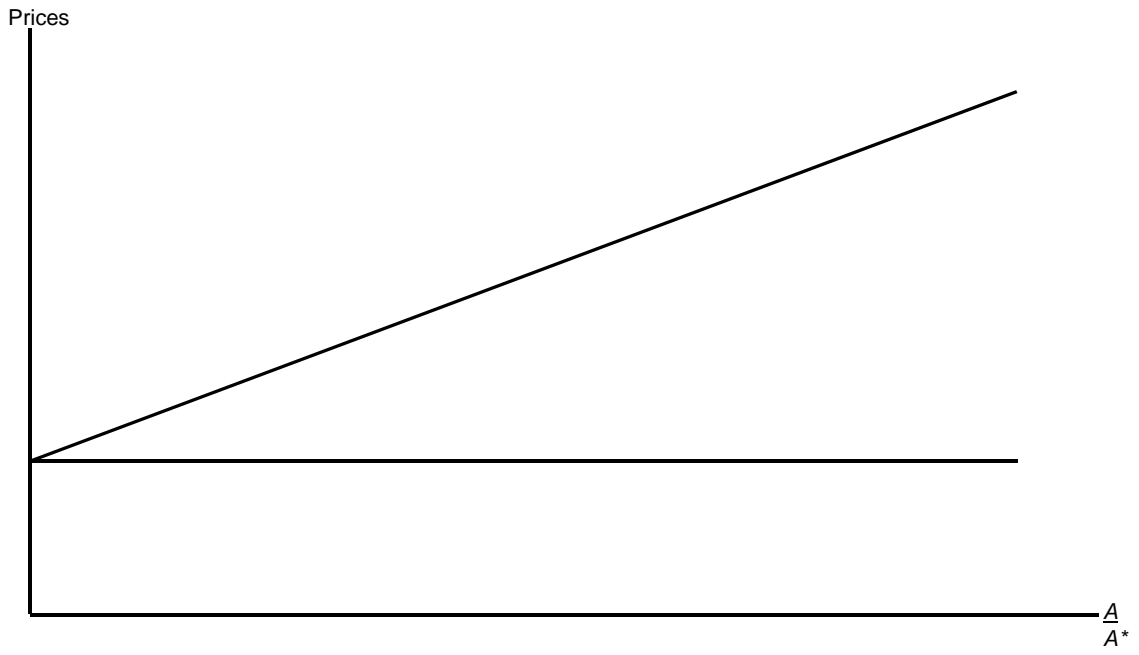


Figure 1: Free-trade dumping margin

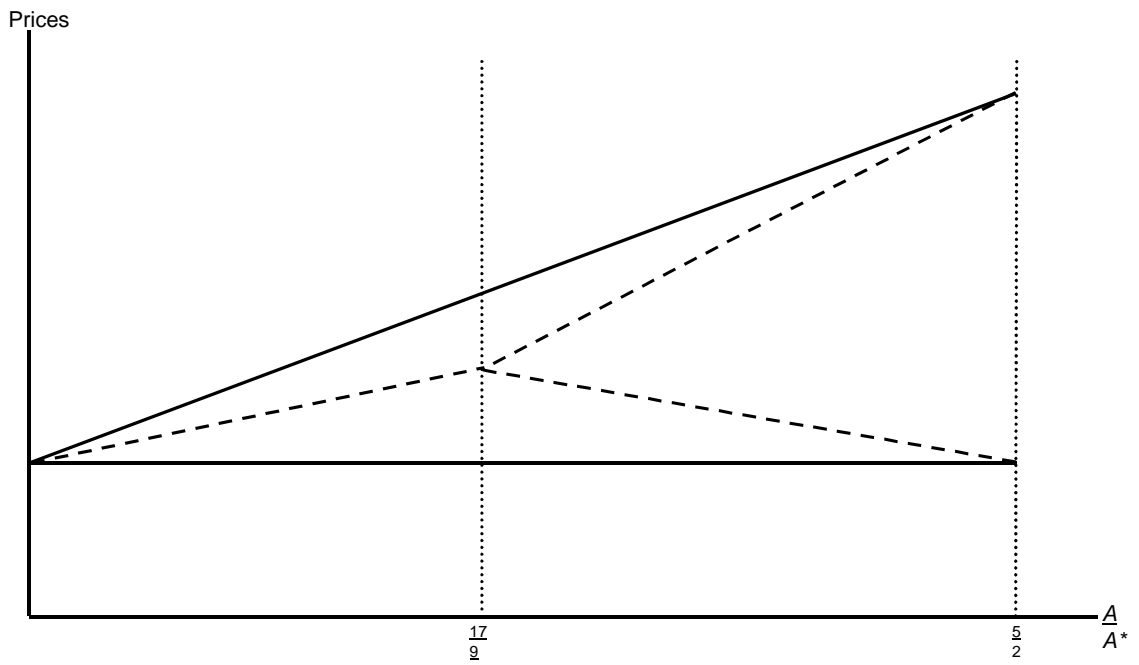


Figure 2: Only the home firm behaving strategically (without Byrd Amendment)

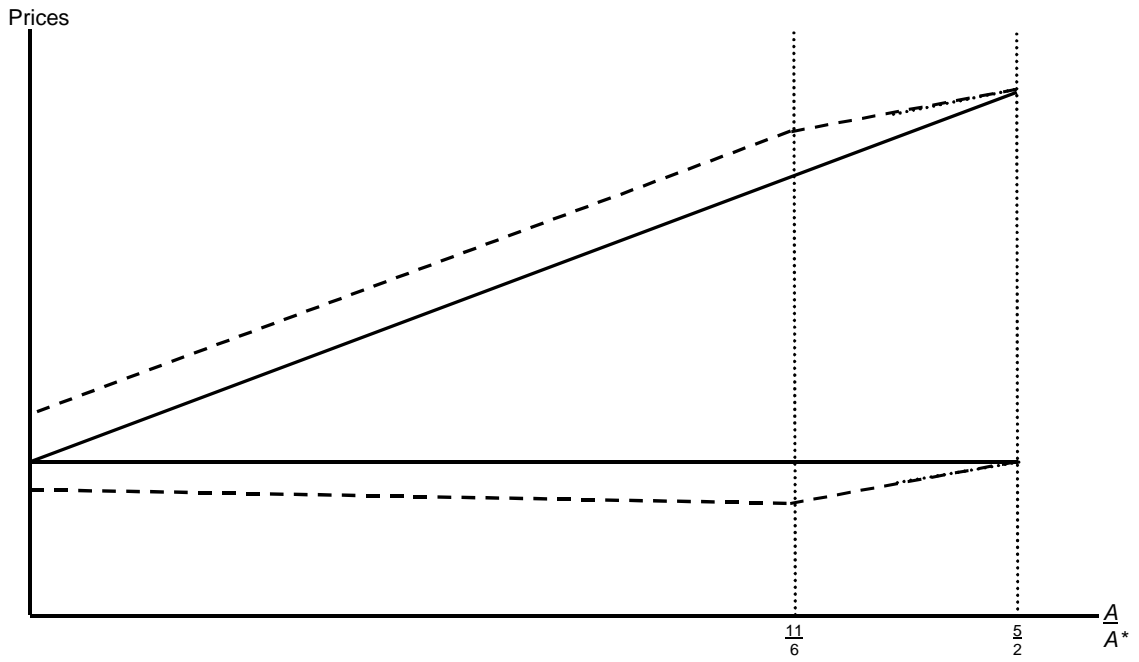


Figure 3: Only the foreign firm behaving strategically (without Byrd Amendment)

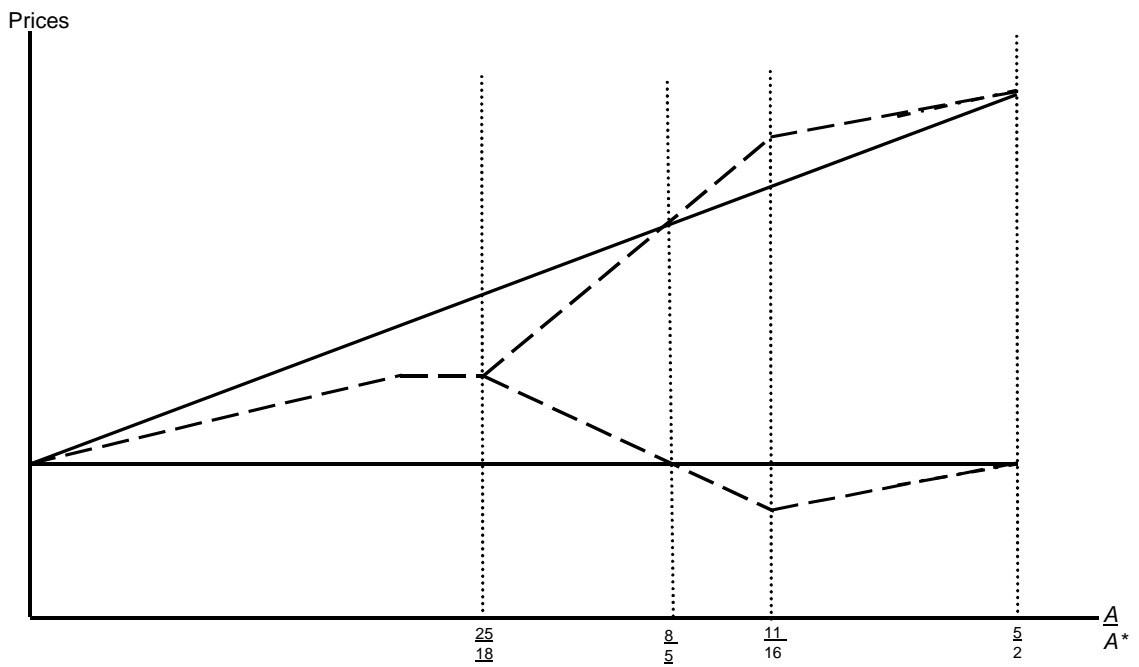


Figure 4: Both firms behaving strategically (without Byrd Amendment)

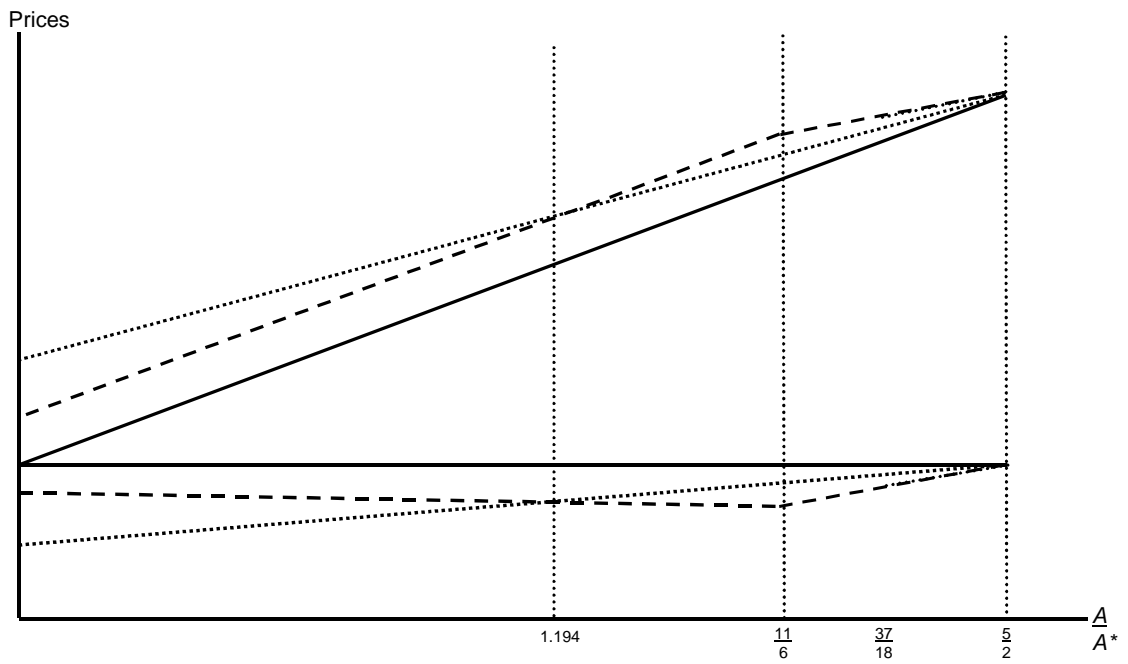


Figure 5: Only the foreign firm behaving strategically (with Byrd Amendment)

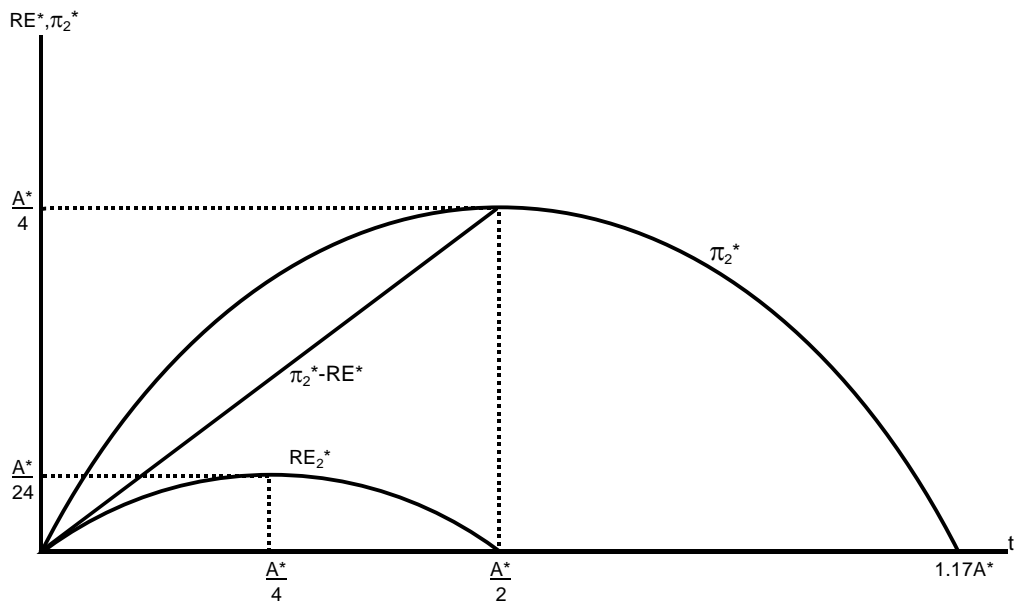


Figure 6: The second-period revenue effect

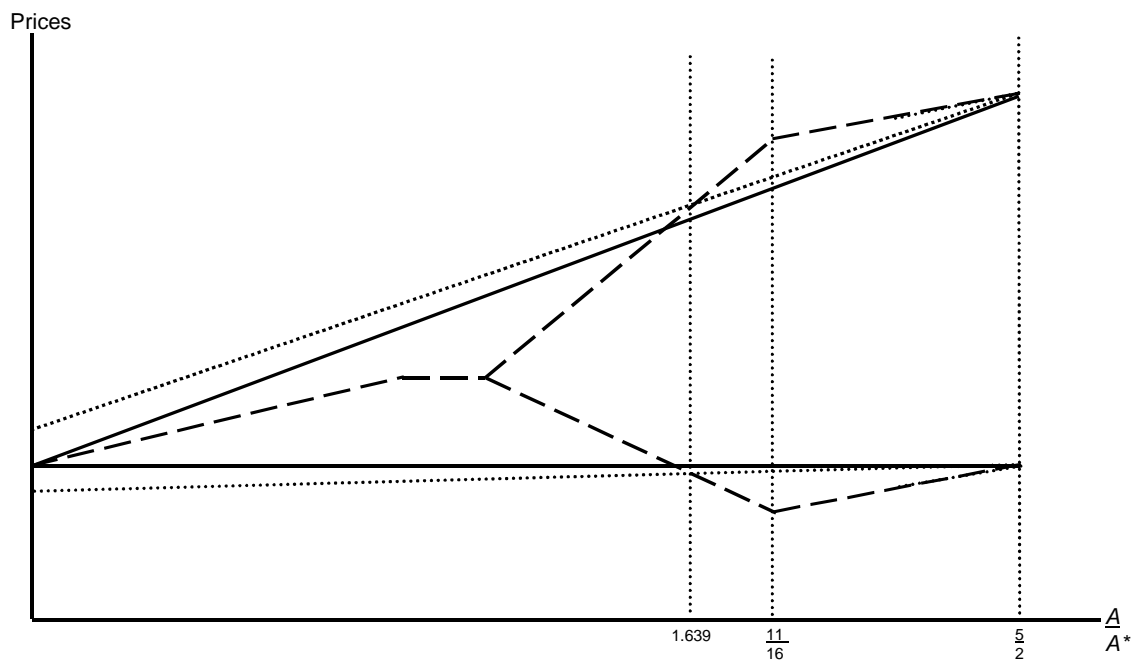


Figure 7: Both firms behaving strategically (with Byrd Amendment)