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Antidumping duties and price undertakings: A welfare analysis ☆

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ABSTRACT

In this paper we examine differences in welfare implications between two trade protection measures: antidumping (AD) duties and price undertakings. Based on a stylized model of duopolistic competition under an effective AD law, we first analyze the case where a foreign firm convicted of dumping is required to pay an AD duty. We then examine the case in which a convicted foreign firm has the option of (i) paying an AD duty or (ii) accepting an undertaking by raising product price to its "normal value." Taking into account the GATT/WTO policy that an AD duty rate must not exceed the margin of dumping, we show conditions under which a foreign firm chooses to evade its AD fine by a price undertaking. We find that the welfare-maximizing AD duty rate for a dumped product depends crucially on its normal value. If the foreign product's normal value is "critically high," the optimal AD rate is set to fully reflect the dumping margin. Otherwise, the optimal AD rate is set *lower* than the dumping margin. From the perspective of social welfare, these findings help to identify the economic conditions under which one policy instrument is chosen over the other against foreign dumping.

1. Introduction

From the perspectives of importing countries, the use of antidumping (AD) policy to protect domestic industries has a long history spanning more than a century. The literature on the economic effects of AD policy is huge.[1] Under the GATT/WTO AD code, foreign firms convicted of dumping violations may have the discretion to choose between paying an AD duty and raising product price to its normal value. The latter option available to the convicted foreign firms is referred to as price undertakings.[2,3] The aim of this paper is to analyze how the availability of price undertakings affects an importing country's decision on setting its optimal AD duty against a dumped product. In the analysis, we take into account the GATT/WTO regulation that an AD duty rate must not exceed the margin of dumping.

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[1] For studies on dumping under the traditional antidumping law, see, e.g., Dixit (1988), Prusa (1992, 1994), Fischer (1992), Reitzes (1993), Anderson (1992, 1993), Anderson, Schmitt, and Thisse (1995), Blonigen and Prusa (2003), Gao and Miyagiwa (2005), Wu et al. (2011), and Dinlersoz and Dogan (2010). For issues related to administered protection and the political economy of antidumping, see, e.g., Finger, Hall, and Nelson (1982), Tharakan (1991), Niels (2000), Irwin (2004), and Nelson (2006). For other issues on AD such as the Continued Dumping and Subsidy Offset Act implemented by the U.S. government under which the revenues from AD fines are redistributed to domestic firms alleging harm see, for example, Collie and Vandenbussche (2006), Evenett (2006) and Chang and Gayle (2006). For other issues related to AD measures and their various economic effects see, e.g., Vandenbuscche and Wauthy (2001), Pauwels and Springael (2002), Belderbos et al. (2004), Moore (2005), and Ishikawa and Miyagiwa (2008).

[2] An undertaking is a commitment by an exporter to raise the export price of its product or to restraint its exporting volume to avoid the possibility of an AD duty. In general, undertakings may take the form as a price increase or a volume reduction. Given that many cases of undertakings involve setting products at their normal values, we focus our analysis on price undertakings. Price undertaking measures are usually regarded as a "softer option" than a definitive duty because the foreign firms can pocket the price differences by raising product prices to the levels of their normal values.

[3] It should be noted that an importing country's government has the discretion to decide whether it wants to offer price undertaking or not.

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When imported products are placed on AD orders because foreign firms dump the products at prices below their normal values,[4] the firms may accept price undertakings as a business strategy to evade their payments of AD duties. In this paper, we argue that the availability of price undertakings to foreign exporters imposes a significant constraint on the government of an importing country in setting its welfare-maximizing AD duties. We show that the socially optimal AD duty rate on a dumped product depends crucially on its margin of dumping or the foreign import's normal value. If the foreign product's normal value is "critically high," the optimal AD duty rate on the product is set to fully reflect its dumping margin. Otherwise, the optimal AD duty rate is set lower than the dumping margin. To demonstrate these results, we present a simple model of duopolistic competition between home and foreign firms under an effective AD law. We first examine the "traditional" case where a foreign firm convicted of dumping is required to pay an AD duty. We then analyze the alternative case in which a convicted foreign firm has the option of paying an AD fine or accepting a price undertaking.

The acceptance of price undertakings by foreign firms as a settlement strategy plays a role in affecting the termination of AD cases in the European Economic Community (EEC). It has been observed that the EEC countries frequently allow foreign firms to accept price undertakings. In an interesting contribution, Zanardi (2006) remarked that out of 578 affirmative AD actions for the EEC between 1981 and 2001, as high as 40.6% of these cases were terminated by price undertakings.[5] However, using the more updated data from 1995 to 2008, Rovegno and Vandenbussche (2011) indicate that the use of price undertakings in the EU has decreased steadily and in favor of AD duty.[6] Most price undertakings in the EU were granted to firms from New EU Member States. Once these countries joined the Union, and no AD could be targeted at them, the number of price undertakings dropped.

Studies on the economic effects of price undertakings include the contributions by Stegemann (1990), Vandenbuscche and Wauthy (2001), Pauwels and Springael (2002), Belderbos, Vandenbussche, and Veugelers (2004), Moore (2005), and Ishikawa and Miyagiwa (2008). Stegemann (1990) contends that price undertakings are a "legally" implemented collusive device as convicted foreign firms may find it beneficial to raise their product prices without paying AD fines. Pauwels and Springael (2002) examine the welfare implications of AD duties and price undertakings in EU. The authors show that social welfare is greater under an AD duty than under a price undertaking, regardless of whether (i) home and foreign firms compete in a Cournot or Bertrand fashion or (ii) the competing firms move simultaneously or sequentially in their output decisions. Vandenbuscche and Wauthy (2001) analyze how the product quality decisions of firms may be affected by AD measures in EU. They show that price undertakings lead to low product quality in the domestic competitive industries of an importing country. Belderbos et al. (2004) examine the incentives for foreign firms to engage in foreign direct investment (FDI) under AD duties and price undertakings. The authors indicate that an importing country's government chooses price undertakings over AD duties in order to lower the incentives of international firms in FDI. Moore (2005) compares the effects of price undertakings and voluntary export restraints (VERs) in a model of international Bertrand duopoly. An interesting finding is that the imposition of a VER can result in lower domestic prices and profits than that of a price undertaking. Ishikawa and Miyagiwa (2008) further show the differences between price undertakings and VERs in affecting the incentives of FDI by international firms. These studies have made significant contributions to our understanding of price undertakings and their effects on different economic issues. A striking feature of the majority of these analyses is the assumption that the amounts of AD duties are exogenously given.[7]

In this paper, we examine differences in the welfare implications between AD duties and price undertakings in an import-competing market. We consider the case that the optimal amount of AD duty on a foreign import is determined endogenously. Importing countries may not necessarily pursuit the goal of maximum welfare in setting their AD fines. But, as in most studies in the international trade literature, we adopt the assumption of social welfare optimization in order to look at the efficiency aspect of the alternative AD measures when equal weights are placed on domestic consumers and producers.[8] We discuss the economic determinants of a socially optimal AD duty on a dumped import under the condition that a foreign firm has the discretion to choose between an AD fine and a price undertaking. In the analysis, we consider a simple three-stage game. At stage one, an importing country's government determines its optimal AD duty, taking into account two constrained conditions. One condition is the GATT/WTO policy that the amount of AD duty must not exceed the dumping margin. The other condition is that a convicted foreign firm has the option of paying an AD duty or raising product price to its normal value in order to waive the AD fine. At stage two, the foreign firm decides whether it wants to pay the AD fine or to accept a price undertaking. At the third and last stage of the game, the home and foreign firms independently and simultaneously make their output decisions that maximize respective profits. We use backward induction to solve for the sub-game perfect Nash equilibrium.

[4] Dumping investigations frequently involve some complicated steps in calculating the difference between a foreign product's price in the market of the exporting country (referred to as the "normal value") and the appropriate price in the market of the importing country. If sales in the exporting country market are unavailable, two alternative bases can be used to measure the foreign product's normal value. One is the price of the product sold to a third country. The other is the foreign product's "constructed normal value," which is calculated according to its production cost, "plus selling, general, and administrative expenses, and profits." For guidelines set forth by the GATT/WTO to calculate a product's constructed normal value and to determine its dumping margin, see: http://www.wto.org/english/tratop_e/adp_e/adp_info_e.htm.

[5] The number of price undertakings accepted has varied considerably over time in the EEC. Tharakan (1991) indicates that, out of 249 affirmative case decisions for the period 1980–1987, as high as 72% were terminated by the acceptance of undertakings in the EEC.

[6] Rovegno and Vandenbussche (2011) note that the average use of AD duty in EU for the period 1995–2008 is more than 76%.

[7] Cheng, Qiu, and Wong (2001) examine an optimal incentive-compatible AD measure to induce firms to reveal their truthful cost information. The analysis ignores the possibilities of price undertakings accepted by the convicted foreign firms. The authors employ a cost-based dumping definition in calculation dumping margin. In our paper, we follow Pauwels et al. (2001) and Evenett (2006) by looking at the normal value of a dumped import.

[8] One notable exception is the contribution by Tharakan (1991) that looks at the political economy of price undertakings and analyzes motivations of governments for choosing to offer the option of raising prices. The author indicates that price undertakings may reduce the tension of trade retaliation for a political reason. For other studies that examine issues related to the regulation of international firms and possible compensation to foreigners for protectionist policies see, e.g., Hillman and Ursprung (1988, 1990).

We show that if a product's normal value is significantly high (or if the dumping margin is significantly large), a foreign firm convicted of dumping finds that raising the product price to its normal value is more expensive than paying an AD duty. The reason is that paying the AD fines without accepting a price undertaking allows the firm to maintain Cournot competition in the import-competing market. Moreover, the foreign firm's resulting loss of market share is relatively less, as compared to the case of a price undertaking. But if the normal value is not significantly high, we have the opposite result. Raising product price to its normal value turns out to be relatively less-expensive for a convicted foreign firm. In this case, the firm prefers a price undertaking over an AD duty.

The remaining parts of the paper are organized as follows. In Section 2, we lay out the simple model and discuss the benchmark case where a foreign firm convicted of dumping is required to pay an AD duty. In Section 3, we analyze the scenario that price undertaking is also an available option to the convicted foreign firm. Section 4 contains concluding remarks.

2. Optimal AD duty when a convicted foreign firm pays an AD fine

We present a simple model of imperfect competition in an import-competing market under an AD law. There are two firms, one domestic and one foreign, producing and selling a homogenous (or "like") product in the market. We assume that the importing country's government is committed to the AD law and its enforcement is perfectly effective.

Denote q and q^* as the quantities of the competing good produced by the home and foreign firms, respectively. Specifically, market demand for the product in the domestic country is taken to be linear:

$$p = a - (q + q^*). \tag{1}$$

We assume that the home firm's marginal cost is constant at c and the foreign firm's marginal cost is constant at c^*, where $c \geq c^*$.[9] This assumption indicates that the home firm can never be more efficient in production than the foreign firm. We normalize c^* to zero and interpret $c(\geq 0)$ as the marginal cost differential between the home and foreign firms. These two firms employ a Cournot strategy in their production decisions.

If the foreign firm is convicted of an AD violation, it is required to pay fines according to its dumping margin. Denoting δ as the margin of dumping, we have the following formula:

$$\delta = \begin{cases} \phi - p > 0 & \text{if } p < \phi, \\ 0 & \text{if } p \geq \phi, \end{cases} \tag{2}$$

where p is the market price of the foreign product and ϕ is its normal value. As in Pauwels, Vandenbussche, and Weverbergh (2001), Evenett (2006), and Wu, Chang, and Chen (2011), we assume that the value of ϕ is exogenously given and is common knowledge to both firms and the importing country's government. When the foreign firm sells its product at a price below its normal value, i.e., $p < \phi$, dumping arises.

In the presence of foreign dumping such that $p < \phi$ and $\delta > 0$, the home government imposes an AD duty, denoted as t, on each unit of the imported product. The variable profits of the home and foreign firms are given, respectively, as

$$\pi = (p - c)q; \quad \pi^* = (p - t)q^*. \tag{3}$$

The first-order conditions (FOCs) for the two firms are:

$$\frac{\partial \pi}{\partial q} = a - 2q - q^* - c = 0; \tag{4a}$$

$$\frac{\partial \pi^*}{\partial q^*} = a - q - 2q^* - t = 0. \tag{4b}$$

The Nash equilibrium outputs are $q^A = (a - 2c + t)/3$ and $q^{*A} = (a + c - 2t)/3$, where the superscript A denotes the case that the foreign firm pays the AD duty. Solving for the equilibrium consumption, market price, and firm profits yields

$$Q^A = \frac{2a - c - t}{3}; p^A = \frac{a + c + t}{3}; \tag{5}$$

$$\pi^A = \frac{(a - 2c + t)^2}{9}; \quad \pi^{*A} = \frac{(a + c - 2t)^2}{9}. \tag{6}$$

[9] We assume that the marginal cost of the foreign firm includes the transport cost. As indicated by Brander and Krugman (1983), dumping may arise in the presence of transport costs. The assumption of $c > c^*$ is based on the notion of comparative advantage that a foreign firm has over the domestic firm in production. In this case, the foreign market share in the import-competing industry is greater than the domestic market share and the foreign firm is likely to be convicted of dumping. This assumption is in line with the analysis of dumping and R&D in Miyagiwa and Ohno (2007). The authors present an interesting model to show that a foreign firm dumps because it possesses a low-cost production technology. Our paper abstracts from innovation or R&D activities by assuming that a foreign firm has a cost advantage over the domestic firm.

The GATT/WTO antidumping regulation requires that the duty rate, t, be no greater than the margin of dumping, δ. We take this constraint into account when determining an optimal AD duty that maximizes the welfare of an importing country. The problem facing the importing country's government is:

$$\underset{\{t\}}{\text{Max}}\ W^A = CS^A + \pi^A + tq^{*A} = \frac{(2a-c-t)^2}{18} + \frac{(a-2c+t)^2}{9} + t\left(\frac{a+c-2t}{3}\right) \tag{7}$$

$$\text{subject to } t \le \delta \tag{8}$$

where $\delta(=\phi - p > 0)$ is the dumping margin as defined in Eq. (1). Note that the market price of the product under free trade is $p = (a + c)/3$, which is less than ϕ. Taking the first-order derivative of W^A with respect to t yields

$$\frac{dW^A}{dt} = \frac{(a-3t)}{3}. \tag{9}$$

The second-order derivative is strictly negative since $d^2W^A/dt^2 = -1 < 0$. The welfare function W^A in Eq. (7) is thus strictly concave on t and has an extreme point at $\hat{t} = a/3$.

In determining an optimal AD duty rate when there is dumping, we analyze the following two possible cases: (i) $t = 0$; and (ii) $t = \delta$ where $\delta = \phi - p = \phi - [(a + c)/3] > 0$. Case (i) reflects free trade under which the AD duty rate is zero. Case (ii) reflects the GATT/WTO constraint that the AD duty rate must not exceed the margin of dumping.

Evaluating the first-order derivative of W^A with respect to t at $t = 0$ and $t = \delta$ respectively, we have

$$\left.\frac{dW^A}{dt}\right|_{t=0} = \frac{a}{3} > 0; \tag{10}$$

$$\left.\frac{dW^A}{dt}\right|_{t=\delta} = \frac{\left[a-3\left(\phi-\frac{a+c}{3}\right)\right]}{3} = \frac{(2a+c-3\phi)}{3} > 0. \tag{11}$$

[10]

Eq. (10) indicates that the imposition of an AD duty is welfare-improving to the importing country. Eq. (11) indicates the positive sign for the derivative in Eq. (11) at $t = \delta$. Fig. 1 presents a graphical illustration of the above results, which has an interesting policy implication. The AD duty rate that reflects the full amount of the dumping margin is strictly *lower* than the optimal AD duty rate without the GATT/WTO constraint. That is, $t^A = \delta < \hat{t}$. This suggests that the importing country is required not to set its AD duty rate at $\hat{t}$. Instead, the country should set its AD duty rate that satisfies the following condition:

$$t^A = \delta = \phi - p. \tag{12}$$

The above analysis permits us to establish

Proposition 1. *In an import-competing market where a foreign firm convicted of dumping is required to pay an AD fine, the GATT/WTO-consistent AD duty rate is equal to the full amount of the dumping margin. But this AD duty rate is lower than its socially optimal level in the absence of the GATT/WTO constraint.*

The finding in Proposition 1 indicates that the GATT/WTO constraint is strictly binding. Substituting t^A from Eq. (12) into W^A in Eq. (7), we calculate the reduced-form solution for the optimal level of social welfare:

$$W^A = \frac{\left(18a\phi - 9\phi^2 - 16ac + 13c^2 - 2a^2\right)}{18}. \tag{13}$$

Our next step is to examine social welfare when a convicted foreign firm has the discretion to accept a price undertaking. We then compare differences in social welfare between the two alternative AD measures.

3. Optimal AD duty when a convicted foreign firm has alternative options

In this section, we analyze the scenario that a foreign firm convicted of a dumping violation has the discretion to choose between an AD fine and a price undertaking. In the analysis, we also take into account the GATT/WTO antidumping code. Our purpose is two-fold. First, we examine the conditions under which a foreign firm prefers one option over the other and then analyze how these two alternative AD measures affect the equilibrium outcomes of an import-competing industry under an

[10] The inequality in Eq. (11) holds since the foreign product's normal value is no greater than the monopoly price, $\phi \le (a + c)/2$, we have $\left.\frac{dW^A}{dt}\right|_{t=\delta} = \frac{(2a+c-3\phi)}{3} > \frac{\left(2a+c-3\left(\frac{a+c}{2}\right)\right)}{3} = \frac{a+c}{6} > 0$.

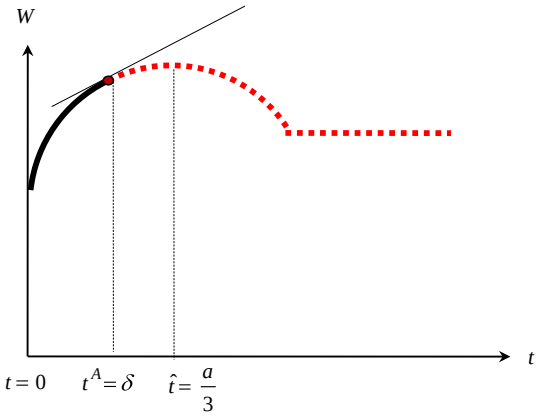

Fig. 1. The GATT/WTO-consistent AD duty and welfare.

effective AD law. Second, we examine the decision of the home government on determining its optimal AD duty for a dumped product when a convicted foreign firm may choose to undertake its price.

As discussed in Pauwels et al. (2001), we examine the market equilibrium outcomes when two possible games are played by the home and foreign firms. One is that the home firm is the first-mover and the foreign firm a second-mover in a Stackelberg (sequential) game. The other is that the two firms play a simultaneous-move game.

3.1. Both firms move sequentially with the home firm being the first-mover

When a convicted foreign firm opts for a price undertaking, it is required to raise product price to its normal value, ϕ. In this case, the foreign firm's variable profit is

$$\pi^{*U} = \phi q^{*U},$$

where the superscript U represents the acceptance of undertaking its price and q^{*U} is the level of output produced by the foreign firm. To evade the payment of an AD fine, the foreign firm sets its product price at ϕ so that the market price equation in (1) becomes

$$\phi = p = a - q^{U} - q^{*U}, \tag{14}$$

where q^{U} denotes the level of output produced by the home firm.

The home firm maximizes its profit, $\pi^{U} = (\phi - c)q$, under the condition that the normal value of the competing product is given at ϕ. The first-order derivative of π^{U} with respective to home output is

$$\frac{\partial \pi^{U}}{\partial q} = (\phi - c). \tag{15}$$

When the two firms play a sequential-move game, the first-order derivative in Eq. (15) is strictly positive because $\phi > c$. This implies that the home firm's profit is a monotonically increasing function of its output. The home firm, being the first-mover in the Stackelberg game, finds it profitable to produce as much of its output as possible. The equilibrium outcome turns out to be a "corner" solution because the home firm completely monopolizes the market. That is,

$$q^{U\max} = a - \phi. \tag{16}$$

It follows immediately from Eqs. (14) and (16) that $q^{*U} = 0$. The foreign firm is excluded from the market if it accepts the price undertaking, letting the home firm enjoy the first-mover advantage. To prevent such an unwanted outcome from happening, the foreign firm's strategy is not to accept the price undertaking. Instead, it chooses to pay the AD fine. This analysis leads to

Proposition 2. *A foreign firm convicted of a dumping violation will never find it profitable to accept a price undertaking when the home firm is the first-mover in a Stackelberg game.*

Proposition 2 has an interesting implication for a convicted foreign firm. Despite the availability of price undertakings, the firm finds it profitable to simply pay an AD duty in a sequential-move game. The welfare implication of paying an AD fine follows the line of the analysis presented in Section 2.

3.2. Home and foreign firms move simultaneously

Next, we discuss the second case of a simultaneous-move game played by the home and foreign firm. We use the home firm's FOC (see Eq. (4a)) and the foreign firm's reaction function under price undertaking (see Eq. (14)) to solve for their equilibrium outputs:

$$q^U = \phi - c; \tag{17a}$$

$$q^{*U} = (a + c) - 2\phi. \tag{17b}$$

Eqs. (17a) and (17b) indicate that the product's normal value ϕ plays a key role in determining the equilibrium outputs of the two firms. That is, $\partial q^U/\partial \phi > 0$ and $\partial q^{*U}/\partial \phi < 0$. By accepting a price undertaking, the foreign firm's output and market share are negatively affected by the product's normal value. Note that ϕ is no greater than the monopoly price but is higher than the free market price, $(a + c)/3 < \phi \leq (a + c)/2$. This condition guarantees that $q^{*U} \geq 0$.

Making use of Eqs. (17a) and (17b), we calculate profits for the home and foreign firms:

$$\pi^U = (\phi - c)^2; \tag{18a}$$

$$\pi^{*U} = \phi(a + c - 2\phi). \tag{18b}$$

It is then interesting to examine the incentives of the foreign firm in choosing between paying an AD fine and accepting a price undertaking. To do so, we use equations π^{*A} in (7) and π^{*U} in (18b) to compute the difference in foreign profits between the alternative AD measures and record the result as follows:

$$\pi^{*U} - \pi^{*A} = \frac{9\phi(a + c - 2\phi) - (a + c - 2t)^2}{9}. \tag{19a}$$

Solving for the critical level of the AD duty rate (denoted as $\tilde{t}$) that makes π^{*U} and π^{*A} identical yields[11]

$$\tilde{t} = \frac{(a + c) - 3\sqrt{\phi(a + c - 2\phi)}}{2}. \tag{19b}$$

It follows directly from Eqs. (19a) and (19b) that

$$\text{(i)}\ \ \pi^{*A} > \pi^{*U} \ \text{ if and only if } \ t < \tilde{t}; \tag{20a}$$

$$\text{(ii)}\ \ \pi^{*U} > \pi^{*A} \ \text{ if and only if } \ t > \tilde{t}. \tag{20b}$$[12]

These necessary and sufficient conditions help determine which option, an AD fine or a price undertaking, is a more profitable strategy for the convicted foreign firm. Based on the findings in Eqs. (19a) and (19b) and (20a) and (20b), we have

Corollary 1. *When an AD duty rate is "critically low" $(0 \leq t < \tilde{t})$, a foreign firm convicted of dumping finds it relatively more profitable to pay the AD fine. If, instead, the AD duty rate is "critically high" $(t > \tilde{t})$, the foreign firm's best strategy is to evade the payment of the AD fine by accepting a price undertaking.*

The logic behind Corollary 1 is as follows. From the perspective of a foreign exporter, if an AD duty rate is not significantly high, making the AD payment is the preferred choice. By paying the fine, the foreign exporter is able to maintain its output decision as a Cournot competitor in the import-competing market. But when an AD duty rate is sufficiently high $(t > \tilde{t})$, the preferred choice is to accept a price undertaking as it incurs no monetary fines to the exporter. The $\tilde{t}$ as shown in (19b) is the critical AD duty rate below which a convicted firm chooses to make an AD payment (i.e., above which the firm chooses to accept a price undertaking).

Fig. 2 presents a graphical interpretation of the two AD measures and their effects on the market equilibriums. Note that the normal value, ϕ, of the competing product and the margin of dumping (see Eq. (2)) allow us to define a "zero-dumping-margin" line as shown by AA'. Line AA' has a slope of minus one since $d\phi = 0$ implies that $dq^*/dq = -1$. The market equilibrium is initially given by point F, which is the interception of the home firm's reaction curve RR' and the foreign firm's reaction curve $R^*(t = 0)$ in the absence of any duties. Given that the foreign firm dumps its product at a price below its normal value, ϕ, point F is lying outside of line AA'. The GATT/WTO antidumping policy has that a foreign firm convicted of an AD violation be allowed to pay

[11] We exclude the other solution for the AD duty, $\tilde{t} = [(a + c) + 3\sqrt{\phi(a + c - 2\phi)}]/2$, as it leads to a negative profit for the foreign firm.

[12] Following the suggestion by a referee, we have utilized the Global Antidumping Database to calculate some simple statistics in order to see whether price undertakings were associated with higher level of antidumping duties. The results are presented in the Appendix A (see Table 1). We thank the anonymous referee for this valuable suggestion.

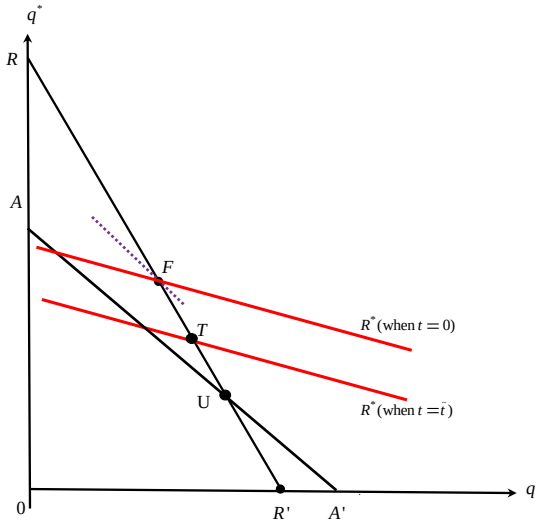

Fig. 2. Market equilibriums under the alternative AD measures regimes.

an AD duty or accept a price undertaking. If the foreign firm accepts a price undertaking, it is required to raise product price to its normal value. In this case, the foreign firm's reaction function is shown by the AA' curve.[13] Market equilibrium occurs at point U, which is the interception of AA' and RR' curves.

But if the foreign firm chooses to pay an AD duty, its reaction curve shifts downward from $R^*(\text{when } t = 0)$ under free trade to $R^*(\text{when } t = \tilde{t})$. The extent to which the foreign firm's reaction curve shifts leftward depends on the amount of the AD fine. For the purpose of comparison, we assume that the AD duty rate is set equal to the critical value, $\tilde{t}$, and the resulting market equilibrium occurs at point T. Note that the $\tilde{t}$ (see Eq. (19a)) is the AD duty rate that makes π^{*A} and π^{*U} identical. That is, foreign profit at T is exactly identical to that at U.[14] Apparently, the home firm makes a higher profit when its foreign rival accepts the price undertaking rather than paying the AD fine.[15]

Furthermore, we find that the foreign market share at point U is lower than that at T. This implies that there is a higher cost to the foreign firm of accepting a price undertaking than paying the AD duty. Such a cost is measured by the loss of foreign sales in the import-competing market. This is due to the fact that the foreign firm is required to raise product price up to its normal value when accepting a price undertaking. The price increase generates a negative effect on the level of output produced by the foreign firm, as compared to the situation when it pays the AD fine and continues to be Cournot competitor in the market. This analysis leads to

Corollary 2. *In a simultaneous-move game, the equilibrium market share of a convicted foreign firm is lower when it accepts a price undertaking than when it pays an AD duty.*

3.3. The determination of an optimal AD duty when price undertaking is an available option

One question that naturally arises is: How should the importing country's government set its AD duty rate (denoted as t^U) when price undertaking is an available option to a convicted foreign firm? The answer to this question depends crucially on the dumping margin, δ. We investigate the following two cases:

Case 1. $\delta < \tilde{t}$

This is when the margin of dumping is less than the critical AD duty rate. It follows from Eq. (20a) that the foreign firm finds it beneficial to pay the AD fine since $\pi^{*A} > \pi^{*U}$. In view of Fig. 2, the market equilibrium occurs at a point somewhere between F

[13] No AD fines will be charged to the foreign firm when it raises its price such that $p = \phi$. The foreign firm must be producing at a point on the zero-dumping-margin line to waive the AD charges.

[14] It should be noted that T and U can never be the same point. Otherwise, market equilibria for the alternative anti-dumping measures would be identical (i.e., $\pi^A = \pi^U$ and $\pi^{*A} = \pi^{*U}$). Given that the foreign firm pays an AD fine at point T, its profit at T must be less than that at U. That is, $\pi^{*A} < \pi^{*U}$. For any duty rate higher than $\tilde{t}$, the foreign firm finds it beneficial to accept the price undertaking. This explains why point U lies to the southeast of point T.

[15] The home firm's iso-profit curve passing through point U must lie below its iso-profit curve passing through point T. The home firm thus makes a high profit when the foreign firm accepts a price undertaking. We do not draw these curves in Fig. 2.

and T. The home government should set its AD duty rate to fully reflect the dumping margin, i.e., $t^U = \delta$. This decision is consistent with the GATT/WTO policy as discussed in Proposition 1.

Case 2. $\delta \geq \tilde{t}$

This is when the margin of dumping is greater than the critical AD duty rate. Referring back to Fig. 1, we know that welfare function (W) is increasing in t for an AD duty rate that satisfies $t \leq \delta$. For an AD duty rate such that $t<\tilde{t}$, we have $t<\tilde{t}\leq\delta$, which further implies that $W^A(t)<W^A(\tilde{t})$. This result indicates that setting $t = \tilde{t}$ is the welfare-maximizing AD policy when the convicted foreign firm chooses to pay an AD fine.

For an AD duty rate such that $t > \tilde{t}$, the foreign firm accepts a price undertaking in order to evade the payment of the AD fine (see Eq. (20b)). To calculate the home country welfare (denoted as W^U), we make use of the equilibrium outputs and profits in Eqs. (17a) and (17b) and (18a) and (18b). The home country welfare when the foreign firm accepts the price undertaking is given as

$$W^U = \frac{1}{2}(a-\phi)^2 + (\phi-c)^2. \tag{21}$$

It follows from equation W^A in Eq. (13) and W^U in Eq. (21) that

$$W^U - W^A|_{t=\tilde{t}} \geq W^U - W|_{t=\delta} = \frac{\Omega}{18}, \tag{22a}$$

where $\Omega = 11a^2 + 36\phi^2 + 5c^2 + 16ac - 36a\phi - 36\phi c$. Since the product's normal value is no greater than the monopoly price, $\phi \leq \frac{(a+c)}{2}$, and is higher than the free market price, $\frac{(a+c)}{3}$, we have

$$\frac{\partial \Omega}{\partial \phi} = 72\left[\phi - \frac{(a+c)}{2}\right] < 0 \tag{22b}$$

and

$$\Omega \geq \Omega\Big|_{\phi=\frac{(a+c)}{2}} = 2(a-2c)(a+c) > 0. \tag{22c}$$

It follows from Eqs. (22a), (22b) and (22c) that $W^U > W|_{t=\delta}$, which further implies that

$$W^U - W^A|_{t=\tilde{t}} > 0.$$

The economic implication of this finding is as follows. When $\delta \geq \tilde{t}$, allowing a convicted foreign firm to accept a price undertaking is welfare-improving to the importing country. For $\tilde{t}<t^U\leq\delta$, the foreign firm's best strategy is to accept a price undertaking. For any AD duty rate that is somewhere between $\tilde{t}$ and δ the home firm's profit and the importing country's welfare remain unchanged. The home government should therefore set its optimal AD duty within the range of $t^U \in (\tilde{t}, \delta]$ for inducing the foreign firm to accept the price undertaking.

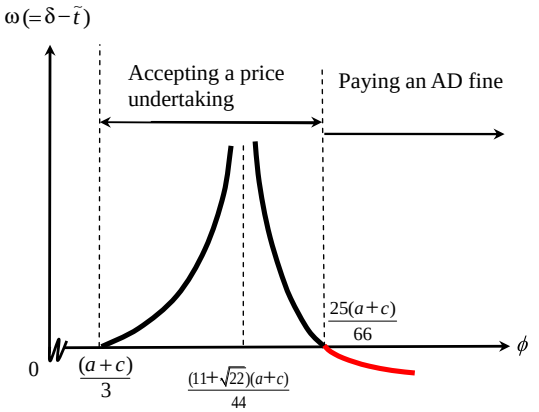

Fig. 3. Optimal AD duty when price undertaking is an available option to a convicted foreign firm.

On the basis of the results discussed above, we have

Corollary 3. *The welfare-maximizing AD duty rate, which is consistent with GATT/WTO rule in allowing a convicted foreign firm to choose between an AD fine and a price undertaking, is determined according to the following conditions:*

(i) $t^U = \delta$ when $\delta < \tilde{t}$;
(ii) $t^U \in (\tilde{t}, \delta]$ when $\delta \geq \tilde{t}$.

One question that remains to be answered is: What are the factors that determinate the relative magnitude of δ and $\tilde{t}$? To answer this question, we subtract $\tilde{t}$ (see Eq. (19b)) from δ, where $\delta = \phi - p = \phi - \frac{(a+c)}{3}$, to yield the following:

$$\delta - \tilde{t} = \omega, \text{ where } \omega = \frac{6\phi - 5(a+c) + 9\sqrt{\phi(a+2c-2\phi)}}{6}. \tag{23}$$

Setting the value of ω in Eq. (23) to zero, we find two possible roots: $\tilde{\phi}_1 = \frac{(a+c)}{3}$ and $\tilde{\phi}_2 = \frac{25(a+c)}{66}$. It is necessary to check whether the value of ω is positive or negative. Taking the first-order derivative of ω with respect to φ and evaluating this derivative at $\tilde{\phi}_1$ and $\tilde{\phi}_2$, respectively, we have

$$\left.\frac{\partial \omega}{\partial \phi}\right|_{\tilde{\phi}_1 = \frac{(a+c)}{3}} = \frac{1}{4} > 0; \quad \left.\frac{\partial \omega}{\partial \phi}\right|_{\tilde{\phi}_2 = \frac{25(a+c)}{66}} = \frac{-11}{40} < 0. \tag{24}$$

The second-order derivative of ω with respect to ϕ is

$$\frac{\partial^2 \omega}{\partial \phi^2} = \frac{3(a+c)^2}{8[\phi(a+c-2\phi)]^{\frac{3}{2}}} > 0. \tag{25}$$

Based on the signs in Eqs. (24)–(25), we use Fig. 3 to illustrate the relationship between ω and ϕ. For a dumping margin ϕ that satisfies the condition: $\frac{(a+c)}{3} < \phi \leq \frac{25(a+c)}{66}$, we have $\omega \geq 0$ such that $\delta \geq \tilde{t}$. If the home government sets its AD duty rate higher than $\tilde{t}$, it is in the interest of the foreign firm to evade the AD payment by accepting a price undertaking. In response, the home government sets its optimal AD duty rate at $\tilde{t}$.

For a dumping margin ϕ that satisfies the condition: $\phi > \frac{25(a+c)}{66}$, we have $\omega < 0$ such that $\delta < \tilde{t}$. Based on Eq. (20a), we know that for $\delta < \tilde{t}$, the foreign firm finds it relatively less expensive to make the AD payment. In this case, the optimal AD duty rate is set to fully reflect the dumping margin, which is consistent with the finding in Proposition 1. This result may explain why some importing countries set their AD duties so that the convicted foreign firms pay the full amounts of the dumping margins.

From the findings of the above analysis, we have

Proposition 3. *When a foreign firm convicted of dumping a product has the discretion to decide whether it wants to pay an AD fine or to undertake its price, the optimal AD duty rate on the dumped import depends crucially on the product's normal value. If the normal value is significantly high, the optimal AD duty rate is set to fully reflect the dumping margin. But if the normal value is low, the optimal AD duty rate is set less than the dumping margin.*

The economic intuitions behind Proposition 3 are as follows. Given the normal value of a dumped import, there is *a trade-off* for a foreign firm to choose between an AD duty and a price undertaking. If the foreign firm raises product price to its normal value in order to evade the payment of an AD fine, this price-undertaking decision requires the firm to behave as a "price taker." But by paying the AD duty, the foreign firm is able to maintain Cournot competition in the import-competing market with a loss in market share being *less* than when it accepts a price undertaking. This trade-off depends crucially on the size of the dumping margin and hence on the product's normal value. As discussed in Fig. 2, if the normal value is relatively high or if the dumping margin is relatively large, the acceptance of a price undertaking causes the foreign market share to decline (i.e., the zero-dumping-margin line AA′ downward to the left). Accordingly, the cost to the convicted foreign firm of accepting the price undertaking turns out to be relatively high. The foreign firm's best strategy is to pay the AD duty. This explains why the home government is able to levy a high AD duty when the foreign product's normal value is high. Thus, under the sub-game perfect equilibrium, as long as the normal value of a dumped product is significantly high, an importing country's optimal AD duty rate on the product should be set at the level that fully reflects the margin of dumping.

But when a product's normal value is relatively low, the cost to a convicted foreign firm of raising its product price to the normal value is also relatively low. It is then to the benefit of the foreign firm to simply accept a price undertaking, which is also consistent with the importing country's welfare maximization. In this case, an importing country's optimal AD duty rate on the product is set at a level lower than its dumping margin but no lesser than $\tilde{t}$, for inducing the foreign firm to accept the price undertaking. This may be used to explain why in some importing countries their AD duty rates are set below the margins of dumping.

Table 1
AD measures (The European Union Case).

Final AD measure	Final AD measures with complete data				Others	Total
	Ad valorem duty	Price undertaking	Ad valorem duty/price undertaking	Specific duty		
Numbers of AD cases	217	17	12	10	488	744
Preliminary AD duty (on average)	23.55%	33.30%	22.85%	–	–	–

Table 1 is computed from a master spreadsheet in the Global Antidumping Database, compiled by Bown (2012), which is available at http://econ.worldbank.org/ttbd/gad/.

4. Concluding remarks

In this paper, we examine the differences in welfare implications between antidumping duties and price undertakings in an import-competing market, where the AD duty rate on a dumped product is determined endogenously. We discuss the economic determinants of a socially optimal AD duty when a convicted foreign firm may have the discretion to choose between paying an AD fine and accepting a price undertaking.

In a stylized model of duopolistic competition under an effective AD law, we first analyze the case where a foreign firm convicted of dumping is required to pay an AD duty. We show that the optimal AD duty that reflects the full amount of the dumping margin is strictly *lower* than the optimal AD duty without the GATT/WTO constraint. We then examine the case that a convicted foreign firm has the option of paying an AD duty or accepting a price undertaking. We show that the optimal AD duty rate depends crucially on the foreign product's normal value. If the normal value is significantly high, the optimal AD duty rate is set equal to the dumping margin. In contract, if the normal value is low, the optimal AD duty rate is set lower than the dumping margin but is slightly higher than a critical level that induces price undertakings. From the perspective of social welfare, these findings help to identify the economic conditions under which one policy instrument is chosen over the other against foreign dumping.

Appendix A

Using the Global Antidumping Database, we calculate some statistics to see whether price undertakings were more common in cases with higher level of antidumping duties. The results are presented in Table 1 utilizing EU as an example.[16] As can be seen in Table 1, there are five possible outcomes of AD investigation including ad valorem duty, price undertaking, ad valorem duty/price undertaking, and specific duty and others.[17] The numbers of cases for these five outcomes were 217, 17, 12, 10, and 488, respectively. The average preliminary dumping margins for the cases of ad valorem duty, price undertaking, and ad valorem duty/price undertaking were 23.5%, 33.3%, and 22.85%, respectively. These results indicate that the average preliminary dumping margin under price undertaking was relatively higher than that under the ad valorem duty.

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[16] This dataset contains AD cases for EU from 1978 to 2011, but there were 744 AD petition cases investigated. However, it seems that data prior to 1987 were not completed because it contained only 5 cases. The dataset provides detailed information on products, firms, and the investigative procedure and outcomes of the historical use of the antidumping policy instrument across large importing country users.

[17] There are 12 cases of final AD measures which are classified as "ad valorem duty/price undertaking" because some firms accept the ad valorem duties and other firms choose to accept price undertaking. "Others" in Table 1 mean that preliminary dumping decision is negative, withdrawn prior to ruling by petitioning industry, terminated prior to ruling by government agency, not relevant as cases never reached that stage of the investigation, or the case is recent enough that the final measure imposition information is still unavailable, or data is missing or incomplete.

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