RIETI Discussion Paper Series 17-E-031

Does Trade Liberalization Promote Antidumping Protection? A theoretical analysis

MUKUNOKI Hiroshi
Gakushuin University

RIETI
Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 17-E-031

March 2017

Does Trade Liberalization Promote Antidumping Protection? A theoretical analysis[1]

MUKUNOKI Hiroshi

Gakushuin University

Abstract

Reducing trade costs by tariff reductions can be overturned if the tariff reductions induce governments to implement "contingent" protections, such as antidumping (AD) and safeguard measures. Some empirical papers have shown that a commitment to reduce tariffs leads to a more frequent use of contingent protections, while other papers have shown that such substitution effect is rarely observed. This paper theoretically explores the conditions under which a lower import tariff promotes the import country's AD actions. The result shows that the relationship between tariff reductions and AD actions is not monotone, and that lower tariff discourages AD actions under certain conditions.

Keywords: Trade liberalization, Antidumping, International oligopoly, Political economy

JEL classification: F12, F13

[1]This study is conducted as a part of the "Analyses of Trade Costs" project undertaken at the Research Institute of Economy, Trade and Industry (RIETI). The author is grateful for helpful comments and suggestions by Hitoshi Sato (IDE-JETRO), Yoichi Sugita (Hitotsubashi University), and Kiyoyasu Tanaka (IDE-JETRO).

1 Introduction

Multilateral negotiations under the General Agreements on Tariffs and Trade (GATT) and the World Trade Organization (WTO), and the recent proliferation of Regional Trade Agreements (RTAs) have greatly facilitated the liberalization of the trade in goods. Now, many countries have committed to set low levels of import tariff rates. However, the commitment does not guarantee freer trade, because countries can still use "contingent" trade policies to protect the domestic industry, and it triggers more frequent use of these protectionist policies.

A typical example of a contingent protection is antidumping (AD) policy. Under the rules of the WTO, countries are allowed to impose an AD duty on an imported good by adopting an AD law. Under AD law, if the government receives a request for an AD measure from a domestic industry, it initiates an AD investigation. Then, if the importing country's administrator concludes that the foreign producer is "dumping" its exported product, and the dumping causes a "material injury" to a domestic industry, the government can impose an AD duty at a level lower than the dumping margin. In the context of international trade, dumping is identified if the free on board (fob) price of a product in the importing country is less than the "normal value."[1] Typically, the "normal value" is the price in the exporting country market. The dumping margin is defined as the price in the exporting country minus the fob price of the importing country.

Countries frequently use AD actions to protect domestic industries. From 1995 to 2015, there were a total of 4,987 AD investigations. On average, about 237 AD investigations take place annually. The large number of AD actions in the world are associated with the recent wave of AD law adoption. The number of countries with AD laws was approximately 50 in 1990 and exceeded 120 in 2014 (Blonigen and Prusa, 2015). Some countries have strengthened the implementation of their existing AD laws. For instance, Japan amended its guidelines for applying its AD law in 2011 to boost domestic industries' use of AD.[2] Some papers have confirmed that the proliferation of AD protection negatively affects world trade flows. Prusa (1997) showed that AD measures seriously reduce imports of the targeted products. AD pro-

[1] The free on board price is the price excluding transportation costs and tariffs. It is the producer price of a good that the producer receives when exporting.

[2] See Japan's Trade Remedy Laws, Regulations and Rules (`http://enforcement.trade.gov/trcs/downloads/documents/japan/index.html`), accessed January 6, 2016.

tection can even reduce imports Vandenbussche and Zanardi (2010) found that AD measures have a large chilling effect on aggregate imports, and it substantially offsets the increase in trade volume derived from trade liberalization in Mexico and India.

These contrasting trends in tariff reduction and AD protection give rise to an important question: Do reductions in tariffs and other trade costs induce governments to implement AD protection? If the answer is yes, trade liberalization may lead to more, rather than less, protection against foreign producers.

Some recent papers have examines whether there is a substitution effect from trade liberalization to AD protection. Bown and Tovar (2011) apply the political-economy model of Grossman and Helpman (1994) and empirically show that India unwound its commitment to reduce tariffs through use of AD and safeguard protection. Bown and Crowley (2014) suggests that emerging economies use AD measures more frequently after they join the WTO. However, Moore and Zanardi (2011) empirically found a substitution effect only for a small set of heavy users of AD among developing countries and found no significant effect for other countries. Based on these empirical evidences, it seems safe to deem that the relationship between trade liberalization and AD protection is still an open question.

In particular, we need a theoretical analysis as much as empirical analyses that takes into account specific properties of AD protection. Existing papers on this subject have simply treated AD protection as a kind of tariff that can be temporarily imposed to a specific country. Since a commitment to maintain a lower tariff limits the effectiveness of the tariff as a protectionist tool, it seems natural to expect that an exogenous reduction of tariff increases demands for other tools like AD protection. However, AD protection is different from a tariff in many respects and the relationship between trade liberalization and AD protection is actually more complicated than it seems

Specifically, since the level of dumping duty is correlated to the dumping margin of the targeted product, the level of protection is associated with international price discriminations of foreign producers. In the case of an import tariff, it usually reduces import prices and changes the terms of trade in favor of the importing country under perfect competition, or it has a rent-shifting effect under imperfect competition because an imperfect pass-through of reduces the import price and the generated tariff revenues exceeds the corresponding decrease

in consumer surplus. In the case of AD protection, since foreign producers can manipulate the prices to reduce or even eliminate the dumping margin to avoid an AD duty, AD protection *increases* the import prices of targeted products without generating much revenues. Besides that, the effects of AD protection would depend on the reason why foreign producers set lower prices in the exporting market. It may due to the difference in the market conditions such as size or the degree of competition between the countries and, importantly, the imperfect tariff pass-through means that a tariff itself is a reason why foreign firms "dump" their products. Under the situation, the effect of a tariff reduction on the country's incentive to enact AD legislation becomes much complicated, because it changes both the dumping margin and the magnitude of the effects of AD protection.

The aim of this paper is to theoretically explore the relationship between trade liberalization and endogenously implemented AD protection in an international oligopoly model Although there have been some theoretical papers such as Anderson et al. (1995) that investigate governments' incentives to implement AD protection with taking account the targeted firms' optimal reactions to the protection, they have not considered how trade liberalization affects the governments' decisions.[3] In our model, the one domestic firm and one foreign firm compete in the domestic country, and the foreign firm monopolizes the market in the foreign country. The market sizes may differ between the countries and an import tariff is imposed on imports from the foreign country. With this setting, the foreign firm's dumping occurs because the domestic market size is smaller than the foreign market size (the market-size effect), an imperfect tariff pass-through lowers the export price (the pass-through effect), or the competition is tougher in the domestic market (the competition effect). The domestic government may place a larger weight on the profit of the domestic producer in enacting AD legislation.

In brief, the results of the paper suggest that there is not monotone relationship between trade liberalization and the implementation of AD protection. If the fixed cost of AD protection is absent, trade liberalization promote AD protection in the sense that less politically motivated government becomes a new user of AD protection. When the domestic market size is larger, however, trade liberalization may prevent AD protection. It may even eliminate the dumping

[3]There have been some other analyses that theoretically examine the effects of AD protection in an international oligopoly model, such as Reitzes (1993), Anderson et al. (1995), Gao and Miyagiwa (2005), Miyagiwa and Ohno (2007), and Moraga-González and Viaene (2015). However, none of these papers has investigated the effects of tariff reductions.

margin, which undermine AD protection. Furthermore, in the presence of the fixed cost of AD protection, trade liberalization prevent AD protection even if the market size of the domestic country is smaller.

These results support an existing empirical finding that emerging economies, whose market sizes are relatively smaller than the advanced economies, tend to counter trade liberalization by enacting AD legislation and implementing AD protection. To block the substitution effect in those economies, the discipline of implementing AD measures should be strengthened so that the fixed cost of AD protection becomes larger.

The rest of the paper is organized as follows. Section 2 sets up the basic model and derive the equilibrium. Section 3 explores the effect of trade liberalization on the domestic government decision to adopt an AD law. Section 4 extends the baseline model to include the fixed cost of AD protection. Section 5 summarizes the paper and presents concluding remarks.

2 Model

We construct a two-country (D and F), two-firm (D and F) international duopoly model. The two goods are horizontally differentiated. Both firms supply their goods in country D. The direct utility function of the representative consumer in country D is given by

$$U_D = a(x_D + x_F) - \frac{(x_D)^2 + (x_F)^2}{2} - bx_D x_F + Y \tag{1}$$

where x_i is the consumption of good i ($i \in \{D, F\}$) produced by firm i and Y is the consumption of the numeraire good in country D. The budget constraint is given by $p_D x_D + p_F x_F + Y \leq M$, where p_i is the consumer price of good i and M is the income in the domestic country. By maximizing U_D with respect to x_D and x_F, subject to the budget constraint, the inverse demand function of good D and that of good D are respectively given by $p_D = a - x_D - bx_F$ and $p_F = a - x_F - bx_D$, where $b \in (0, 1)$ represents the substitutability of products. If $b = 0$, the products are nonsubstitutable and, as b approaches one, the products become more substitutable.

By combining the inverse demand functions, we obtain the demand functions of goods as

$$x_D(p_D, p_F) = \frac{(1-b)\,a - p_D + bp_F}{1-b^2}, \tag{2}$$

$$x_F(p_F, p_D) = \frac{(1-b)\,a - p_F + bp_D}{1-b^2}. \tag{3}$$

In country F, only firm F supplies the good. We implicitly suppose that firm D cannot export because the fixed cost of exporting for firm D is sufficiently high.[4] As a result, the market in country F is monopolized by firm F. The utility function of country F is given by

$$U_F = a\lambda x_F^* - \frac{(x_F^*)^2}{2} + Y^*, \tag{4}$$

where x_F^* is the consumption of good F and Y^* is the consumption of the numeraire good in country F. Note that λ (> 0) is the parameter that represents the relative market size in country F. When $\lambda = 1$, both countries have the same market size for good F. The domestic market is smaller than the foreign market if $\lambda > 1$ holds and it is larger if $\lambda < 1$. Let p_F^* be the price of good F in country F. The demand for good F becomes

$$x_F^*(p_F^*) = \lambda a - p_F^*. \tag{5}$$

The dumping margin is defined as the home price minus the export price of the same good. Hence, the dumping margin of good F is given by

$$d = p_F^* - (p_F - t). \tag{6}$$

We suppose the two markets are segmented in the sense that the prices of the same good can be different between the countries. The indirect utility function of each country is respectively given by $V(p_D, p_F, M) = -a(p_D + p_F) + (p_D^2 + p_F^2)/2 - bp_Dp_F + M$ and $V^*(p_F^*, M^*) = -\lambda a p_F^* + (p_F^*)^2/2 + M$.

Without loss of generality, the unit cost of production is normalized to zero. Let t denote the specific tariff of country D imposed on the imports of good F. Then, the profits of firms

[4] We normalize firm F's fixed cost of exporting to be zero.

D and F become:

$$\Pi_D = p_D x_D(p_D, p_F), \tag{7}$$

$$\Pi_F = (p_F - t)x_F(p_F, p_D) + p_F^* x_F^*(p_F^*). \tag{8}$$

The social welfare of country D is the sum of consumer surplus, tariff revenue, and the profit of firm D. It is given by

$$W_D = V(p_D, p_F, M) - M + tx_F + \Pi_D, \tag{9}$$

Because country F does not import any product, its social welfare is the sum of consumer surplus and the profit of firm F, which is given by

$$W_F = V^*(p_F^*, M^*) - M^* + \Pi_F. \tag{10}$$

The timing of the game is as follows. In Stage 1, the government. of country D decides whether to adopt an AD law. The domestic government may place a substantial weight on firm D's profits in its decisions. Government D' action is given by $s \in \{N, AD\}$ where N represents the government decision not to enact AD legislation, and AD represents the government decision to undertake an AD investigation. Government D's payoff, gross of the fixed cost of AD application, is given by

$$G_D = \gamma W_D + (1 - \gamma)\,\Pi_D, \tag{11}$$

where γ is the government's weight on social welfare relative to the domestic firm's profit. If $\gamma = 1$, the government maximizes social welfare and, if $\gamma = 0$, the government is only concerned with the domestic firm's profit. This government's payoff function reflects the fact that countries sometimes consider public interest concerns before making a decision on the imposition of AD duty. Public interests include those of consumers and industrial users of the products who will be negatively affected by the AD measures.[5] In our model, we regard γ as the degree of the government's consideration of public interests in implementing AD actions.

In Stage 2, firm D decides whether to request an AD investigation against firm F. In Stage

[5]See Kotsiubska (2011) for details.

3, firm D and firm F engage in Bertrand-type competition in the domestic country, and firm F sets the price in the foreign country. Under AD protection, AD duty is actually levied only if firm F's dumping is detected. This means that firm F can avoid AD duty by setting p_F no lower than p_F^*.

2.1 Product-market competition and dumping

This section derives the subgame equilibrium in Stage 3. An AD protection of country D is effective if and only if the domestic government enacts AD legislation in Stage 1 and firm D requests an AD protection in Stage 2.

2.1.1 No AD protection

Let me start with the equilibrium under no AD protection. Firms D and F maximizes (7) and (8) with respect to p_D and p_F, respectively. The equilibrium consumer prices of goods in country D are given by

$$\widetilde{p}_D(N) = \frac{(1-b)(2+b)a + bt}{4-b^2}, \tag{12}$$

$$\widetilde{p}_F(N) = \frac{(1-b)(2+b)a + 2t}{4-b^2}. \tag{13}$$

We assume $t < (1-b)(2+b)a/(2-b^2)$ holds to focus on the case where the equilibrium import of good F by country D is positive, that is, $x_F(\widetilde{p}_F(N), \widetilde{p}_D(N)) > 0$.

Firm F maximizes (8) with respect to p_F^*, and the monopoly price in country F is given by

$$\widetilde{p}_F^*(N) = \frac{\lambda a}{2}. \tag{14}$$

The equilibrium dumping margin of good F becomes

$$\begin{aligned} \widetilde{d}(\lambda, t) &= \widetilde{p}_F^*(N) - \{\widetilde{p}_F(N) - t\} \\ &= \frac{\{(2-b)\lambda - 2(1-b)\}(2+b)a + 2\left(2-b^2\right)t}{2(4-b^2)}. \end{aligned} \tag{15}$$

The dumping margin is increasing in both λ and t. As λ increases, the market size of country F becomes larger, increasing $\widetilde{p}_F^*(N)$ and thereby $\widetilde{d}$. We call the effect the *market-size effect* on

the dumping margin. Given that markets are segmented, the firm makes a (third-degree) price discrimination and sets a higher price in the market with a higher market size.

In imperfectly competitive markets, because firms' markup depends on the price elasticity of demand and their market share in the market, firms may not fully pass through changes in trade costs to their consumer prices. If the demand curve is not so convex, the tariff pass through of firm F is always imperfect. This implies that as t becomes higher, the export price of good F decreases while the consumer price increases, expanding the dumping margin. We call the effect the *pass-through effect* on dumping margin.

Even if $\lambda = 1$ and $t = 0$ hold and the market-size effect and the pass-through effect are absent, $\widetilde{d}(1,0) = (2+b)\,ba/\{2\left(4-b^2\right)\} > 0$, meaning that the equilibrium dumping margin is still positive. This is because the two firms compete in country D while firm F is the monopolist in country F, making the equilibrium price of good F lower in country D. We call this effect the *competition effect*.

Let $\widehat{\lambda}(t)$ denote the cut-off value of the relative market size of country F that satisfies $\widetilde{d}(\widehat{\lambda}(t), t) = 0$. We have

$$\widehat{\lambda}(t) \equiv \frac{2\{(1-b)\,(2+b)\,a - \left(2-b^2\right)t\}}{(4-b^2)\,a}. \tag{16}$$

The dumping margin is positive if $\lambda > \widehat{\lambda}(t)$, negative if $\lambda < \widehat{\lambda}(t)$, and zero if $\lambda = \widehat{\lambda}(t)$. Note that $d\widehat{\lambda}(t)/dt < 0$ holds. We have the following proposition.

Proposition 1 *As the tariff is higher and the market size in the foreign country is larger, the dumping margin is more likely to be positive. If* $\lambda > \widehat{\lambda}(0) = 2\,(1-b)\,/\{(2-b)\}$ *holds, the dumping margin of good* F *is always positive irrespective of the tariff level.*

Note that $\widehat{\lambda}(0)$ is less than one, implying that even if the market size of country F is smaller than that of country D, the dumping margin is still positive due to the pass-through effect and the competition effect.

By substituting (12), (13), and (14) into (7) and (8), the equilibrium profits of the firms are given by $\widetilde{\Pi}_D(N)$ and $\widetilde{\Pi}_F(N)$. Similarly, the equilibrium welfare becomes $\widetilde{W}_D(N)$ and $\widetilde{W}_F(N)$.

2.1.2 AD protection

Next, we investigate the case in which country D files an AD investigation against firm F. Firm F anticipates that if the dumping margin of good F is positive, the government of country D will charge the antidumping duty that is equal to the dumping margin, d. Then, firm F's optimal reaction is to offer a "price undertaking" to the government of country D, by which the firm eliminates the dumping margin and sets a uniform price across the two countries (see Appendix A.1 for details). This paper focuses on the case where the government of country D accepts firm F's offer of price undertaking.

Firm F maximizes (8) with respect to p_F subject to $d = 0$ (i.e., $p_F^* = p_F - t$). The equilibrium consumer prices of the two goods in country D are given by

$$\widetilde{p}_D(AD) = \widetilde{p}_D(N) + \frac{2b\left(1-b^2\right)}{8-5b^2}\widetilde{d}\,(\lambda,t)\,, \tag{17}$$

$$\widetilde{p}_F(AD) = \widetilde{p}_F(N) + \frac{4\left(1-b^2\right)}{8-5b^2}\widetilde{d}\,(\lambda,t)\,. \tag{18}$$

The equilibrium price of good F in country F becomes

$$\widetilde{p}_F^*(AD) = \widetilde{p}_F^*(N) - \frac{(4-b^2)}{8-5b^2}\widetilde{d}\,(\lambda,t)\,. \tag{19}$$

Compared to the case without AD protection, firm F increases the price in country D and decreases the price in country F to eliminate the dumping margin and avoid an AD duty. Because the firms' choices of prices are strategic complements, firm D's price undertaking also increases firm D' equilibrium price in country F.

By substituting these prices into (7) and (8), the equilibrium profits of the firms are given by $\widetilde{\Pi}_D(AD)$ and $\widetilde{\Pi}_F(AD)$, and the equilibrium welfare of each country is given by $\widetilde{W}_D(AD)$ and $\widetilde{W}_F(AD)$.

As the dumping margin becomes larger, the degree of firm F's price adjustments increases. If λ is significantly high, firm F may stop exporting and sets the profit-maximizing price in country F, rather than adjusting the prices and lose the profits in the high-demand market. We focus only on the case where $\widetilde{\Pi}_F(AD) > \widetilde{p}_F^*(N)x_F^*(\widetilde{p}_F^*(N))$ holds.

2.1.3 The effect of AD protection

Here, we compare the equilibrium profits and welfare with and without AD protection. Let $\Delta\Pi_i = \widetilde{\Pi}_i(AD) - \widetilde{\Pi}_i(N)$ and $\Delta W_i = \widetilde{W}_i(AD) - \widetilde{W}_i(N)$ $(i \in \{D, F\})$ respectively denote the effect of country D's AD protection on the profit of firm i and the welfare of country i. We can confirm that country D's AD benefits the domestic producer ($\Delta\Pi_D > 0$) and the degree of the increase in profit becomes smaller as the tariff decreases ($\partial(\Delta\Pi_D)/\partial t > 0$). As for the welfare of country D, $\Delta W_D < 0$ and $\partial(\Delta W_D)/\partial t < 0$ hold. The AD protection worsens the welfare and the degree of the decrease in social welfare becomes smaller as the tariff decreases.

Proposition 2 *The import country's AD protection increases the profit of the domestic firms and worsens the welfare of the country. Trade liberalization decreases both the domestic firm's gains and the welfare loss from AD.*

Because AD protection increases the prices of good F in country D, firm D gains from the AD. Since there is no costs to file an AD petition, firm D always does so in Stage 2 whenever the government adopts AD legislation in Stage 1.[6] However, the AD protection decreases the imports and the prices of both goods, it reduces the tariff revenue and the consumer surplus in country D. Because these negative effects dominate the positive effect on the profit of firm F, AD protection worsens the welfare.

AD protection of country D can either increase or decrease the profit of firm F. On the one hand, firm F cannot discriminate the prices between the two markets with the AD protection, reducing the profit of firm F. On the other hand, if $\lambda < 1$, the market size is larger in country D and the dumping occurs because of the pass-through effect and the competition effect. If firm F would not compete with firm D in country D and the tariff is not so high, it would have set a higher price in country D than in country F. Under the situation, the AD protection becomes a commitment devise for firm F to increase p_F, and the increase in p_F increases p_D set by firm D. This so called "collusive" effect has a positive effect on firm F's profit, and it dominates the negative effect on profit from reducing $\widetilde{p}_F^*$ in country F if the market size is sufficiently larger in country D.

Proposition 3 *The import country's AD protection increases the profit of the exporting firm*

[6] We will introduce the fixed cost of AD petition in Section 4.

and the welfare of the exporting country if the market size is sufficiently larger in the importing country than the exporting country. Otherwise, the AD protection decreases the profit of the exporting firm and it either increase or decreases the welfare of exporting country.

Because AD protection decreases the equilibrium price in country F, it benefits consumers in country F. Therefore, if $\Delta\Pi_F > 0$ holds, $\Delta W_F > 0$ always holds. However, if $\Delta\Pi_F < 0$ holds, the sign of ΔW_F is ambiguous.

2.2 The government's decision on enacting AD legislation

Here, we investigate the decision of country D's government in Stage 1. The change in country D's government's payoff from its AD protection is given by

$$\Delta G_D = \gamma \Delta W_D + (1-\gamma)\Delta\Pi_D. \tag{20}$$

By Proposition 2, $\Delta W_D < 0$ and $\Delta\Pi_D > 0$ if the dumping margin, $\widetilde{d}\,(\lambda, t)$, is positive. Hence, ΔG_D is decreasing in the government weight on the social welfare, γ, and $\Delta G_D > 0$ holds at $\gamma = 0$ and $\Delta G_D < 0$ at $\gamma = 1$. This means that we can find the unique, cut-off level of γ, $\widehat{\gamma}$ $(\in (0,1))$, at which $\Delta G_D = 0$ holds. It is given by

$$\widehat{\gamma} = \frac{\Delta\Pi_D}{\Delta\Pi_D - \Delta W_D}. \tag{21}$$

The government enacts AD legislation and implements AD protection if and only if $\gamma < \widehat{\gamma}$ holds.

Proposition 4 *Given that the dumping margin of good F is positive, country D implements AD protection if the government's weight on the firm's profit is large enough.*

3 Trade liberalization and AD protection

Now, we discuss how a tariff reduction changes the government incentive to implement AD protection. The effect is explored by investigating how a tariff reduction changes $\widehat{\gamma}$. We have

$$\frac{\partial\hat{\gamma}}{\partial t} = \frac{\hat{\gamma}(1-\hat{\gamma})(\epsilon_\Pi - \epsilon_W)}{t} \tag{22}$$

where

$$\epsilon_W \equiv \frac{t}{\Delta W_D}\frac{\partial(\Delta W_D)}{\partial t} > 0 \tag{23}$$

is the tariff elasticity of the changes in country D's welfare by AD protection and

$$\epsilon_\Pi \equiv \frac{t}{\Delta \Pi_D}\frac{\partial(\Delta \Pi_D)}{\partial t} > 0 \tag{24}$$

is the the tariff elasticity of the changes in the firm D's profit. If $\epsilon_\Pi > \epsilon_W$ holds so that the profit effect is larger than the welfare effect in percentage terms, we have $\partial\hat{\gamma}/\partial t > 0$ and a tariff reduction discourages AD protection in the sense that it decreases the cutoff level of the weight on social welfare, below which country D implements AD actions. If $\epsilon_\Pi < \epsilon_W$ holds, however, a tariff reduction promote AD protection.

As will be explored below, the relationship between the import tariff and the cut-off level of the government weight on social welfare depends on the relative market size of the two countries.

3.1 Smaller market size in country D

Let me start with $\lambda \geq 1$, where the market size of country D is smaller than that of country F. In this case, the market-size effect, the pass-through effect, and the competition effect all contribute to generate the dumping margin. Hence, a reduction in import tariff is relatively less important to reduce the dumping margin and does not significantly reduces the profit gains from AD protection, $\Delta\Pi_D$. However, it reduces the welfare cost of AD more since smaller t decreases the tariff revenue loss from AD protection. Therefore, $\epsilon_\Pi < \epsilon_W$ holds in this case and trade liberalization promotes AD protection.

Proposition 5 *If the market size of country D is not larger than that of country F, a reduction in import tariff always promotes AD protection in the sense that it increases the cut-off level of the government weight on social welfare, below which AD protection is implemented.*

Figure 1 depicts the relationship between t and $\hat{\gamma}$ with $\lambda \geq 1$.

[Figure 1 around here]

3.2 Larger market size in country D

Next, we investigate the case with $\lambda < 1$. In this case, the market-size effect on the dumping margin is negative and it counteracts the pass-through effect and the competition effect. This implies that a tariff reduction is relatively more important in reducing the dumping margin. Note that the reduction of dumping margin affects $\Delta\Pi_D$ more if the substitutability between the goods is higher. Although it also reduces the welfare cost of AD protection, because AD protection does not fully eliminate the dumping margin caused by the pass-through effect and the competition effect with $\lambda < 1$, the changes in ΔW_D becomes relatively smaller.

Let λ_t denote the cut-off level of λ, at which $\epsilon_\Pi = \epsilon_W$ holds (See Appendix A.5 for details). Because $\lambda_t < 1$, a tariff reduction prevents AD protection only if the market size of country D is larger than that of country F. Besides that, $\lambda_t > 0$ only if the substitutability of the goods is large enough to satisfy $b > 0.68237$. As a result, $\epsilon_\Pi > \epsilon_W$ holds if b is large enough to make $\lambda_t > 0$ and λ is small enough to satisfy $\lambda < \lambda_t$.

Proposition 6 *If the market size of country D is larger than country F and the substitutability of the goods is high, a reduction in import tariff may prevent AD protection in the sense that it decreases the cut-off level of the government weight on social welfare. Otherwise, it promotes AD protection.*

Furthermore, a tariff reduction may prevent AD protection by eliminating the dumping margin itself. By (16), the equilibrium dumping margin is positive if $\lambda > \widehat{\lambda}(t)$ holds, and $\widehat{\lambda}(t)$ is increasing in t. Therefore, if $\lambda < \widehat{\lambda}(0)$ holds, there exists the unique cut-off level of tariff, $\underline{t}$ (> 0), that satisfy $\lambda = \widehat{\lambda}(\underline{t})$. If $t < \underline{t}$ holds, firm F sets a higher price in country D and the dumping margin becomes negative, because the negative market-size effect dominates the pass-through effect and the competition effect. This result suggests that if the tariff is reduced from $t_0 > \underline{t}$ to $t_1 < \underline{t}$, the reduction prevents AD protection because firm F spontaneously stops its dumping in the post-liberalization equilibrium.

Proposition 7 *If the market size of country D is sufficiently large than country F such that the dumping margin is eliminated under free trade, a reduction in import tariff below the cut-off level prevents AD protection irrespective of the government weight on social welfare.*

Figure 2 depicts the relationship between t and $\hat{\gamma}$ with $\lambda < 1$, where $\lambda < \lambda_t$ and $\lambda < \widehat{\lambda}(0)$ hold in the upper diagram and $\lambda_t < \lambda < \widehat{\lambda}(0)$ holds in the lower diagram.

[Figure 2 around here]

4 Extension: A model with fixed cost of AD protection

Up to this point, we have assumed that there is no cost of implementing AD protection. However, when a firm files an AD petition to the domestic government, it may incur application costs such as the cost of documenting and reporting the damages caused by the targeted firm's dumping. Here, we introduce the fixed cost of AD petition, K, and investigate how the fixed cost affects the relationship between trade labialization and the implementation of AD protection.

In the presence of the fixed cost, even if the government in country D enacted AD legislation in Stage 1, firm D files an AD petition in Stage 2 only if $\Delta\Pi_D > K$ holds. In Stage 1, the government in country D recognizes that firm D incurs cost of AD protection. If $\Delta\Pi_D \leq K$ holds, the choice between N and AD is meaningless for the government because firm D never files an AD petition in either way. If $\Delta\Pi_D > K$ holds, the government enacts AD legislation if and only if $\Delta G_D > K$ holds. Figure 3 shows the possible equilibrium outcome in the (γ,K) space when $\lambda \geq 1$.[7]

[Figure 3 around here]

In Figure 3, the downward-sloping line represents ΔG_D, where the intercept is equal to $\Delta\Pi_D > 0$ and the slope is $\Delta W_D - \Delta\Pi_D < 0$. At $\gamma = 1$, $\Delta G_D = \Delta W_D < 0$.

If the government in country D places a sufficiently large weight on firm D's profit in its decision and the fixed cost of AD protection is not so high, it enacts AD legislation and firm D requests and the government implements AD protection against firm F. If the fixed cost of AD is sufficiently high, or the government places sufficiently large weight on social welfare, AD legislation is not enacted or firm D does not request AD protection in equilibrium. Even if $\gamma < \hat{\gamma}$ holds, the government in country D does not adopt AD legislation if $\Delta G_D < F$ holds.

[7]With $\lambda < 1$, a tariff reduction may decrease $\widehat{\gamma}$. However, we have qualitatively the same results as to the changes in the equilibrium outcomes with $K > 0$.

In this situation, a tariff reduction reduces the intercept of the downward-sloping line and makes the slope of the line less steep. Figure 4 depicts how trade liberalization changes the equilibrium outcomes, where the dotted line represents the pre-liberalization level of ΔG_D and the solid line represents the post-liberalization level.

[Figure 4 around here]

We have the following proposition.

Proposition 8 *With the fixed cost of AD protection, trade liberalization prevents AD protection when the government's weight on the profit of firm D is large and the fixed cost of AD is in the middle range. Trade liberalization promotes AD protection if the fixed cost is low and the government's weight on social welfare is in the middle range.*

Without the fixed cost, trade liberalization always promotes AD protection if $\lambda \geq 1$. With the fixed cost, however, it may prevent AD protection even if $\lambda \geq 1$, if the fixed cost is neither very high or very low, and the government places a large weight on the domestic firm's profit.

5 Concluding remarks

In an international oligopoly model, this paper analyzed how trade liberalization changes a country's decisions concerning AD protection against the foreign firm. A reduction of import tariff not only decreases the domestic firm's gains from AD protection, but it decreases welfare loss from AD protection. The relative magnitudes of these two effects determine whether tariff and AD protection are substitutes or complements.

If the market size of the domestic country is smaller than the foreign country, a tariff reduction basically promotes AD protection, in that it induces the adoption of AD law by the government that has relatively higher weight on social welfare. In this case, a tariff reduction may paradoxically hurt the domestic consumers and benefits the domestic producer if the effects of the induced AD protection overturn the direct effects of tariff reduction. However, a tariff reduction may also prevent AD protection when the fixed cost of AD protection and the government's weight on the producer's profit are relatively high.

If the market size of the domestic country is larger, there is a case where a tariff reduction prevents AD protection. It can even eliminate the dumping margin and take away the domestic country's opportunity to implement AD protection. In this case, a withdrawal of AD protection amplifies consumer's gains and the domestic producer's loss from trade liberalization. These results suggest that the relationship between trade liberalization and AD protection is not monotone, and depends on the reason why dumping occurs, the relative market size, and the cost of implementing AD protection. The results also provide a theoretical rationale for why trade liberalization increases AD protection by emerging economies whose the domestic markets are small.

My analysis can be extended in several directions. It will be interesting to consider a reciprocal dumping model and compare the effects of unilateral liberalization and those of reciprocal liberalization. It will provide useful policy implications to investigate how the formations of RTAs changes the members' and non-members' incentives to implement AD protection.[8]

Appendix

A.1 Price undertaking

Suppose that firm F chooses p'_F and $p^{*\prime}_F$ in equilibrium such that $d' = p^{*\prime}_F - (p'_F - t)$ under AD protection. Then an AD duty equals to d' is imposed on imports of good F. The corresponding price of good D is denoted by p'_D. Then, firm F's profit becomes $\Pi'_F = (p'_F - d' - t)x_F(p'_F, p'_D) + p'^*_F x^*_F(p'^*_F)$. If firm F alternatively sets $p''_F = p'_F - d'$, it eliminates the dumping margin and avoid an AD duty without affecting $p^{*\prime}_F$. Then, the profit becomes $\Pi''_F = (p''_F - t)x_F(p''_F, p'_D) + p'^*_F x^*_F(p'^*_F)$. Because $\Pi''_F - \Pi'_F = (p'_F - d' - t)\{x_F(p'_F - d', p'_D) - x_F(p'_F, p'_D)\} > 0$, the price adjustment increases the profit because it increases the sales of good F, $x_F(p'_F - d', p'_D) > x_F(p'_F, p'_D)$. This contradict the initial supposition that p'_F and $p^{*\prime}_F$ are the equilibrium prices. Therefore, firm F always chooses the prices that eliminate the dumping margin under AD protection.

[8] Another paper, Mukunoki (2016), has explored how a formation of a free trade agreement changes a member's incentives to implement AD protection against both members and non-members.

A.2 Proof of Proposition 2

By comparing $\widetilde{\Pi}_D(N)$ and $\widetilde{\Pi}_D(AD)$, we have

$$\Delta\Pi_D = \frac{2\widetilde{d}\,(\lambda,t)\,\Gamma_1}{(4-b^2)\,(8-5b^2)^2} > 0,$$

where $\Gamma_1 \equiv \left(1-b^2\right)\left(4-b^2\right)b\lambda a + 2a\,(1-b)\,(2+b)\left(8-b-5b^2+b^3\right) + 2\left(10-8b^2+b^4\right)bt > 0$, and

$$\frac{\partial\{\Delta\Pi_D\}}{\partial t} = \frac{2b\Gamma_2}{(4-b^2)^2\,(8-5b^2)^2} > 0$$

where $\Gamma_2 \equiv \left(3-2b^2\right)\left(4-b^2\right)^2 b\lambda a + 2\,(1-b)^2\,(2+b)\left(4-b-2b^2\right)\left(4+2b-b^2\right)a + 2(10-8b^2+b^4)bt > 0$. By comparing $\widetilde{W}_D(N)$ and $\widetilde{W}_D(AD)$, we have

$$\Delta W_D = -\frac{2(1-b)\widetilde{d}\,(\lambda,t)\,\Gamma_3}{2\,(8-5b^2)^2}$$

where $\Gamma_3 \equiv -\left(4-b^2\right)(1+b)\,\lambda a + 2a\left(10+b-7b^2-b^3\right) + 4\,(1+b)\left(3-2b^2\right)t$. $\Gamma_3 < 0$ holds if $\lambda > \lambda' \equiv \{2a\left(10+b-7b^2-b^3\right) + 4\,(1+b)\left(3-2b^2\right)t\}/\{\left(4-b^2\right)(1+b)\,a\}$ is satisfied. However, if evaluated at $\lambda = \lambda'$, we have $\widetilde{\Pi}_F(AD) - \widetilde{p}_F^*(N)x_F^*(\widetilde{p}_F^*(N)) = -\Gamma_4/\{(1+b)(1-b^2)(4-b^2)^2\}$ where $\Gamma_4 \equiv (1-b)\left(28-4b-33b^2+2b^3+14b^4+2b^5\right)a^2 + 2t(1-b^2)(36+2b-34b^2-2b^3+10b^4+b^5)a + (1+b)\,(28-56b^2+34b^4-7b^6)t^2 > \left(32-32b^2+9b^4\right)\left(4+b-3b^2-b^3\right)^2 t^2/\{(1-b)(2+b)^2\} > 0$ holds. The first inequality to assess Γ_4 is due to the constraint that $t < (1-b)\,(2+b)\,a/(2-b^2)$ must hold. Therefore, $\Gamma_3 > 0$ must hold and $\Delta W_D < 0$ always holds. We also have

$$\frac{\partial\{\Delta W_D\}}{\partial t} = -\frac{(1-b)\Gamma_5}{(4-b^2)\,(8-5b^2)^2} < 0,$$

where $\Gamma_5 \equiv \left(4-b^2\right)(1+b)\left(4-3b^2\right)\lambda a + 2(8-4b-4b^2+7b^3-b^4-3b^5)a + 8t\,(1+b)\,(3-2b^2)(2-b^2) > 0$ holds. ■

A.3 Proof of Proposition 3

By comparing $\widetilde{\Pi}_F(N)$ and $\widetilde{\Pi}_F(AD)$, we have

$$\Delta\Pi_F = -\frac{\widetilde{d}\,(\lambda,t)\,\Gamma_6}{2\,(4-b^2)\,(8-5b^2)^2},$$

where $\Gamma_6 \equiv \left(4-b^2\right)\left(32-32b^2+9b^4\right)\lambda a - 2\left(32-16b^2-b^4\right)\{(2+b)(1-b)a - t\left(2-b^2\right)\}$. At Γ_6 is increase in λ and $\Gamma_6|_{\lambda=1} = \left(32-32b+20b^3-11b^4\right)(2+b)ba + 2\left(2-b^2\right)\left(32-16b^2-b^4\right)t > 0$. By $\lambda > \lambda(t)$, $\Gamma_6 > \Gamma_6|_{\lambda=\lambda(t)} = -4b^2\left(8-5b^2\right)\{(2+b)(1-b)a - t\left(2-b^2\right)\} > 0$ where the last inequality comes from $t < (1-b)(2+b)a/(2-b^2)$. Therefore, there is the cut-off level of λ, $\lambda' \in (\lambda(t), 1)$, above which $\Gamma_6 > 0$ and $\Delta\Pi_F > 0$ holds, and below which $\Gamma_6 < 0$ and $\Delta\Pi_F < 0$. Since consumer surplus in country F is larger under AD protection, $\Delta W_F > 0$ holds whenever $\Delta\Pi_F > 0$ holds. When $\Delta\Pi_F < 0$, ΔW_F has an ambiguous sign. ■

A.4 Proof of Proposition 5

We can calculate that

$$\epsilon_\Pi - \epsilon_W = -\frac{abt(1-b)\{\widetilde{d}(\lambda,t)\}^2\Gamma_7}{4(8-5b^2)^3(4-b^2)(\Delta\Pi_D)|\Delta W_D|},$$

where $\Gamma_7 \equiv (1+b)\left(4-b^2\right)\left(2-b^2\right)b\lambda + 2\left(12-8b-22b^2+4b^3+11b^4+b^5-b^6\right)$. Γ_7 is increasing in λ and at $\lambda = 1$, we have $\Gamma_7|_{\lambda=1} = (1-b)\left(24+16b-20b^2-18b^3-2b^4+b^5\right) > 0$. Therefore, $\epsilon_\Pi - \epsilon_W < 0$ holds if $\lambda \geq 1$. By (22), $\partial\hat{\gamma}/\partial t < 0$ holds. ■

A.5 Proof of Proposition 6

By the proof of Proposition 5, the sign of $\epsilon_\Pi - \epsilon_W$ is negatively correlated to the sign of Γ_7. At the cut-off level, $\lambda = \lambda_t \equiv -2\left(12-8b-22b^2+4b^3+11b^4+b^5-b^6\right)/\{(1+b)\left(4-b^2\right)\left(2-b^2\right)b\}$, $\epsilon_\Pi = \epsilon_W$. If $\lambda(t) < \lambda < \lambda_t$ holds, $\Gamma_7 < 0$ and $\epsilon_\Pi - \epsilon_W > 0$. By (22), $\partial\hat{\gamma}/\partial t > 0$ holds. We can confirm that $\lambda_t > 0$ if and only if $b > 0.68237$ is satisfied. Besides that, since $\widehat{\lambda}(0)$ is decreasing in b and $\widehat{\lambda}(0) = 0$ at $b = 1$ and $\widehat{\lambda}(t)$ is decreasing in t, there always exists the range of b such that $\widehat{\lambda}(t) < \lambda_t$ holds. If $\lambda > \lambda_t$, we have $\epsilon_\Pi - \epsilon_W < 0$ and $\partial\hat{\gamma}/\partial t < 0$. ■

References

[1] Blonigen, B.A. and Prusa, T.J. (2015) "Dumping and antidumping duties," NBER working paper No. 21573

[2] Bown, C.P. and Crowley, M.A. (2014) "Emerging economies, trade policy, and macroeconomic shocks," *Journal of Development Economics* 111, pp.261-273

[3] Bown, C. P. and Tovar, P. (2011) "Trade liberalization, antidumping, and safeguards: evidence from India's tariff reform," *Journal of Development Economics* 96(1), pp.115-125

[4] Gao, X. and Miyagiwa, K. (2005) "Antidumping protection and R&D competition," *Canadian Journal of Economics* 38(1), pp.211-227

[5] Grossman, G.M. and Helpman, E. (1994) "Protection for Sale," *American Economic Review* 84(4), pp.833-850

[6] Kotsiubska, V. (2011) "Public interest consideration in domestic and international antidumping disciplines," MILE 11 Thesis, World Trade Institute, University of Bern.

[7] Miyagiwa, K. and Ohno, Y. (2007) "Dumping as a signal of innovation," *Journal of International Economics* 71(1), pp.221-240

[8] Moore, M.O. and Zanardi, M. (2011) "Trade liberalization and antidumping: Is there a substitution effect?," *Review of Development Economics* 15(4), pp.601-619

[9] Moraga-González, J.L. and Viaene, J.M. (2015) "Antidumping, intra-industry trade, and quality reversals," *International Economic Review* 56(3), pp.777-803

[10] Mukunoki, H. (2016) "Preferential trade agreements and antidumping actions against members and nonmembers", IDE Discussion Paper No. 611

[11] Prusa, T.J. (1997) "The trade effects of US antidumping actions." In Feenstra, R.C. (Ed.), *The Effects of US Trade Protection and Promotion Policies*. University of Chicago Press,Chicago.

[12] Reitzes, J.D. (1993) "Antidumping policy," *International Economic Review* 34, pp.745-763

[13] Vandenbussche, H. and Zanardi, M. (2010) "The chilling trade effects of antidumping proliferation," *European Economic Review* 54(6), pp.760-777

Figure 1: Trade liberalization and AD protection with $\lambda > 1$

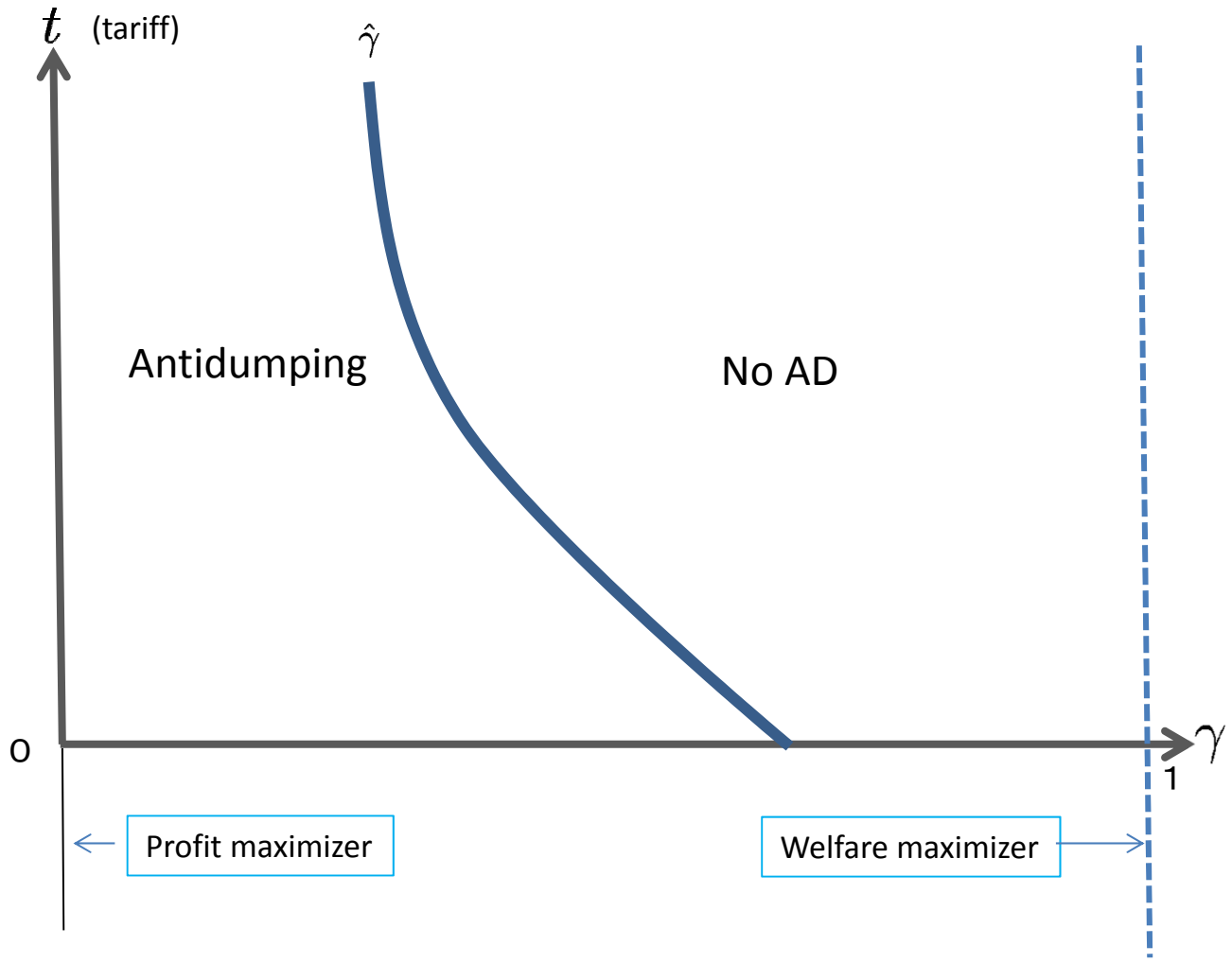
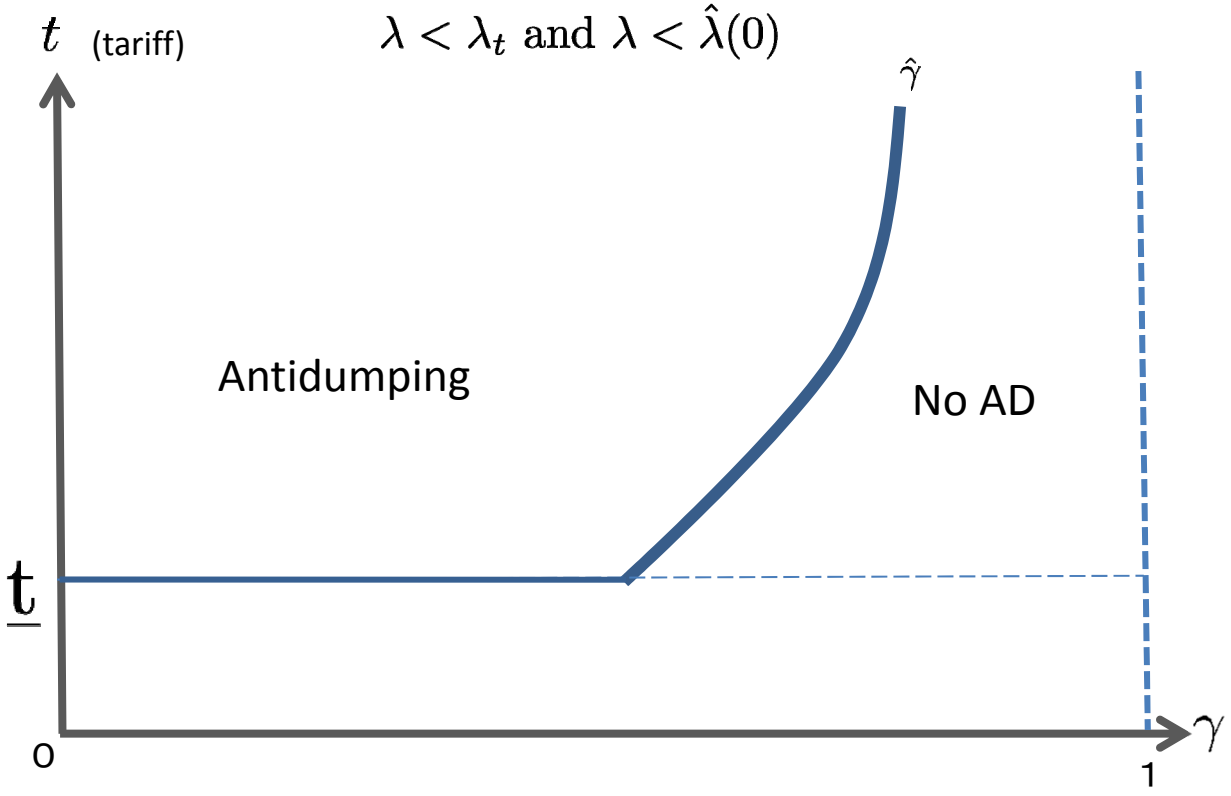


Figure 2: Trade liberalization and AD protection with $\lambda < 1$



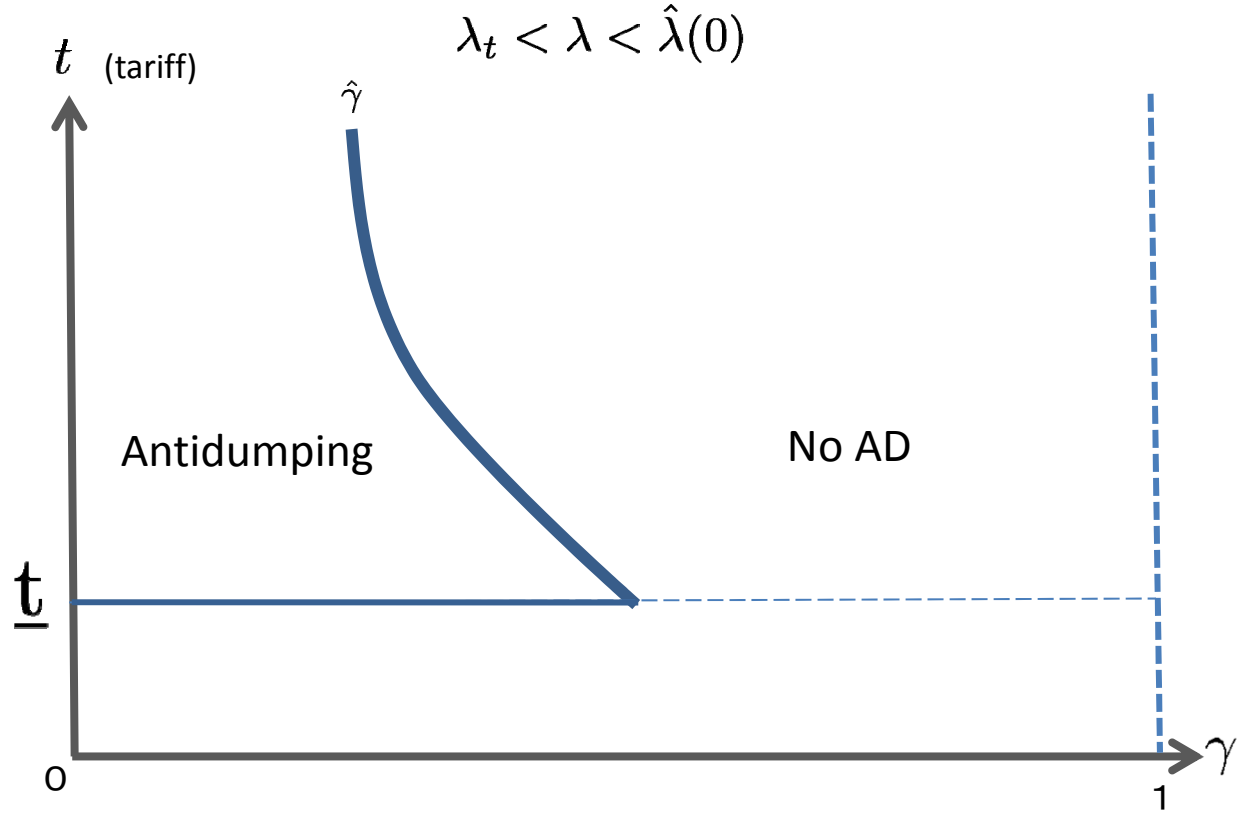


Figure 3: AD protection with the fixed cost

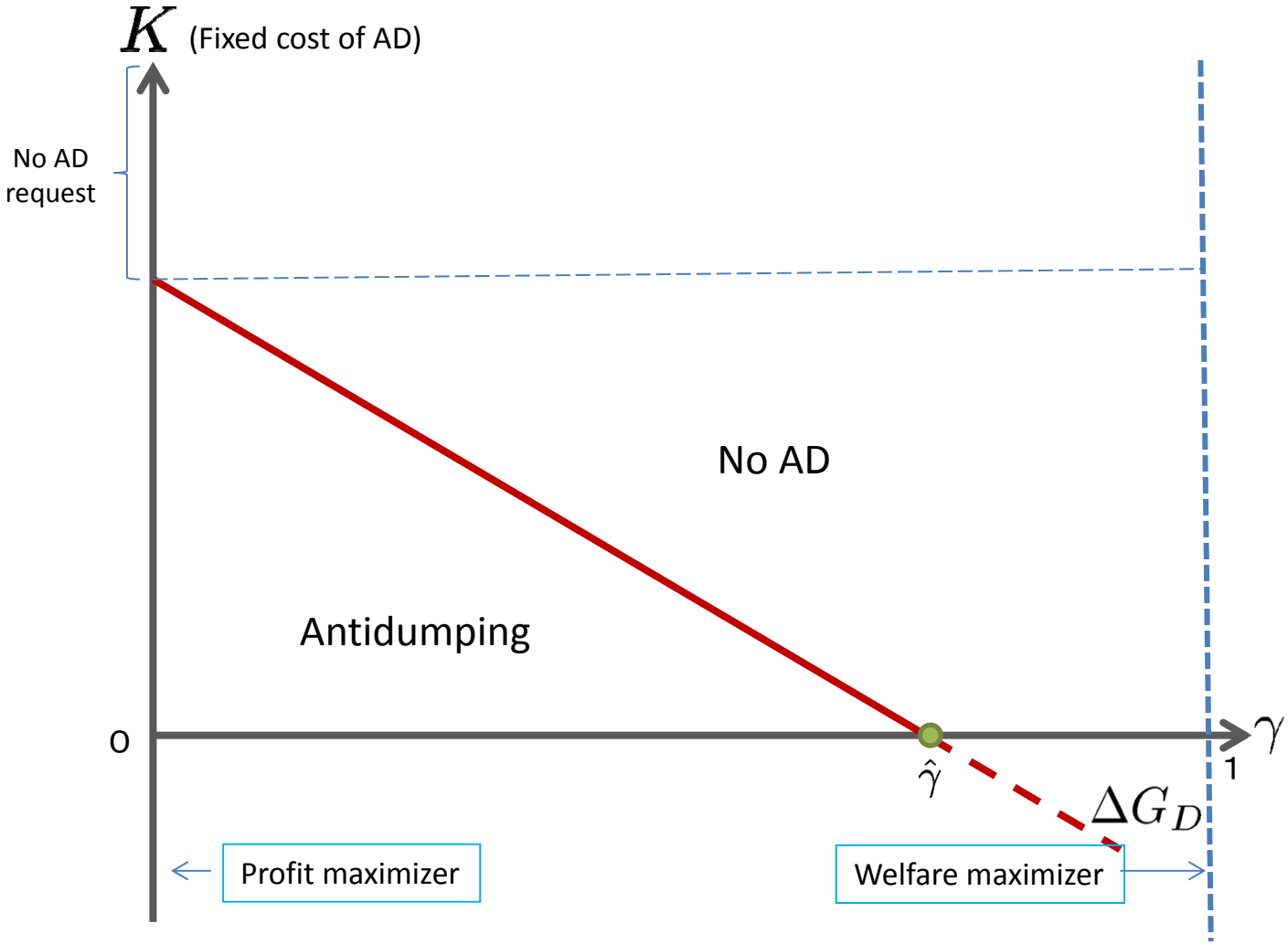


Figure 4: Trade liberalization and AD protection with the fixed cost