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Profit-enhancing parallel imports*

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Abstract

We investigate competition between a domestic intellectual property right holder and a foreign imitator and consider how parallel imports affect their profits. We consider a two-country model. Country A is a developed country where intellectual property rights are highly protected, and Country B is a developing country where protection is weak. The intellectual property right holder can sell the products for both markets while the imitator cannot export the products to Country A. We find that permitting parallel imports can be beneficial for both players because it serves as a commitment device to soften price competition.

Keywords: parallel imports, profits, intellectual property rights

JEL Classification: F12, K33, L13,

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1 Introduction

Parallel imports are genuine goods imported without the authorization of a trademark, patent, or copyright owner. Parallel imports can be found almost worldwide, and they are intensively discussed in the context of trademark protection and the protection of goodwill investments of producers. As Abbott (1998) points out, the real possibility exists that OECD industries will pressure their government to demand that WTO members take steps to prevent parallel importation on the grounds that parallel imports deprive them of the expected return on their IPRs (intellectual property rights) investment. Thus, this problem is an important North-South trade problem.[1] In spite of the importance of parallel imports, there has been only a small body of literature on the topic until recently.

Malueg and Schwartz (1994) is a pioneering work about parallel imports. They show that, if demand schedules in the various countries served by a monopolist are sufficiently different, parallel imports by unauthorized sellers may reduce world welfare. Malueg and Schwartz (1994), as well as most subsequent researchers, mainly consider how parallel imports affect welfare, and a relatively smaller body of literature focuses on the profits of firms holding IPRs.

At first glance, parallel imports obviously reduce the profits of the intellectual property right holders.[2] It is not obvious, however, whether or not parallel imports harm firms. Some works have already pointed out the possibility that parallel imports increase profits of IPR holders.

[1] Abbott (1998) also points out that this is not solely a North-South trade problem. Japan, for example, has followed a more open policy with respect to parallel imports in trademarked goods than has the United States, and a decision by Japan's Supreme Court with respect to parallel imports in patented products is pending. For a discussion on parallel imports, see also Richardson (2002).

[2] See, e.g., the above discussion in Abbott (1998).

Anderson and Ginsburgh (1999) focus on consumer arbitrage and show that parallel imports may increase the profits of a monopolist. They assume that arbitrage costs differ across consumers. They show that a monopolist may wish to create a second market in another country in order to discriminate across consumers in the home country. Let us assume that the higher a consumer's willingness to pay, the higher his arbitrage cost. The monopolist then effectively discriminates among consumers by exporting low-priced products and supplying high-priced products in the home markets. In their model, parallel imports can increase the monopolist's profits only if the consumer's willingness to pay is correlated with his arbitrage cost. This condition is not always satisfied in many product markets. For example, if expert dealers, rather than consumers themselves, import products and products for domestic and foreign markets are homogeneous, differences of arbitrage costs between consumers might disappear.

Ahmadi and Yang (2000) also show that there is a possibility that parallel imports may actually increase profits. They assume that the quality of imported goods is lower than that of original goods, because of inconvenience or lack of warranty. Under the assumption, parallel importation becomes another channel for authentic goods and creates a new product version that allows the manufacturer to practice price discrimination.

Both papers' driving force of the results is that parallel importation is a device in order to practice second-degree price discriminate in home countries.[3] However, both papers consider monopoly models only and ignore the possible strategic interaction

[3] Maskus and Chen (2004) present the perspective of vertical price control. They consider the possibility that an authorized wholesaler may be a parallel trader. They show how, in equilibrium, a manufacturer balances the trade-off between achieving efficient vertical pricing and preventing parallel importing and that restricting parallel imports always benefits the manufacturer. Maskus (2000) also presents the perspective of vertical price control.

between firms. As mentioned in Abbott (1998), inter-brand competition is an important factor in trademarked product markets. Abbott (1998, pp.629-30) reports the following:

> Under US legislation and Supreme Court doctrine, the vertical territorial allocation of distribution markets in trademarked products is permitted, subject to rule of reason analysis in the competition law context. At the retail level, the US internal market in trademarked product is policed by the first sale doctrine. The first buyer of a trademarked good outside the manufacture's vertical distribution chain may resell that good throughout the United States. It should be noted, however, that intrabrand competition may be restrained at the wholesale distribution level, in favor of enhancing interbrand competition.

As Abbott (1998) indicates, inter-brand competition with a trademarked product requires an oligopoly setting. In this paper, we consider a two-country duopoly setting, and, at each country, one firm produces its products. We introduce the competition between the intellectual property right holder and the foreign imitator. The intellectual property right holder supplies high-quality goods for the home and foreign markets, while the foreign imitator supplies low quality goods for foreign market only.[4]

The problem of parallel imports is also important for developing countries. In many developing countries IPRs are not sufficiently protected. Under such situations, if parallel imports are not banned, producers holding IPRs might hesitate to supply their products for such developing countries, resulting in great losses for consumers in developing countries.

In this paper, we consider the following situation. The home country is a developed country where intellectual property rights are highly protected, and the foreign country is a developing country where the protection is weak. The foreign firm cannot export

[4] As pointed by Abbott (1998, p.621), a substantial part of international trade is in goods that are not protected by IPRs.

its products because it infringes on the rights of the rival. We assume that the imported goods are indifferent from genuine goods. We also assume that a middleman (parallel importer) arbitrages (rather than each consumer). Thus, the firm (intellectual property right holder) cannot use parallel imports as a device of price discrimination. We show that there is a real possibility that parallel imports actually increase profits. The driving force is that permission for parallel imports serves as a commitment device to soften price competition in the foreign markets.

If parallel imports are impossible, the intellectual property right holder has an incentive to set a lower price in a foreign market than in the home country since it faces competition in the foreign market. If parallel imports are possible, it cannot maintain the lower price in the foreign market because it induces parallel imports, resulting in a loss in the home market. Thus, parallel imports reduce the incentive of price cuts in the foreign market. This is the reason that parallel imports serve as a commitment device. As mentioned earlier, the mechanism is different from those in Anderson and Ginsburgh (1999) and Ahmadi and Yang (2000) because the driving force of our result is not based on the price discrimination of the intellectual property right holder.

The result of the paper might provide a reason why some DVD content distributers are preventing customers from using contents sold in the other regions, the others are not (supply DVD contents without any restriction). Many major content distributors (for instance, Fox, Polygram, Columbia, etc.) have released DVD contents with region restrictions. On the contrary, we can see DVD contents without any restriction. We think that the condition shown in the paper might provide a hint to answer the interesting question. We will briefly discuss the topic in Section 3.

The remainder of this paper is organized as follows. Section 2 presents the basic model. Section 3 presents the main result of our paper. Section 4 concludes the paper.

2 The model

There are two countries, A and B. In each country, a firm produces a product, and a continuum of consumers exists. The products are vertically differentiated. All consumers agree on the most preferred kind of product and on the preference ordering. This assumption permits the set of goods to be ranked by some index $s \in [0, 1]$, where 1 is the most preferred good. In our paper, we assume that the two countries have an identical size.

Suppose that consumer surplus from buying s at price p is given by $\theta s - p$, where $\theta \in [0, 1]$. $F(\theta)$ is the cumulative distribution function of θ and $f(\theta)$ is the density function of θ. As commonly assumed, we assume that the functions satisfy the second-order conditions of the firms. We also assume that $F(\theta)$ and $f(\theta)$ satisfy the monotone hazard rate property, $d[F(\theta)/f(\theta)]/d\theta \geq 0$.[5]

Firm a (*res.* b) is in Country A (*res.* B). We assume that $s_a = 1$ and s_b (< 1) (s_i is the rank of firm i's product). The assumption is plausible if firm a is the innovator and firm b is an imitator that can produce old models of a product. Each firm produces a unit of its product at constant marginal cost normalized to be zero. Firm a exports its product to Country B at zero transport cost.

We assume that firm a can sell its product to both countries, however, firm b can only sell its product to its own country (Country B). This assumption can be rationalized if we consider the following situation. Suppose that Country A is a developed country in which intellectual property rights are highly protected, while Country B is a developing country with weak protection. The imitator (firm b) cannot sell its product

[5] See Laffont and Tirole (1993, Ch. 1, pp. 66) about the property for more details.

in Country A because it infringes on the intellectual property rights of firm a, but it can sell in Country B due to the lack of protection of patent holders.[6] Each firm sets its price in each country. Denote p_a^A to be the price set by firm a in Country A, p_a^B to be the price set by firm a in Country B, and p_b^B to be the price set by firm b in Country B.

After observing the prices, a middleman appears and buys firm a's product in Country B to sell the product to consumers in Country A, if the price set by firm a in Country A is higher than the sum of the price set by firm a in Country B and the per-unit arbitrage cost (τ) incurred by the middleman. That is, if p_a^A is higher than $p_a^B + \tau$, the middleman appears, and arbitrage emerges. An example of this arbitrage cost is transport cost. However, since we assume that firm a exports its product at zero transport cost, this example might be inadequate. Another example of arbitrage cost is the printing cost of the new manual for consumers in Country A, whose language is different from that in Country B. It is possible that both transport and printing costs constitute the arbitrage cost τ.

3 Result

First, we consider a case in which parallel imports are not permitted, that is, firm a can perfectly discriminate the markets. The profit maximization problems and the

[6] The assumption is not essential but clarifies the driving force of our result. Using a slightly modified setting, we can derive our main result, even though firm b is able to sell its product to both countries. We present it in Appendix B.

first-order conditions are as follows:

$$\pi_a = \max_{p_a^A, p_a^B} (1 - F(p_a^A))p_a^A + \left(1 - F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right)\right) p_a^B, \tag{1}$$

$$\pi_b = \max_{p_b^B} \left(F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right) - F\left(\frac{p_b^B}{s_b}\right)\right) p_b^B. \tag{2}$$

$$\frac{\partial \pi_a}{\partial p_a^A} = 0 \Leftrightarrow 1 - F(p_a^{A*}) - f(p_a^{A*})p_a^{A*} = 0, \tag{3}$$

$$\frac{\partial \pi_a}{\partial p_a^B} = 0 \Leftrightarrow 1 - F\left(\frac{p_a^{B*} - p_b^{B*}}{1 - s_b}\right) - f\left(\frac{p_a^{B*} - p_b^{B*}}{1 - s_b}\right)\frac{p_a^{B*}}{1 - s_b} = 0, \tag{4}$$

$$\frac{\partial \pi_b}{\partial p_b^B} = 0 \Leftrightarrow F\left(\frac{p_a^{B*} - p_b^{B*}}{1 - s_b}\right) - F\left(\frac{p_b^{B*}}{s_b}\right) - f\left(\frac{p_a^{B*} - p_b^{B*}}{1 - s_b}\right)\frac{p_b^{B*}}{1 - s_b} - f\left(\frac{p_b^{B*}}{s_b}\right)\frac{p_b^{B*}}{s_b} = 0, \tag{5}$$

where we label the solution to this problem as p_a^{A*}, p_a^{B*}, and p_b^{B*}.

Second, we consider a case in which parallel imports are permitted. Obviously, firm a never chooses $p_a^A > p_a^B + \tau$ because it induces parallel imports and reduces the profits of firm a. Thus, firm a faces the constraint, $p_a^A \leq p_a^B + \tau$. There exists the value of τ such that $p_a^{A*} = p_a^{B*} + \tau$. We label the value as τ^*. If $\tau > \tau^*$, the constraint $p_a^A \leq p_a^B + \tau$ is not binding, and whether parallel imports are permitted or not does not matter. We assume that $\tau \leq \tau^*$. Then the profit maximization problems of the firms are as follows:

$$\pi_a = \max_{p_a^A, p_a^B} (1 - F(p_a^A))p_a^A + \left(1 - F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right)\right) p_a^B, \quad s.t. \;\; p_a^A = p_a^B + \tau. \tag{6}$$

$$\pi_b = \max_{p_b^B} \left(F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right) - F\left(\frac{p_b^B}{s_b}\right)\right) p_b^B. \tag{2'}$$

The first-order conditions are as follows:

$$
\begin{aligned}
\mathcal{L} &= (1-F(p_a^A))p_a^A + \left(1-F\left(\frac{p_a^B - p_b^B}{1-s_b}\right)\right)p_a^B + \lambda(\tau - p_a^A + p_a^B). && (7)\\
\frac{\partial \mathcal{L}}{\partial p_a^A} = 0 \;&\Leftrightarrow\; 1-F(\tilde{p}_a^A) - f(\tilde{p}_a^A)\tilde{p}_a^A - \tilde{\lambda} = 0, && (8)\\
\frac{\partial \mathcal{L}}{\partial p_a^B} = 0 \;&\Leftrightarrow\; 1-F\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1-s_b}\right) - f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_a^B}{1-s_b} + \tilde{\lambda} = 0, && (9)\\
\frac{\partial \mathcal{L}}{\partial \lambda} = 0 \;&\Leftrightarrow\; \tau - \tilde{p}_a^A + \tilde{p}_a^B = 0, && (10)\\
\frac{\partial \pi_b}{\partial p_b^B} = 0 \;&\Leftrightarrow\; F\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1-s_b}\right) - F\left(\frac{\tilde{p}_b^B}{s_b}\right) && (11)\\
&\qquad -f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_b^B}{1-s_b} - f\left(\frac{\tilde{p}_b^B}{s_b}\right)\frac{\tilde{p}_b^B}{s_b} = 0,
\end{aligned}
$$

where we label the solution to the problem as $\tilde{p}_a^A$, $\tilde{p}_a^B$, $\tilde{p}_b^B$, and $\tilde{\lambda}$.

Lemma 1 *There exist $\bar{\tau} < \tau^*$ such that, for any $\bar{\tau} < \tau \leq \tau^*$, $\partial\tilde{\pi}_a/\partial\tau$ is negative.*

The equilibrium outcome when parallel imports are prohibited is exactly the same as when they are permitted and $\tau = \tau^*$. Thus Lemma 1 implies Proposition 1.

Proposition 1 *If $\bar{\tau} < \tau < \tau^*$, allowing parallel imports increases the profits of both firms.*

We now explain the intuition behind Lemma 1. For firm a, a decrease in τ increases the difficulty of price discrimination between two countries. Therefore, firm a raises the price in the competitive market (Country B) and cuts the price in the monopoly market (Country A). Obviously, the price increased by firm a in Country B increases the profit of firm b. Responding to a higher price of firm a, firm b raises its price in Country B; therefore, it increases the profits of firm a from Country B. On the other hand, the price cut in Country A decreases the profits. If τ is close to τ^*, the price in Country A is close to the monopoly price p_a^{A*}; therefore, a slight reduction of p_a^A from the monopoly price has the second-order negative effect (envelope theorem). A slight increment of p_a^B also has the second-order negative effect. On the other hand, a raise of p_b^B has the first-order positive effect. Thus, a higher τ induces higher profits of firm a. That is, there is a real possibility that parallel imports actually increase profits. The driving force is that the permission for parallel imports serve as a commitment device to soften price competition with firm b in Country B. The mitigation of price competition is crucial. A mere arbitrage of the good does not induce our result.

The result of the paper might provide a reason why some DVD content distributers are preventing customers from using contents sold in the other regions, the others are not (supply DVD contents without any restriction). As discussed in Dunt *et al.* (2001), the international distribution of films on DVD has been segmented into geographically distinct markets by technology-based restrictions. The regional coding system requires that all DVD players must be manufactured for distribution and use in one of six geographic regions around the world. The coding system prevents users from using contents sold in the other regions. Many major content distributors (for instance, Fox, Polygram, Columbia, etc.) have released DVD contents with region restrictions. Those content distributors mainly sell valuable, funny, famous, and expensive contents. That is, the transport (arbitrage) cost τ is relatively small. Based on Proposition 1, parallel imports harm the profits of those firms. On the contrary, we can see DVD contents without any restriction. Those contents are mainly distributed by not-so-famous content distributors. Those contents are mainly sold at reasonable and cheep prices. That is, the transport (arbitrage) cost τ is relatively high. Therefore, those firms do not need protect their contents from parallel importations which are harmless or beneficial.

Finally, we briefly discuss welfare effects. Prohibiting parallel imports raises the price of Country A. Therefore, it harms the welfare of Country A. Prohibiting parallel imports reduces the prices of Country B and increases the consumer surplus of Country B. At the same time, it reduces the profit of firm b. If we assume that $F(\theta)$ is the uniform distribution function of θ, the former effect always dominates the latter effect, i.e., the welfare of Country B is improved by the prohibition of parallel imports (see Appendix C).

4 Concluding remarks

In this paper, we consider whether or not parallel imports harm firms. We show that there is a real possibility that parallel imports actually increase profits. Existing works, such as those by Anderson and Ginsburgh (1999) and Ahmadi and Yang (2000), have already shown that parallel imports might increase the profits of the monopolist if they can make price discrimination through parallel imports. We show that even if price discrimination is impossible under parallel imports, parallel imports might be able to increase the profits of all firms. The permission for parallel imports is a commitment device to soften price competition in the foreign country to which the IPR holder exports. Our results depends entirely on the strategic structure. We have assumed that each firm faces price competition; thus, the strategic structure is strategic compliment. If we assume that each firm faces quantity competition, the strategic structure is strategic substitute, and our result would not hold.

APPENDIX A

Proof of Lemma 1: Suppose that parallel imports are permitted. We investigate the marginal effects of changes in τ on the solution. Using the envelope theorem, we derive

$$\frac{\partial \tilde{\pi}_a(\tau)}{\partial \tau} = \left[1 - F(\tilde{p}_a^B + \tau) - f(\tilde{p}_a^B + \tau)(\tilde{p}_a^B + \tau)\right] + \frac{\tilde{p}_a^B}{1 - s_b} f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1 - s_b}\right) \frac{\partial \tilde{p}_b^B}{\partial \tau}. \quad (12)$$

Taking account of equation (8) and the constraint $\tilde{p}_a^A = \tilde{p}_a^B + \tau$, we find that the value in the bracket is $\tilde{\lambda}$ and that

$$\frac{\partial \tilde{\pi}_a(\tau)}{\partial \tau} = \tilde{\lambda} + \frac{\tilde{p}_a^B}{1 - s_b} f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1 - s_b}\right) \frac{\partial \tilde{p}_b^B}{\partial \tau}. \quad (12')$$

Using (3), we rearrange it and have that

$$\left.\frac{\partial \tilde{\pi}_a}{\partial \tau}\right|_{\tau = \tau^*} = \frac{\tilde{p}_a^B}{1 - s_b} f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1 - s_b}\right) \frac{\partial \tilde{p}_b^B}{\partial \tau}, \quad (13)$$

where we use $\tilde{\lambda} = 0$ and $\tilde{p}_a^B + \tau = \tilde{p}_a^A = p_a^{A*}$ if $\tau = \tau^*$. If the sign of (13) is negative, we obtain Lemma 1 because $\tilde{\pi}_a$ is continuous. In other word, if $\partial \tilde{p}_b^B / \partial \tau$ is negative, we obtain Lemma 1.

We now show that the sign of $\partial \tilde{p}_b^B / \partial \tau$ is minus. To show it, we use the first-order conditions of the firms, that is, we use equations (8), (9), and (11). Using (8) and (9), we derive

$$\begin{aligned} 1 - F(\tilde{p}_a^B + \tau) - f(\tilde{p}_a^B + \tau)(\tilde{p}_a^B + \tau) + 1 - F\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1 - s_b}\right) \\ - f\left(\frac{\tilde{p}_a^B - \tilde{p}_b^B}{1 - s_b}\right) \frac{\tilde{p}_a^B}{1 - s_b} = 0. \quad (14) \end{aligned}$$

The total differentiation of equation (14) is

$$\begin{aligned}
&\left[2f(\tilde{p}_a^B+\tau)+f'(\tilde{p}_a^B+\tau)(\tilde{p}_a^B+\tau)+2f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{1}{1-s_b}\right.\\
&\qquad\left.+f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_a^B}{(1-s_b)^2}\right]\frac{d\tilde{p}_a^B}{d\tau}\\
&=\left[\frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)+\frac{\tilde{p}_a^B}{(1-s_b)^2}f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]\frac{d\tilde{p}_b^B}{d\tau}\\
&\qquad-(2f(\tilde{p}_a^A)+f'(\tilde{p}_a^A)\tilde{p}_a^A).
\end{aligned}\tag{15}$$

The total differentiation of equation (11) is

$$\begin{aligned}
&\left[\frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{\tilde{p}_b^B}{(1-s_b)^2}f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]\frac{d\tilde{p}_a^B}{d\tau}\\
&=-\left[-\frac{2}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{2}{s_b}f\left(\frac{\tilde{p}_b^B}{s_b}\right)\right.\\
&\qquad\left.+f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_b^B}{(1-s_b)^2}-f'\left(\frac{\tilde{p}_b^B}{s_b}\right)\frac{\tilde{p}_b^B}{s_b^2}\right]\frac{d\tilde{p}_b^B}{d\tau}.
\end{aligned}\tag{16}$$

We now define four symbols:[7]

$$
\begin{aligned}
A &\equiv \left[2f(\tilde{p}_a^B+\tau)+f'(\tilde{p}_a^B+\tau)(\tilde{p}_a^B+\tau)+2f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{1}{1-s_b}\right.\\
&\qquad\left.+f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_a^B}{(1-s_b)^2}\right]>0,\\
B &\equiv \left[\frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)+\frac{\tilde{p}_a^B}{(1-s_b)^2}f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right],\\
C &\equiv \left[\frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{\tilde{p}_b^B}{(1-s_b)^2}f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]>0,\\
D &\equiv \left[\frac{2}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)+\frac{2}{s_b}f\left(\frac{\tilde{p}_b^B}{s_b}\right)\right.\\
&\qquad\left.-f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\frac{\tilde{p}_b^B}{(1-s_b)^2}+f'\left(\frac{\tilde{p}_b^B}{s_b}\right)\frac{\tilde{p}_b^B}{s_b^2}\right]>0.
\end{aligned}
$$

Using the symbols, we can simplify equations (15) and (16) as follows:

$$
A\cdot\frac{d\tilde{p}_a^B}{d\tau}-B\cdot\frac{d\tilde{p}_b^B}{d\tau}=-(2f(\tilde{p}_a^A)+f'(\tilde{p}_a^A)\tilde{p}_a^A), \tag{18}
$$

$$
C\cdot\frac{d\tilde{p}_a^B}{d\tau}-D\cdot\frac{d\tilde{p}_b^B}{d\tau}=0. \tag{19}
$$

Solving the simultaneous equations, we have:

$$
\frac{d\tilde{p}_a^B}{d\tau}=\frac{-(2f(\tilde{p}_a^A)+f'(\tilde{p}_a^A)\tilde{p}_a^A)D}{AD-BC},\quad \frac{d\tilde{p}_b^B}{d\tau}=\frac{-(2f(\tilde{p}_a^A)+f'(\tilde{p}_a^A)\tilde{p}_a^A)C}{AD-BC}. \tag{20}
$$

[7] From the ordinary second order conditions, A and D are positive. The reason why C is positive is as follows:

$$
\begin{aligned}
C &= \frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{\tilde{p}_b^B}{(1-s_b)^2}f'\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right) \qquad (17)\\
(\because \text{MHR-property}) &\geq \frac{1}{1-s_b}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{\tilde{p}_b^B}{(1-s_b)^2}f^2\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\Big/F\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\\
&= \frac{1}{1-s_b}\left[f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\Big/F\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]\times\\
&\qquad\left[F\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)-\frac{\tilde{p}_b^B}{(1-s_b)}f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]\\
(\because \text{Equation (11)}) &= \frac{1}{1-s_b}\left[f\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\Big/F\left(\frac{\tilde{p}_a^B-\tilde{p}_b^B}{1-s_b}\right)\right]\left[F\left(\frac{\tilde{p}_b^B}{s_b}\right)+\frac{\tilde{p}_b^B}{s_b}f\left(\frac{\tilde{p}_b^B}{s_b}\right)\right]>0.
\end{aligned}
$$

The numerator of $d\tilde{p}_b^B/d\tau$ is negative. The denominator of $d\tilde{p}_b^B/d\tau$ is positive because $A > B$ and $D > C$. Thus, $d\tilde{p}_b^B/d\tau$ is negative. Therefore, Lemma 1 holds. **Q.E.D.**

APPENDIX B

We now consider the case in which firm b also exports its product to Country A at zero transport cost. We build a slightly modified model including the model mentioned in section 2. The basic assumptions in this appendix are the same ones in section 2 except the following ones. First, firm b also exports its product to Country A at zero transport cost. Second, consumers in Country A evaluate firm b's product at hs_b ($h < 1$). The assumption reflects that firm a is a world-wide famous firm but firm b is a domestic minor firm. Since firm b is not so familiar to consumers in Country A, their evaluations for firm b's product is smaller than s_b. Third, we assume that $F(\theta)$ is the uniform distribution function of θ.

We first consider a case in which parallel imports are not permitted, that is, firm a can perfectly discriminate the markets. The profit maximization problems are as follows:

$$\pi_a = \max_{p_a^A, p_a^B} \left(1 - F\left(\frac{p_a^A - p_b^A}{1 - hs_b}\right)\right) p_a^A + \left(1 - F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right)\right) p_a^B, \tag{21}$$

$$\pi_b = \max_{p_b^A, p_b^B} \left(F\left(\frac{p_a^A - p_b^A}{1 - hs_b}\right) - F\left(\frac{p_b^A}{hs_b}\right)\right) p_b^A + \left(F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right) - F\left(\frac{p_b^B}{s_b}\right)\right) p_b^B. \tag{22}$$

The first-order conditions lead to

$$p_a^{A*} = \frac{2(1 - hs_b)}{4 - hs_b},\ p_b^{A*} = \frac{hs_b(1 - hs_b)}{4 - hs_b},\ p_a^{B*} = \frac{2(1 - s_b)}{4 - s_b},\ p_b^{B*} = \frac{s_b(1 - s_b)}{4 - s_b},$$
$$\pi_a^* = \frac{4(32 - 24(1 + h)s_b + (1 + 16h + h^2)s_b^2 - h(1 + h)s_b^3)}{(4 - s_b)^2(4 - hs_b)^2}. \tag{23}$$

Second, we consider a case in which parallel imports are permitted. Obviously, firm a never chooses $p_a^A > p_a^B + \tau$ because it induces parallel imports and reduces the profits of firm a. Thus, firm a faces the constraint, $p_a^A \leq p_a^B + \tau$. There exists the value of τ such that $p_a^{A*} = p_a^{B*} + \tau$. We label the value as $\tau^* \equiv 6(1 - h)s/((4 - s)(4 - hs))$.

If $\tau > \tau^*$, the constraint $p_a^A \leq p_a^B + \tau$ is not binding, and whether parallel imports are permitted or not does not matter. We assume that $\tau \leq \tau^*$. Then, the profit maximization problems of the firms are as follows:

$$\pi_a = \max_{p_a^A, p_a^B} \left(1 - F\left(\frac{p_a^A - p_b^A}{1 - hs_b}\right)\right) p_a^A + \left(1 - F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right)\right) p_a^B, \quad s.t. \ \ p_a^A = p_a^B + \tau. \tag{24}$$

$$\pi_b = \max_{p_b^A, p_b^B} \left(F\left(\frac{p_a^A - p_b^A}{1 - hs_b}\right) - F\left(\frac{p_b^A}{hs_b}\right)\right) p_b^A + \left(F\left(\frac{p_a^B - p_b^B}{1 - s_b}\right) - F\left(\frac{p_b^B}{s_b}\right)\right) p_b^B. \tag{22'}$$

The first-order conditions lead to

$$\begin{aligned}
\tilde{p}_a^A &= \frac{(1 - hs_b)(4(1+\tau) - (4+\tau)s_b)}{8 - 5(1+h)s_b + 2hs_b^2}, \ \tilde{p}_b^A = \frac{hs_b(1 - hs_b)(4(1+\tau) - (4+\tau)s_b)}{2(8 - 5(1+h)s_b + 2hs_b^2)}, \\
\tilde{p}_a^B &= \frac{(1 - s_b)(4(1-\tau) - (4-\tau)hs_b)}{8 - 5(1+h)s_b + 2hs_b^2}, \ \tilde{p}_b^B = \frac{s_b(1 - s_b)(4(1-\tau) - (4-\tau)hs_b)}{2(8 - 5(1+h)s_b + 2hs_b^2)}, \\
\tilde{\pi}_a &= \frac{(1 - hs_b)(4(1+\tau) - (4+\tau)s_b)(8(1-\tau) - 2(1+3h-(1+2h)\tau)s_b - \tau hs_b^2)}{2(8 - 5(1+h)s + 2hs_b^2)^2} \\
&\quad + \frac{(1 - s_b)(4(1-\tau) - (4-\tau)hs_b)(8(1+\tau) - 2(3+h-(2+h)\tau)s_b + \tau hs_b^2)}{2(8 - 5(1+h)s + 2hs_b^2)^2}.
\end{aligned} \tag{25}$$

We now derive the condition that $\tilde{\pi}_a - \pi_a^* > 0$. After several calculus, we find that if the following inequality is satisfied, there exists $\tilde{\tau}(< \tau^*)$ such that for any $\tau \in (\tilde{\tau}, \tau^*)$, $\tilde{\pi}_a - \pi_a^* > 0$.

$$s_b < \frac{4(2(1+h) - \sqrt{4 + h + 4h^2})}{7h}. \tag{26}$$

Note that, h must be smaller than 1. If $h = 1$, there is no τ that satisfies $\tilde{\pi}_a - \pi_a^* > 0$.

APPENDIX C

We now consider the case in which θ is uniformly distributed over $[0,1]$.

The profit maximization problems of the firms are as follows:

$$\begin{aligned}
\pi_a &= \max_{p_a^A, p_a^B} (1-p_a^A)p_a^A + \left(1 - \frac{p_a^B - p_b^B}{1-s_b}\right) p_a^B, \quad s.t.\ \ p_a^A \le p_a^B + \tau. \\
\pi_b &= \max_{p_b^B} \left(\frac{p_a^B - p_b^B}{1-s_b} - \frac{p_b^B}{s_b}\right) p_b^B.
\end{aligned}$$

The Kurush-Kuhn-Tucker condition and the first order condition are as follows:

$$\mathcal{L} = (1-p_a^A)p_a^A + \left(1 - \frac{p_a^B - p_b^B}{1-s_b}\right) p_a^B + \lambda(\tau - p_a^A + p_a^B).$$

$$\frac{\partial \mathcal{L}}{\partial p_a^A} = 0 \Leftrightarrow 1 - 2p_a^A - \lambda = 0, \tag{27}$$

$$\frac{\partial \mathcal{L}}{\partial p_a^B} = 0 \Leftrightarrow 1 - \frac{p_a^B - p_b^B}{1-s_b} - \frac{p_a^B}{1-s_b} + \lambda = 0, \tag{28}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} \Leftrightarrow \tau - p_a^A + p_a^B \ge 0, \ \ \lambda(\tau - p_a^A + p_a^B) = 0, \ \lambda \ge 0. \tag{29}$$

$$\frac{\partial \pi_b}{\partial p_b^B} = 0 \Leftrightarrow s_b p_a^B = 2p_b^B. \tag{30}$$

If $\tau - p_a^A + p_a^B > 0$ ($\tau > 3s_b/(2(4-s_b))$), $\lambda = 0$. This case is equivalent to the case in which parallel imports are prohibited. Using (27), (28), (29), and (30), we derive

$$p_a^A = \frac{1}{2},\ p_a^B = \frac{2(1-s_b)}{4-s_b},\ p_b^B = \frac{s(1-s_b)}{4-s_b},\ \pi_a^n = \frac{32 - 24s_b + s_b^2}{4(4-s_b)^2},\ \pi_b^n = \frac{(1-s_b)s_b}{(4-s_b)^2}.$$

Consumers surplus and social surplus in each country are

$$\begin{aligned}
Cs_A^n &\equiv \int_{p_a^A}^{1} (\theta s_a - p_a^A) d\theta = \frac{1}{8},\ \text{(where } s_a = 1,) \\
Cs_B^n &\equiv \int_{\frac{p_a^B - p_b^B}{1-s_b}}^{1} (\theta - p_a^B) d\theta + \int_{\frac{p_b^B}{s_b}}^{\frac{p_a^B - p_b^B}{1-s_b}} (\theta s_b - p_b^B) d\theta = \frac{4 + 5s_b}{2(4-s_b)^2}, \\
SW_A^n &\equiv \pi_a^n + Cs_A^n = \frac{(80 - 56s_b + 3s_b^2)}{8(4-s_b)^2}, \\
SW_B^n &\equiv \pi_b^n + Cs_B^n = \frac{1 + 2s_b}{2(4-s_b)}.
\end{aligned}$$

If $\tau - p_a^A + p_a^B = 0$ ($\tau \leq 3s_b/(2(4-s_b))$), $\lambda \geq 0$. Using (27), (28), (29), and (30), we derive

$$p_a^B = \frac{4(1-s_b)(1-\tau)}{8-5s_b},\ p_b^B = \frac{2s_b(1-s_b)(1-\tau)}{8-5s_b},\ p_a^A = \frac{4(1-s_b)+(4-s_b)\tau}{8-5s_b},$$
$$\lambda = \frac{3s_b - 2(4-s_b)\tau}{8-5s_b}.$$
$$\pi_a^p = \frac{(1-\tau)(16(1-s_b)(2-s_b)+(32(1-s_b)+9s_b^2)\tau)}{(8-5s_b)^2},\ \pi_b^p = \frac{4s_b(1-s_b)(1-\tau)^2}{(8-5s_b)^2}.$$

Consumers' surplus and social surplus in each country are

$$Cs_A^p = \frac{(4-s_b)^2}{2(8-5s_b)^2},$$
$$Cs_B^p = \frac{16(1+\tau)^2 - 4(1+12\tau+7\tau^2)s_b - (3+2\tau)(1-6\tau)s_b^2}{2(8-5s_b)^2},$$
$$SW_A^p = \frac{(1-\tau)(16(5+3\tau) - 8(23+13\tau)s_b + (137+73\tau)s_b^2 - (33+17\tau)s_b^3)}{2(1-s_b)(8-5s_b)^2},$$
$$SW_B^p = \frac{16(1+\tau)^2 - 12(1+8\tau+3\tau^2)s_b - 3(5-32\tau-8\tau^2)s_b^2 + (11-32\tau-4\tau^2)s_b^3}{2(1-s)(8-5s)^2}.$$

The difference between SW_B^n and SW_B^p is

$$SW_B^n - SW_B^p = \frac{(1-s_b)(3s_b - 2(4-s_b)\tau)(16-13s_b+2(4-s_b)\tau)}{2(4-s_b)(8-5s_b)^2}.$$

When $\tau \geq 3s_b/(2(4-s_b))$, the constraint $p_a^A \leq p_a^B + \tau$ is not binding, and whether parallel imports are permitted or not does not matter. Therefore, $3s_b - 2(4-s_b)\tau$ is always positive, and then $SW_B^n - SW_B^p > 0$.

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