

Trademark Protection, Quality Improvement and Exports in Developing Countries

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Abstract

Trademarks indicate the inherent quality or other distinguishing features of products. Strong trademark protection can lower consumers' costs of searching for preferred quality characteristics. With weak trademark protection, firms in developing countries may not be willing to provide high quality products. With strong trademark protection, firms have an incentive to maintain or improve quality over time in order not to erode the value of their trademarks. By solving the theoretical model, we show that strengthened trademark protection in developing countries may induce domestic firms to become exporters and raise the quality of products on the export market. The welfare analyses show that strengthened trademark protection in developing countries benefits Southern customers and firms producing high quality products, but harms firms producing counterfeits and uninformed customers, if firm H charges low prices. Given firm H charges a high price, the strengthened trademark protection only helps firm H and informed customers in the South while leaves the others unaffected.

Key words: Trademark Protection, Quality, Exports

JEL Classification: L13; L24; L40; H25; D43

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1. Introduction

Export performance in international market plays an important role in economic development in developing countries. Therefore, firms in developing countries have incentives to improve their product quality to appeal to richer developed-country consumers. However, firms in developing countries are not willing to provide high quality products because of weak trademark protection in their home market.

Trademarks protect rights to use a particular distinctive mark or name to identify a product, service or company. It can be thought of as a standard of quality since it indicate the inherent quality or other distinguishing features of identified products. Maskus (2000) claims that trademark infringement is fairly common in developing countries, which affects both international brands and local enterprises.

China has been famous for infringement for many years. A group of domestic firms in China specialize in copying not only products of famous Chinese brands, such as Lining, the sportswear, and Maotai, the rice wine, but also those of big international brands, such as Chanel, Adidas, Lego, Barbie, and Hennessy, who shift part or all of their production to China via foreign direct investment or outsourcing. The infringement would affect the sales of the genuine products in China, as well as the exports from China of these genuine products to the global market. As a result, firms' decision on quality improvement of the genuine products would be different when facing different levels of infringement risks. Therefore, we are interested in answering the question whether the shift toward stronger trademark protection might change the quality of exports of firms in developing countries.

This paper draws from a strand of literature on counterfeit-product trade, reputation and quality upgrading in international trade. Grossman and Shapiro (1988a) analyze trade in both legitimate and counterfeit products. They find that the possibility of counterfeiting may raise or lower equilibrium quality and price depending upon the border inspection technology due to the following reasons. First, the presence of foreign counterfeits harms the home economy because of the harm to some home consumers when they unwittingly purchase counterfeit. Second, the possibility of counterfeiting also changes the rivalry among domestic manufactures because potential counterfeiting forces firms to adjust their price and quality so to protect themselves from imitators. Grossman and Shapiro (1988b) study the positive and normative effects of counterfeiting in markets where consumers are not deceived by forgeries. They find that consumers are willing to pay more for counterfeits than for generic merchandise of similar quality because they value the prestige associated with brand-name trademarks. As a result, counterfeits allow consumers to unbundle the status and quality attributes of the brand-name products, and alter the competition among oligopolistic trademark owners. Nicholson (2000) studies the impacts of trademark protection in dynamic, general equilibrium models of innovation and growth. He shows that stronger IPRs that reduce trademark infringement will raise the innovation rate in a global economy that experiences much infringement, but will lower the innovation rate if protection is already strong. Further, he finds that global consumer welfare achieves a maximum with an intermediate level of IPRs in the South. Similarly, Nicholson (2002) concludes that an intermediate level of protection

leads to welfare maximization because it allows for technology transfer to low-cost producers and consumers enjoy the quickest stream of innovations with the lowest possible prices.

This paper is also related to the literature on reputation and quality. Klein and Leffler (1981) demonstrate that in general a price with a positive profit margin is necessary for producers to deliver the promised quality level. This is due to the fact that a higher price increases long-run profit more for firms that provide the promised quality because such firms benefit from the repeat business of satisfied customers. Hence, at a sufficiently high price the profit from repeat business exceeds the profit from cheating on quality and firms will provide the promised quality level.

Rasmusen and Perri (2000) find that Klein and Leffler (1981) does not explain why high-quality firms would dissipate the rents they earn from quality-assuring price premia. In contrast they find that complete rent dissipation does occur if such firms have the same cost of producing low-quality items as other firms that are worse at producing high quality by assuming consumers do not know any firm's cost of producing quality goods. Rasmusen (2004) compares a technological model in which the advanced country is able to produce high quality more cheaply than the South and a reputation model in which the North and South have exactly the same technology, but Northern firms have reputations for high quality and Southern firms do not. He shows that there are differences in the implications of the two models due to the positive profits the Northern firms earn from the high-quality good in the reputation model. Accordingly a country benefits more if its firms produce the high-quality good

than the low-quality good.

Our paper also builds on the strand of literature on quality and international trade. Verhoogen (2007) conducts both theoretical and empirical study between expanding trade and rising wage inequality in developing countries. He shows that only the most productive plants in a developing country enter the export market and produce a better-quality good for export than for domestic market in order to appeal to consumers in richer developed countries. Therefore more-productive plants increase exports and produce a greater share of high-quality goods, while less-productive plants remain focused on the domestic market. As a result, an increase in the incentive for developing-country producers to export generates differential quality upgrading within industries.

The aforementioned papers provide important insights, yet previous literature has paid little attention to the link between trademark protection in developing countries and the quality of their exports. With strong trademark protection, firms have incentive to maintain or improve quality over time in order not to erode the value of their trademarks. Therefore strong trademark protection can increase the proportion of informed consumers in home country because it can lower consumers' costs of searching for preferred quality characteristics. In this paper by studying the impacts of trademark protection in developing countries on the quality of exports we have the following findings. When the southern trademark protection is strengthened by increasing the proportion of informed consumers in home country, firms in developing countries may enhance the quality of its products due to the increase in the

marginal benefit of quality improvement. It becomes an exporter when the equilibrium quality improvement is greater than the minimum requirement for quality improvement. A further increase in the level of trademark protection enhances the quality of the products on the exports market.

The paper proceeds as follows. In section 2 we develop a theoretical model and analyze the effects of stronger trademark protection in developing countries on the incentive for domestic firms to become exporters. Further we study the impacts of strengthened trademark protection in developing countries on the equilibrium quality of the Southern firms' exports. We provide the impacts of strengthened trademark protection in the South on the Southern welfare in section 3. We conclude in section 4.

2. The Model

We develop a model that allows us to study the effect of trademark protection on the quality of exports of developing countries.

2.1 Consumption

Suppose there are two countries, South and North. There is a mass M_S of statistically identical consumers in the developing country. Each consumer is assumed to buy one unit of a good. Each consumer has the indirect utility function $U = \theta_S q - p$. Here p is the price of the products, q is product quality and θ_S captures the consumer's willingness to pay for quality¹.

¹ See Grossman and Shapiro (1988), Tirole (1988), Verhoogen (2007)

There are a mass M_N of statistically identical consumers in the developed country. Each consumer is assumed to buy one unit of a good. Each consumer has the indirect utility function $U = \theta_N q - p + \varepsilon$. θ can be interpreted as the inverse of the marginal rate of substitution between income and quality, therefore wealthier consumers have a lower “marginal utility of income” or, equivalently, a higher θ .² Accordingly, we can assume that $\theta_N > \theta_S$ as the Northern consumers are wealthier and are more willing to pay for quality than Southern consumers. Following Verhoogen (2007), the random consumer-product-match term, ε , is assumed to be independent and identically distributed across consumers, with a double-exponential distribution, $F(\varepsilon) = \exp(-\exp(-\frac{\varepsilon}{\mu} + \gamma))$. This set-up is a version of standard multinomial-logit models of consumer demand for a market of monopolistic competition. The derived expected demand for each good is give by $x = \frac{M_N}{D} \exp(\frac{\theta q - p}{\mu})$, where $D = \sum_i \exp(\frac{\theta q - p}{\mu})$, i is the total number of firms in the market and μ is a parameter of the distribution of ε that captures the degree of differentiation between goods.³

2.2 Production

There are three types of firms in the Southern country: one H firm producing high quality products, one L firm producing low quality products and $N_S - 1$ firms producing counterfeits, where $N_S \geq 1$. Firm H is a trademark holder producing

² See Tirole (1988),

³ See Verhoogen (2007)

“brand-name” goods. The quality of Firm H’s product is $q(z)$, where $z \geq 0$ denote firm H’s expenditure on quality improvement. We also assume $\frac{dq}{dz} > 0$, $\frac{d^2q}{dz^2} < 0$ and $q(0) = q_0$. Firm L’s product has low quality q_0 . The quality of the counterfeits is also equal to q_0 . Let c_s denote the marginal cost of firm H, firm L and firms producing counterfeits. We make this assumption to capture the fact that the main cost difference between brand-name” goods and counterfeits mainly come from the difference in lump sum costs related to R&D and design instead of the marginal production costs. Our findings remain qualitatively intact if we relax this assumption.

Since the northern consumers have a higher willingness to pay for quality, firm H has incentive to export to the northern country. Let f denote the fixed cost to enter the export market.⁴ In the northern market there are a lot of firms with differentiated products and compete in a monopolistic competition environment. Here we assume that the northern market has the market structure of monopolistic competition for two reasons. First, since the northern consumers have higher willingness to pay for quality and consumers are perfectly informed about product quality (which will be discussed soon), there are a lot of potential entrants with differentiated products. Second, in this model we try to focus on the effect of imperfect information in domestic country on the quality competition among domestic firms, therefore put less emphasis on the reactions from firms in Northern market. For the same reasons we also assume that the southern consumers do not import from northern producers.

We also assume that the northern market and the southern market are segmented,

⁴ See Bernard, Redding and Schott (2007) and Verhoogen (2007)

and the firms can charge different prices in each market. The quality of products of the Southern firms sold in the southern market and those in the northern market are the same.

2.3 Information

Let λ denote the fraction of consumers who can tell the difference between brand-name products and counterfeits (informed consumers); $1 - \lambda$ denote the fraction of consumers who can not tell the difference between brand-name products and counterfeits (uninformed consumers). A country with strong trademark protection has a good mechanism to reveal information to other consumers if one consumer bought a counterfeit, which could lower consumers' costs of searching for preferred quality characteristics. Therefore stronger trademark protection in developing countries could shift the demarcation point along the distribution of consumers and it is reasonable for us to assume stronger trademark protection increases λ .⁵ We also assume that all Northern consumers are perfectly informed, meaning they can always tell the difference between brand-name products and counterfeits.

2.4 The stages of the game

We consider the following game. In the first stage, given the level of trademark protection in the southern country, firm H chooses its expenditure on quality improvement, which also determines its product quality. In the second stage, Firm H and L in the Southern country choose prices for their products simultaneously by

⁵ See Nicholson (2002)

Bertrand competition. Firms producing counterfeits will follow the price set by firm H. In the third stage, consumers in both markets make the purchase and the profits are realized.

2.5 Equilibrium

We solve the subgame equilibrium of the game by backward induction. First we analyze the informed consumer's willingness to pay for products of firm H given firm H's product quality is q . Price competition between firm H and firm L drives the price of products of firm L to c_s , therefore each informed consumer's utility from buying from firm L is $\theta_s q_0 - c_s$. In the equilibrium, the utility of buying from firm H and from buying L for informed consumers will be the same, therefore the informed consumer's willingness to pay for products of firm H with product quality q is $p_1 = \theta_s(q - q_0) + c_s$.

For the uninformed consumers, their utility from buying from firm L is the same as that of informed consumers. However, their expected utility from buying a product with firm H's trademark in the Southern market has been changed to $\frac{1}{N_s}q + \frac{N_s - 1}{N_s}q_0$ because they know there are $N_s - 1$ firms producing counterfeits.

In equilibrium, their expected utility from buying a product with firm H's trademark and from buying L for informed consumers will be the same. Therefore the informed consumer's willingness to pay for products of firm H is $p_2 = \frac{\theta_s}{N_s}(q - q_0) + c_s$. Thus we

have $p_2 < p_1$. Due to the fact that uninformed consumers expect a fraction of $\frac{N_s - 1}{N_s}$

counterfeits in the Southern market and they can not tell whether the products they buy are counterfeits, their willingness to pay for brand-name products is lower than that of informed consumers.

Since firm H can not tell whether a consumer is of informed type or uninformed type, firm H has two choices for price. It can set the price at $p_1 = \theta_s(q - q_0) + c_s$ and in equilibrium all informed consumers buy from firm H and all uninformed consumers buy from firm L. Or firm H can set the price at $p_2 = \frac{\theta_s}{N_s}(q - q_0) + c_s$. In equilibrium all informed consumers buy from firm H and a fraction $\frac{1}{N_s}$ of uninformed consumers will buy from firm H, while the other uninformed consumers will buy from firms producing counterfeits. At that price, any attempt for a firm producing counterfeits to capture more market share with a lower price would signal the poor quality of their products.

Given quality q , firm H's profit from the southern market setting price at p_1 is given by $\lambda M_s \theta_s (q - q_0)$. And its profit from the Southern market setting price at p_2 is given by $(\lambda + \frac{1 - \lambda}{N_s}) M_s \frac{\theta_s}{N_s} (q - q_0)$. Comparing these profits, we find that

firm H will set price at p_1 if $\lambda \geq \frac{1}{N_s^2 - N_s + 1}$ and set price at p_2 if $\lambda < \frac{1}{N_s^2 - N_s + 1}$.

This implies that firm H is more likely to set high price at p_1 when there is strong trademark protection and a large number of firms producing counterfeits in the Southern country. The economic intuition is as follows: (1) the fraction of informed consumers will be increased with strengthened trademark protection, which makes it

more likely for firm H to set high price; (2) the low price set by firm H is to attract the fraction $\frac{1}{N_s}$ of the uninformed consumers. When N_s is large, firm H's incentive to set low price to attract uninformed consumers is small. Hence firm H has more incentive to set high price when N_s is large.

Because of the existence of fixed cost to enter the export market, there is a minimum quality requirement q_{\min} for firms to enter the export market. We denote the corresponding expenditure on quality improvement as z_{\min} to achieve the minimum quality requirement. As the production profit of firm L is equal to zero, firm L cannot enter the export market. We also assume that firms producing counterfeits cannot enter the export market and sell in the northern market either because the North may block the imports from the firms from the South producing counterfeits.

2.5.1 Equilibrium if firm H sets price if $\lambda < \frac{1}{N_s^2 - N_s + 1}$

If $\lambda < \frac{1}{N_s^2 - N_s + 1}$, firm H sets price at p_2 and all informed consumers and a fraction $\frac{1}{N_s}$ of uninformed consumers in the Southern country will buy from firm H.

Firm H will also enter the export market if $z > z_{\min}$. As is standard in logit demand models, the mark-up is constant $p - c_s = \varphi$. Let π_{NL} denote firm H's profit from the export market when charging low price at p_2 . Then π_{NL} is given by

$$\pi_{NL} = \varphi \frac{M_N}{D} e^{\frac{\theta_N - c_s - \varphi}{\mu}} - f \quad (1).$$

Firm H enters the export market only when the profit from exporting is

non-negative. Hence we find that z_{\min} satisfies the following condition

$$e^{\frac{\theta_N q(z_{\min}) - c_S - \varphi}{\mu}} = \frac{Df}{\varphi M_N} \quad (2)$$

The above expression implies that the minimum requirement for quality improvement of firm H will be affected by such factors as the market size of the North, the willingness to pay of the northern consumers, the mark-up in the North, exporting cost of the southern country and the marginal production cost of firm H. This leads to the following lemma.

Lemma 1. The minimum requirement for quality improvement of firm H will be lower when market size of the North is large, the northern consumers have high willingness to pay, the mark-up in the northern market is high, the exporting cost of the southern country is low and firm H has low marginal production cost.

The above results can be explained as follows. The marginal benefit of quality improvement by firm H is high under the scenario when the market size of the North is large, the northern consumers have high willingness to pay, or the mark-up in the northern market is high. Therefore, the minimum requirement for quality improvement of firm H to cover the fixed exporting cost is low. When the exporting cost of the southern country is low, firms producing low quality products can also cover the exporting cost and enter the Northern market. Hence the minimum requirement for quality improvement is low. Firm H is more competitive in the

Northern market when it has low marginal production cost. In this case it can cover the exporting cost and enter the exporting market even it produces low quality product. Accordingly, the minimum requirement for quality improvement of firm H is low when it has low production cost.

We next determine the equilibrium choice of z by firm H in the first stage. Let's denote the optimal expenditure on quality improvement as z^* . Let π_{SL} and π_{SNL} denote firm H's total profit when it only sells in the southern market and sells in both northern market and southern market respectively when charging low price at p_2 . We begin by analyzing the case when firm H chooses not to enter the exports market.

The maximization problem for firm H at stage 1 is

$$\text{Max}_z \pi_{SL} = \text{Max}_z \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} (q - q_0) - z \quad (3)$$

We denote the first order condition of (3) as $g(z^*, \lambda)$. Then the equilibrium expenditure on quality improvement satisfies:

$$g(z^*, \lambda) = \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} \frac{dq}{dz} - 1 = 0 \quad (4)$$

Note that $z^* \leq z_{\min}$ in this scenario. Taking partial derivative of g with respect to z and λ respectively in equation (4), we have

$$\frac{\partial g}{\partial \lambda} = \left(1 - \frac{1}{N_s} \right) M_s \frac{\theta_s}{N_s} \frac{dq}{dz} > 0 \quad (5)$$

$$\frac{\partial g}{\partial z} = \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} \frac{d^2 q}{dz^2} < 0 \quad (6)$$

Thus, we get

$$\frac{dz^*}{d\lambda} = -\frac{\frac{\partial g}{\partial \lambda}}{\frac{\partial g}{\partial z^*}} > 0 \quad (7)$$

Hence, we have the following lemma.

Lemma 2. *When trademark protection is weak in the South ($\lambda < \frac{1}{N_s^2 - N_s + 1}$), firm H charges low price. It only sells in the South when the equilibrium quality improvement is less than z_{\min} . An increase in the level of trademark protection enhances the quality of the product of firm H.*

If firm H chooses to enter the exports market given it charges low price in stage 2, then the maximization problem for firm H in stage 1 is

$$\text{Max}_z \pi_{SNL} = \text{Max}_z \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} (q - q_0) + \varphi \frac{M_N}{D} e^{\frac{\theta_N - c_s - \varphi}{\mu}} - f - z \quad (8)$$

Note that $z^* \geq z_{\min}$ in this case. We denote the first order condition of (8) as $h(z^*, \lambda)$. As is standard in monopolistic competition models, we assume that each firm thinks of itself as small relative to the market as a whole, and treats the aggregate quantity in the denominator of the expression for output, D, as unaffected by its own choice.⁶ The equilibrium expenditure on quality improvement satisfies:

$$h(z^*, \lambda) = \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} \frac{dq}{dz} + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N - c_s - \varphi}{\mu}} \frac{dq}{dz} - 1 = 0 \quad (9).$$

Expression (9) may be analyzed to determine the impact of strengthened Southern

⁶ See Verhoogen (2007).

trademark protection on the equilibrium expenditure on quality improvement of firm

H. Taking second-order derivatives shows that

$$\frac{dz^*}{d\lambda} = -\frac{\frac{\partial h}{\partial \lambda}}{\frac{\partial h}{\partial z^*}} > 0 \quad (10)$$

As shown in (10), the equilibrium expenditure on quality improvement of firm H is positively related to the strength of Southern trademark protection. We thus have the following proposition.

Proposition 1: *When the southern trademark protection is weak, firm H charges low price. It sells in both southern market and northern market if the equilibrium quality improvement is greater than z_{\min} . An increase in the level of trademark protection enhances the equilibrium quality of the product of firm H.*

The economic intuition is as follows. When trademark protection is weak in the South, the fraction of the uninformed consumers is large. Hence firm H has to set low price to attract the part of the uninformed consumers. It can cover the exporting cost and enter the Northern market when the quality improvement is greater than z_{\min} . An increase in the level of trademark protection in the South increases the fraction of informed consumers, which in turn increases the marginal benefit of quality improvement by firm H. Accordingly the equilibrium quality of the product of firm H will be increased under strengthened trademark protection.

2.5.2 Equilibrium if firm H sets price if $\lambda \geq \frac{1}{N_s^2 - N_s + 1}$

If $\lambda \geq \frac{1}{N_s^2 - N_s + 1}$, firm H will set price at p_1 and only informed consumers

will buy from firm H. Let π_{SH} and π_{SNH} denote firm H's profit when it only sells in the southern market and profit from selling in both Southern market and Northern market charging high price at p_1 . If firm H chooses not to enter the northern market, its maximization problem is

$$\underset{z}{\text{Max}} \pi_{SH} = \underset{z}{\text{Max}} \lambda M_s \theta_s (q - q_0) - z \quad (11)$$

We denote the first order condition of (14) as $l(z^*, \lambda)$. Then the equilibrium expenditure on quality improvement satisfies:

$$l(z^*, \lambda) = \lambda M_s \theta_s \frac{dq}{dz} - 1 = 0 \quad (12)$$

Taking partial derivative of l with respect to z and λ respectively in equation, we have

$$\frac{\partial l}{\partial \lambda} = M_s \frac{\theta_s}{N_s} \frac{dq}{dz} > 0 \quad (13)$$

$$\frac{\partial l}{\partial z} = \lambda M_s \theta_s \frac{d^2 q}{dz^2} < 0 \quad (14)$$

Thus, we get

$$\frac{dz^*}{d\lambda} = - \frac{\frac{\partial l}{\partial \lambda}}{\frac{\partial l}{\partial z}} > 0$$

The above discussion is summarized in the following lemma.

Lemma 3. *When the southern trademark protection is strong, firm H charges high price. It sells only in the southern market if the equilibrium quality improvement is lower than z_{\min} . An increase in the level of trademark protection enhances the quality of the product of firm H.*

If firm H chooses to enter the exports market given it charges high price in stage 2, then the maximization problem for firm H in stage 1 is

$$\underset{z}{\text{Max}} \pi_{SNH} = \underset{z}{\text{Max}} \lambda M_s \theta_s (q - q_0) + \varphi \frac{M_N}{D} e^{\frac{\theta_N - c_s - \varphi}{\mu}} - f - z \quad (15)$$

We denote the first order condition of (15) as $k(z^*, \lambda)$. Then the equilibrium expenditure on quality improvement satisfies:

$$k(z^*, \lambda) = \lambda M_s \theta_s \frac{dq}{dz} + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \frac{dq}{dz} - 1 = 0 \quad (16)$$

As shown in appendix B, we have

$$\frac{dz^*}{d\lambda} = - \frac{\frac{\partial g}{\partial \lambda}}{\frac{\partial g}{\partial z^*}} > 0 \quad (17)$$

Hence, we have the following proposition.

Proposition 2: *When the southern trademark protection is strengthened*

($\lambda > \frac{1}{N_s^2 - N_s + 1}$), firm H switches from low price to high price. It becomes an

exporter when the equilibrium quality improvement is greater than z_{\min} . A further increase in the level of trademark protection enhances the quality of the exports of the southern firm.

The above results can be explained as follows. The fraction of informed consumers will be increased with strengthened trademark protection in the South. Therefore firm H has lower incentive to set low price to attract uninformed consumers. Accordingly it will switch from low price to high price and only attract informed consumers. Due to the fact that firm H has to cover a fixed exporting cost f under exporting, firm H will choose to enter the Northern market only when its quality improvement is greater than the threshold quality improvement z_{\min} . The further increase in trademark protection in the South increases the fraction of informed consumers in the South, which enhances the marginal benefit of quality improvement by firm H. Therefore the equilibrium quality of its product of will be increased accordingly.

3. A Note on Welfare Impacts of Strengthened Southern Trademark

Protection

We next study the welfare implications of strengthened trademark protection in the South. The Southern welfare is defined as the sum of firm H's profit, firm L's profit, total profits of $N_S - 1$ firms producing counterfeits, the consumer surplus of

informed consumers and the consumers surplus of uninformed consumers in the South.

We first discuss the change in Southern welfare under strengthened Southern trademark protection when $\lambda < \frac{1}{N_s^2 - N_s + 1}$ and firm H charges low price. In this

scenario all informed consumers a fraction $\frac{1}{N_s}$ of uninformed consumers will buy

from firm H, while a fraction $\frac{N_s - 1}{N_s}$ of uninformed consumers will buy from firms

producing counterfeits. As demonstrated in section 2.5.1, the equilibrium quality improvement and profit of firm H are increased with strengthened Southern trademark protection. Firm L's profit remains zero with strengthened trademark protection in the South. As demonstrated in Appendix C, the total profit of firms producing counterfeits will be reduced under strengthened Southern trademark protection.

As illustrated in Appendix D, the total Southern consumer surplus and the consumer surplus of the informed consumers will be increased while the consumer surplus of uninformed consumers will be decreased under strengthened Southern trademark protection.

Hence we can summarize the welfare implications of strengthened Southern trademark protection when firm H charges low price as follows. While the total profit of the firms producing counterfeits and consumer surplus of uninformed consumers decrease, the total Southern consumer surplus, the consumer surplus of the informed consumers as well as the profit of firm producing high quality products rises.

We next discuss the change in Southern welfare under strengthened Southern

trademark protection when $\lambda > \frac{1}{N_s^2 - N_s + 1}$ and firm H charges high price.

When $\lambda \geq \frac{1}{N_s^2 - N_s + 1}$, firm H will set high and only informed consumers will buy

from firm H while all uninformed consumers buy from firm H. As shown in section 2.5.2, the equilibrium quality improvement and profit of firm H rise with strengthened Southern trademark protection. As mentioned in section 2.5, price competition between firm H and firm L drives the price of products of firm L to c_s , thus the total profit of firm L is equal to zero. As no consumers buy from firms producing counterfeits, the total profit of firms producing counterfeits is equal to zero as well. As demonstrated in Appendix D, under strengthened Southern trademark protection Southern consumer surplus of informed consumers will be increased, Southern consumer surplus of uninformed consumers will be decreased while total Southern consumer surplus has no change.

In summary, under strengthened Southern trademark protection given firm H charges low price, the profit of firm H as well as Southern consumer surplus of informed consumers will be increased, Southern consumer surplus of uninformed consumers will be decreased while total Southern consumer surplus, the profit of firm L and the total profit of firms producing counterfeits has no change.

4. Conclusion

Trademarks indicate the inherent quality or other distinguishing features of identified products. Strong trademark protection can lower consumers' costs of

searching for preferred quality characteristics. With weak trademark protection, firms in developing countries may not be willing to provide high quality products. With strong trademark protection, firms have an incentive to maintain or improve quality over time in order not to erode the value of their trademarks. By solving the theoretical model, we show that strengthened trademark protection in developing countries may induce domestic firms to become exporters and raise the quality of products on the export market. The theoretical examination provides insights into the implications of recent international agreements on intellectual property rights.

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Appendix A: Proof of proposition 1.

From equation (9) in the text, we have

$$h(z^*, \lambda) = \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] M_s \frac{\theta_s}{N_s} \frac{dq}{dz} + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \frac{dq}{dz} - 1 = 0 \quad (\text{A1})$$

Expression (A1) may be analyzed to determine the impact of trademark protection policy on the quality improvement.

We assume that the second-order condition for maximization is satisfied, i.e.,

$$\frac{\partial h}{\partial z} = \left\{ \left[\lambda + \frac{1}{N_s} (1 - \lambda) \right] \frac{M_s \theta_s}{N_s} + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \right\} \frac{d^2 q}{dz^2} + \frac{\varphi M_N \theta_N^2}{D \mu^2} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \left(\frac{dq}{dz} \right)^2 < 0 \quad (\text{A2})$$

Taking partial derivative of $h(z^*, \lambda)$ with respect to λ , we have

$$\frac{\partial h}{\partial \lambda} = \left(1 - \frac{1}{N_s} \right) M_s \frac{\theta_s}{N_s} \frac{dq}{dz} > 0 \quad (\text{A3})$$

Thus, we get

$$\frac{dz^*}{d\lambda} = - \frac{\frac{\partial h}{\partial \lambda}}{\frac{\partial h}{\partial z^*}} > 0 \quad (\text{A4})$$

Appendix B: Proof of proposition 2.

From equation (16) in the text, we have

$$k(z^*, \lambda) = \lambda M_s \theta_s \frac{dq}{dz} + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \frac{dq}{dz} - 1 = 0 \quad (\text{A5})$$

We assume that the second-order condition for maximization is satisfied, i.e.,

$$\frac{\partial k}{\partial z} = \left(\lambda M_s \theta_s + \frac{\varphi \theta_N}{\mu} \frac{M_N}{D} e^{\frac{\theta_N q - c_s - \varphi}{\mu}} \right) \frac{d^2 q}{dz^2} + \frac{\varphi M_N \theta_N^2}{D \mu^2} \left(\frac{dq}{dz} \right)^2 < 0 \quad (\text{A6})$$

Taking partial derivative of k with respect to λ , we have

$$\frac{\partial k}{\partial \lambda} = M_s \frac{\theta_s}{N_s} \frac{dq}{dz} > 0 \quad (\text{A7})$$

Thus, we get

$$\frac{dz^*}{d\lambda} = -\frac{\frac{\partial g}{\partial \lambda}}{\frac{\partial g}{\partial z^*}} > 0 \quad (\text{A8})$$

Appendix C: Welfare Analysis when firm H charges low price.

Let π_{CL} denote the total profits of $N_s - 1$ firms producing counterfeits when firm H charges low price.

Then we have

$$\pi_{CL} = \frac{N_s - 1}{N_s} (1 - \lambda) M_s \frac{\theta_s}{N_s} (q - q_0) \quad (\text{A9})$$

It can be shown that with strengthened Southern trademark protection the total profit of firms producing counterfeits will be reduced.

Let CS_L , CS_{IL} , CS_{UL} represent total Southern consumer surplus, Southern consumer surplus of informed consumers and Southern consumer surplus of uninformed consumers respectively. Then we have

$$\begin{aligned} CS_L &= CS_{IL} + CS_{UL} \\ &= [\theta_s q - \frac{\theta_s}{N_s} (q - q_0) - c_s] \lambda M_s + (1 - \lambda) \frac{M_s}{N_s} [\theta_s q - \frac{\theta_s}{N_s} (q - q_0) - c_s] \\ &\quad + (1 - \lambda) \frac{N_s - 1}{N_s} M_s [\theta_s q_0 - \frac{\theta_s}{N_s} (q - q_0) - c_s] \end{aligned} \quad (\text{A10})$$

Hence we have

$$\frac{dCS_L}{d\lambda} = \frac{M_s}{N_s} (N_s - 1) \theta_s (q - q_0) > 0 \quad (\text{A11})$$

It can also be shown that

$$\frac{dCS_{IL}}{d\lambda} > 0 \quad (\text{A12})$$

$$\frac{dCS_{UL}}{d\lambda} > 0 \quad (\text{A13})$$

Therefore, under strengthened Southern trademark protection, the total Southern consumer surplus and the consumer surplus of the informed consumers will be increased while the consumer surplus of uninformed consumers will be decreased.

Appendix D: Welfare Analysis when firm H charges high price.

When $\lambda > \frac{1}{N_s^2 - N_s + 1}$ and firm H charges high price, all informed consumers buy from firm H, all uninformed consumers buy from firm L. Let CS_H , CS_{IH} , CS_{UH} represent total Southern consumer surplus, Southern consumer surplus of informed consumers and Southern consumer surplus of uninformed consumers respectively. Then we have

$$\begin{aligned} CS_H &= CS_{IH} + CS_{UH} \\ &= [\theta_s q - \theta_s (q - q_0) - c_s] \lambda M_s + (1 - \lambda) M_s (\theta_s q_0 - c_s) \quad (\text{A14}) \\ &= M_s (\theta_s q_0 - c_s) \end{aligned}$$

From the above expression, it can be shown that under strengthened Southern trademark protection Southern consumer surplus of informed consumers will be increased, Southern consumer surplus of uninformed consumers will be decreased while total Southern consumer surplus has no change.