Protective Effect Analysis on Technical Barriers to Trade

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Abstract

Technical Barrier to Trade is widespread and has increasing impact on Chinese export enterprises. It has both trade promotion and trade restriction. In this paper we investigate the interrelationships between technical barriers, enterprise profit and social welfare. Technical regulations raise the quality of both the domestic and foreign enterprises. The quality difference is narrowed. Also, reasonable technical barriers have positive effects on social welfare in the long term. China should strengthen independent innovation to leap technical barriers to trade.

Key words: Technical Barrier to Trade; quality differentiation; welfare

1. Introduction

The impact of technical measures on international trade is at the forefront of policy discussions. Governments issue regulation, standards and conformity assessment procedures in order to pursue a variety of goals related to social welfare. Yet technical measures may also affect international trade. They may, either purposefully or inadvertently, be used to impede trade. All members of WTO are bound by an Agreement on Technical Barriers to Trade. The term 'Technical Barriers to Trade (TBT)' is used to describe a government regulation or a voluntary standard with implicitly restrict or disadvantages the import of goods from another country, despite having a seemingly legitimate purpose to, for instance, regulate the health and safety implications of a particular product. TBT agreement tries to ensure that technical measures do not create unnecessary obstacles to trade. However, mandatory regulations imposed by the government of import country can discriminate against foreign producers and produce serious distortions in international market.

The trade impeding effects of technical barriers are especially worrisome for developing countries. In recent years, China export enterprises have frequently come across technical barriers. The Science and Technology Department of China's Ministry of Commerce reported that 35.16 percent of Chinese export enterprises and 39 percent of export commodities ran into overseas technical barriers with estimated total loss of 622.59

billion dollars in 2011. TBT has become the largest export obstacle factor that is only subordinate to the exchange rate. The latest investigation into the impact of technical barriers on Chinese export enterprises was conducted in February 2012. The General Administration of Quality, Inspection and Quarantine of the People's Republic of China (AQSIQ) investigated 2600 export enterprises across the country. According to the survey, China's five sectors, namely Machinery & Electrical products (34.2%), Metal & Chemical (20.4%), Agricultural & Food sector (14.7%), Toys & Furniture (13.8%), Textiles & Clothing (8.9%), have encountered technical barrier restriction from

other countries（Figure 1）. The competitive advantages of these industries are low cost structures and prices. But they remain as a technological follower for quite a long time because of lacking human and capital resources necessary to satisfy technical measures. The negative impact comes mainly from the three largest trade partners of China: the United States (34%), the European Union (31.1%) and Japan (13.8%). These three places are the origins of TBT. A large number of Chinese products, for technical reasons, are rejected import last year (Table 1).

Table1. Chinese export products are rejected

Country /Region	Recall times	Relate to China	Proportion
USA/CPSC	310	188	60.6%
EU/RAPEX	1568	829	52.87%
Japan /MHLW	770	271	22.6%

We strongly urged the developed partners to reduce technical barriers. Because some export commodities are safe and meet the standards imposed. The TBT exceeding reasonable scale restrict the normal import and hinder the development of international trade. At the same time, we are keenly aware that TBT will have a beneficial effect on low technical level country. Reasonable technical regulations can accelerate the enterprise technology advancement and improve the quality of export products. We should correctly understand the dual role of technical barriers. If a country is able to strengthen independent innovation to leap TBT, then the overall technology level and social welfare are increased.

We established a model of a developing country firm facing with developed country's reasonable technical barriers. The main result of this paper is that imposing reasonable technical barriers raise the quality of both the domestic and foreign enterprises. Also, the quality difference is narrowed. Technical barriers may have
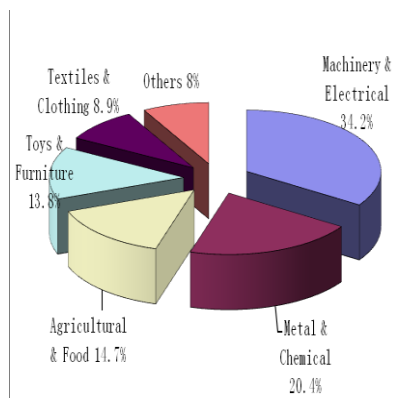
positive effects on social welfare in the long term.

Figure 1: Sectors encountered TBT in 2011
Source: questionnaire by AQSIQ

Notation: CPSC: Consumer Product Safety Commission; RAPEX: The Rapid Alert System for Non-Food Products; MHLW: Ministry of Health, Labor and Welfare. *Source: Chinese technical trade measures in the annual report 2011.*

2. The Basic model

Imagine there are two firms, a firm H located in the developed country and firm L located in the developing country. Each firm produces a quality differentiated product. Firm H supplies a product with quality s_h and price p_h while firm L supplies a product with quality s_l and price p_l, $p_h > p_l$ and $s_h > s_l$. Firm L can export low-quality products to the developed country because of its low cost and price advantage. Each of them faces the same costs of developing the technology. $c(s)$ and $c'(s)$ are assumed to be increasing functions for all feasible qualities s. $c'(s) > 0$ and $c''(s) > 0$. There is a unit mass of consumers in the international market whose tastes are different from one another by a parameter θ, θ ∈ [0, 1]. We assume that consumer maximizes the following indirect utility function, a

common assumption in the literature of Boom (1995):

$\mu_{\theta,i} = \theta s_i - p_i$, if the consumer purchases the quality s_i at the price p_i, 0 if the consumer does not purchases, $\forall_i \in (l,h)$.

A consumer needs to satisfy the following constraint and incentive compatibility constraint：

$(IR_1) \quad \theta_l s_l - p_l \geq 0 \qquad (1)$

$(IR_2) \quad \theta_h s_h - p_h \geq 0 \qquad (2)$

$(IC_1) \quad \theta_l s_l - p_l \geq \theta_h s_h - p_h \qquad (3)$

$(IC_2) \quad \theta_h s_h - p_h \geq \theta_l s_l - p_l \qquad (4)$

We have:

$$\theta_1 = \frac{p_h - p_l}{s_h - s_l}, \qquad \theta_2 = \frac{p_l}{s_l}$$

Consumers with $\theta = \theta_1$ will be indifferent between purchasing the high quality product or the low quality product; Consumers with $\theta = \theta_2$ will be indifferent between purchasing the low quality product and no purchasing at all. So Consumer demand functions are given by:

$$\begin{cases} D_L = \theta_1 - \theta_2 \\ D_H = 1 - \theta_1 \end{cases}$$

Defining

$$\theta_3 = \frac{p_h}{s_h}, \qquad r = \frac{s_h}{s_l}$$

We have

$$\theta_1 = \frac{r\theta_3 - \theta_2}{r - 1} \qquad (5)$$

2.1 Importing country without technical barriers

In the absence of government intervention, firms usually make their decisions about product quality and price in two stages. In stage 1: each firm chooses the quality level at the same time. In stage 2: after observing their rival's quality level, they make simultaneous decisions on prices. A firm can usually change its price fairly easily, while a change in product quality often takes a much longer time. When the market is in equilibrium, the quality of firm H is s_h^* and the quality of firm L is s_l^*. Both of them have no motivation to change quality. If one firm wants to raise or lower the quality, then the changed firm will deviate from the equilibrium state and will be damaged. So the low-quality firm will not take the initiative to improve the quality and produce according to s_l^*.

The solution to such two-stage game proceeds by backward induction starting with the second stage. In the price game, each firm maximizes its revenue with respect to its price, taking its quality and its rival's price and quality as given. That is:

$$MaxR_l(p_l, p_h) = p_l(\theta_1 - \theta_2) \qquad (6)$$

$$MaxR_h(p_l, p_h) = p_h(1 - \theta_1) \qquad (7)$$

Using the first-order conditions for the above revenue maximization, we get the following solutions:

$$\theta_1 = \frac{2r - 1}{4r - 1}, \ \theta_2 = \frac{r - 1}{4r - 1},$$

$$\theta_3 = \frac{2(r - 1)}{4r - 1}$$

Then

$$R_l(s_l, s_h) = \frac{r(r - 1)}{(4r - 1)^2} s_l \qquad (8)$$

$$R_h(s_l, s_h) = \frac{4r(r - 1)}{(4r - 1)^2} s_h \qquad (9)$$

We now can consider the quality competition. In the first stage, each firm chooses

its quality to maximize its profit taking the other firm's quality as given

$$\begin{cases} Max\pi_l(s_l,s_h) = \underset{S_l}{Max}[R_l(s_l,s_h)-c(s_l)] & (10) \\ Max\pi_h(s_l,s_h) = \underset{S_h}{Max}[R_h(s_l,s_h)-c(s_h)] & (11) \end{cases}$$

The first-order conditions for the low- and high-quality firms are:

$$g(r)-c'(s_l)=0 \qquad (12a)$$
$$f(r)-c'(s_h)=0 \qquad (12b)$$

Where

$$g(r)=dR_l(s_l,s_q)/ds_l = r^2(4r-7)/(4r-1)^3 \qquad (13a)$$

$$f(r)=dR_h(s_l,s_q)/ds_h = 4r(4r^2-3r+2)/(4r-1)^3 \qquad (13b)$$

We have

$$f'(r) = -\frac{8(5r+1)}{(4r-1)^4}$$

According to the total differential equation,

$$f(r)=f'_r dr = f'(rs_h ds_h + rs_l ds_l) \qquad (14)$$

$$F'(s_h)=F''(s_h)ds_h \qquad (15)$$

Taking total differentiation with respect to (12b), we get

$$\frac{ds_h}{ds_l} = \frac{\dfrac{8(5r+1)}{(4r-1)^4}s_h}{\dfrac{8(5r+1)}{(4r-1)^4}s_l + s_l F''(s_h)} > 0 \qquad (16)$$

Conclusion 1: In the absence of government intervention, low-quality firm generally will not take the initiative to improve the quality. For any violation of the Nash equilibrium behavior is not the best choice.

If one firm improves the quality will lead to the other firm rise the quality subsequently. Because after the firm L has improved the quality, the low-quality product will become more similar to the high-quality product and the competition between them will increase. To ease the competition, the firm H also increases its quality so as to improve consumer surplus. If on the other hand, the firm H increases its quality, the consequence will be an increase of differentiation and thus reduced competition. This opens a window of opportunity for the firm L to move up the quality scale and increase its profit by charging a higher price.

2.2 Importing country with reasonable technical barriers

If the developed country sets up high quality regulation, then the situation changes from Nash equilibrium point M without government intervention to Stackelberg equilibrium point M. firms usually make their decisions about product quality and price in three stages. In stage 1: the firms chose the quality level at the same time. In stage 2: after knowing the firm L's quality level, firm H make simultaneous decisions on s_h. In stage 3: both of them make simultaneous decisions on prices. In a Stackelberg game firm L acts as a leader by pre-committing itself to an action. If the pre-commitment is credible, the other will adjust its behavior to the announced action. The leader can calculate its optimal actions taking into account the impact of its actions on the rival and thus attain higher profits. So the optimal quality of leader is determined by the point of tangency between reaction line of follower and profit line of leader (Figure 2). The profit of N is definitely better than point M. When foreign country issues high quality regulation, the profit of firm L increases, while the profit of firm L decreases.

Conclusion 2: Technical barriers set up by foreign government makes low-quality firm be in a leader status in Stackelberg equilibrium. So the improving quality increased its profit and welfare of developing country.
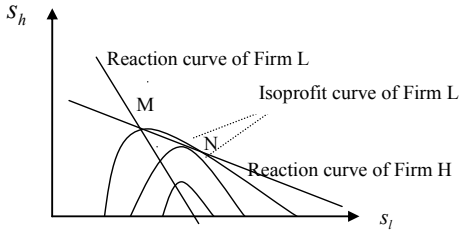
Figure 2 Reaction cure of firm

The welfare of the developed country (W) is the summation of consumers' surplus and the developed firm's profit (π_h). The welfare of the developing country is the same as the developing firm's profit (π_l).

Since the net gains to the consumers' surplus can more than compensate for the net loss in firm's profits, the developed country as a whole will benefit from the high quality. The government has incentive to set technical barriers.

$$W_h = CS + \pi_h$$

$$= [\int_{\theta_2}^{\theta_1} \theta s_l d\theta - p_l D_l + \int_{\theta_1}^{1} \theta s_h d\theta - p_h D_h] + p_h D_h - c(s_h)$$

$$= \frac{r^2 s_l}{2(4r-1)^2} + \frac{(6r^2 - 2r)s_h}{(4r-1)^2} - c(s_h) \quad (17)$$

$$\frac{dW_h}{ds_l} = \frac{\partial W_h}{\partial s_l} + \frac{\partial W_h}{\partial s_h}\frac{ds_h}{ds_l} = \frac{3r^2}{2(4r-1)^2} + \frac{(8r^2-6r-5)}{(4r-1)^3}\cdot\frac{ds_h}{ds_l} > 0 \quad (18)$$

$$\frac{dW_l}{ds_l} = \frac{d\pi_l}{ds_l} = \frac{\partial \pi_l}{\partial s_l} + \frac{\partial \pi_l}{\partial s_h}\frac{ds_h}{ds_l} = \frac{2r+1}{(4r-1)^3}\cdot\frac{ds_h}{ds_l} > 0 \quad (19)$$

$$\frac{d\pi_h}{ds_l} = -\frac{4r^2(2r+1)}{(4r-1)^3}\cdot\frac{ds_h}{ds_l} < 0 \quad (20)$$

Conclusion 3: *The developed country imposed a technical barrier at a reasonable level that is much higher than the original quality level of imports, will (1)reduce the profits of firm H，(2) increase the welfare of the developed country；(3)increase the profits of firm L，(4) increase the welfare*

of the developing country. It would be beneficial to both of them.

3. Suggestions

Facing the increasing technical barrier limitation, China should actively establish and perfect various measures so as to secure the position of our enterprises in the international competition. Several suggestions to both government and enterprises are put forward with consideration of China.

3.1 Policy recommendations for government

Firstly, Chinese government should strengthen the information network construction. Foreign technique rules and standards are various and always changing. Therefore, it is necessary to trace the changing orientations of those regulations and to obtain information in time so as to deal with those technical barriers. The government can adjust early warning grade to remind domestic enterprises of noticing the change and to guide domestic companies' risk evasion.

Secondly, Chinese government should encourage domestic enterprises to actively adopt international standards and advanced standards to implement standardization.

Lastly, Chinese government should speed up the process of personnel training and level up the whole quality and working ability of our work staff.

3.2 Policy recommendations for export enterprises

The product quality is the key for existence and development of enterprise. Chinese enterprises have to invest more on science and technology and realize technical innovation to make structure of export products satisfy demand of the consumers of the developed countries.

Export enterprise should formulate the sustainable development strategy. It re-

quires enterprises pay attention to environmental protection and energy saving, establishing cleaner production mechanism.

Besides, Domestic companies should be encouraged to adopt advanced international standards, acquire international certifications and play active part in the decree and revision of international market.

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