行政院國家科學委員會專題研究計畫　成果報告

出口補貼，成本差異與產品品質

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行政院國家科學委員會專題研究計畫成果報告

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Export Subsidies, Cost Differential and Product Quality

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一、中文摘要

本文發展一個垂直產品差異化模型，分別觀察在 Cournot 數量競爭及 Bertrand 價格競爭下，不同貿易出口國之間最適貿易政策與產品品質的相互關係。我們可以使用這個品質模型去解釋為什麼高生產成本的日本傾向給予它的出口商較高的補貼。這個案例是 de Meza(1986)及出口補貼策略理論所無法解釋的。

Abstract

This paper presents a vertical product differentiation model to examine the relationship between optimal trade policies and product qualities for different export countries under Cournot quantity competition as well as Bertrand price competition. We can also use this quality model to explain why Japan as a high production-cost country tends to offer high subsidies. This is a case that cannot be explained by de Meza (1986) and the strategic theory of export subsidies.

二、緣由與目的

The purpose of this paper is to present a vertical product differentiation model to examine the relationship between optimal trade policies and product qualities for different export countries under Cournot quantity competition as well as Bertrand price competition. We shall also use this quality model to explain why Japan as a high production-cost country tends to offer high subsidies. This is a case that cannot be explained by de Meza (1986) and the strategic theory of export subsidies.

三、結果與討論

Consider a duopoly model in which a single home firm, firm 1, and a foreign firm, firm 2, produce vertically differentiated products and engage in Cournot quantity or Bertrand price competition in a third-country market. Assume that each consumer in the third market can buy at most one unit of the vertically differentiated product and that the utility function of a representative consumer is specified as follows:

$$U = \begin{cases} \theta q_i - p_i \quad (i = 1,2) & \text{if the consumer buys a unit of the } i\text{th product with quality } q_i \text{ at price } p_i \\ 0 & \text{If the consumer does not buy} \end{cases}$$

(1)

where U is separable in quality and price, and should be thought of as the surplus derived from the consumption of the product; q_i $(i = 1,2)$ is a positive real number that describes the quality of the good i; θ is a positive real number serving as a taste parameter which is uniformly distributed in the interval $[\underline{\theta}, \bar{\theta}]$ with unit density.

For simplicity, consider qualities q_1 and q_2 to be fixed and assume that firm 1 is a high quality good producer and firm 2 a low quality producer so that $q_1 > q_2$. The consumer indifferent between buying good 1 and good 2 has a taste parameter θ_1 such that $\theta_1 q_1 - p_1 = \theta_1 q_2 - p_2$ or equivalently $\theta_1 = \frac{p_1 - p_2}{q_1 - q_2}$. On the other hand, the consumer indifferent between buying the low quality good and not buying at all has the taste parameter θ_2 such that $\theta_2 q_2 - p_2 = 0$ or equivalently $\theta_2 = \frac{p_2}{q_2}$. Given the above setting, the demand functions facing the high and low quality firms are given, respectively, by:

$$x_1(p_1, p_2) = \bar{\theta} - \theta_1 = \bar{\theta} - \frac{p_1 - p_2}{q_1 - q_2} = \frac{1}{A}(\bar{\theta}A - p_1 + p_2) \qquad (2)$$

$$x_2(p_1, p_2) = \theta_1 - \theta_2 = \frac{p_1 - p_2}{q_1 - q_2} - \frac{p_2}{q_2} = \frac{1}{Aq_2}(q_2 p_1 - q_1 p_2) \qquad (3)$$

where $A \equiv q_1 - q_2 > 0$.

From (2) and (3), the inverse demand functions are derivable as follows:

$$p_1(x_1, x_2) = q_1(\bar{\theta} - x_1) - q_2 x_2 \qquad (4)$$

$$p_2(x_1, x_2) = q_2(\bar{\theta} - x_1 - x_2) \qquad (5)$$

These demand functions will be used to derive market equilibrium for Cournot quantity and Bertrand price competition.

Under Cournot Competition, the profit functions of the two firms are given by:

$$\pi^1(x_1, x_2) = p_1 x_1 - c_1 x_1 + s_1 x_1 = [q_1(\bar{\theta} - x_1) - q_2 x_2] x_1 - c_1 x_1 + s_1 x_1 \qquad (6)$$

$$\pi^2(x_1, x_2) = p_2 x_2 - c_2 x_2 + s_2 x_2 = [q_2(\bar{\theta} - x_1 - x_2)] x_2 - c_2 x_2 + s_2 x_2 \qquad (7)$$

where c_i is the constant marginal cost and s_i is the per unit subsidy.

The Cournot equilibrium must satisfy:

$$\pi_1^1 = p_1 - q_1 x_1 - c_1 - s_1 = 0 \qquad (8)$$

$$\pi_2^2 = p_2 - q_2 x_2 - c_2 - s_2 = 0 \qquad (9)$$

Assuming the second-order and stability conditions to be met, we can solve simultaneously for the equilibrium outputs as

$x_1 = x_1(s_1,s_2,c_1,c_2,q_1,q_2)$ and $x_2 = x_2(s_1,s_2,c_1,c_2,q_1,q_2)$.

Turning to the first stage game, the welfare levels of the domestic and foreign countries are defined as:

$$W_1 = \pi_1 - s_1 x_1 \qquad (10)$$

$$W_2 = \pi_2 - s_2 x_2 \qquad (11)$$

Then we have:

$$s_1 - s_2 = \frac{q_2}{2q_1 - q_2}[(p_1 - c_1) - (p_2 - c_2)] \qquad (12)$$

To relate our result to de Meza's, we let $(s_1 - s_2) = 0$ in equation (12) to figure out the $(s_1 - s_2) = 0$ curve on the space of (c_1, q_1) as shown in Figure 1. Since $s_1 - s_2 = 0$, it follows from (12) that $(q_1 x_1 - q_2 x_2) = 0$. By noting that $x_1 = x_1(c_1, q_1)$ and $x_2 = x_2(c_1, q_1)$, we differentiate totally this relation with respect to c_1 and q_1 to yield:

$$\frac{dq_1}{dc_1} = \frac{2q_1q_2 + q_2^2}{\bar{\theta}(2q_1q_2 + q_2^2) - 3x_1q_2^2} > 0 \qquad (13)$$

Equation (13) indicates that the $(s_1 - s_2) = 0$ curve is positively sloped, passing through the point (c_2^*, q_2^*). Any point locating below the curve has $s_1 < s_2$, indicating that de Meza's principle that the country with the lowest costs will set the highest subsidies holds true. However, any point locating above the curve (i.e., the shaded area in Figure 1) has the value of $s_1 > s_2$, showing that the country with highest costs (and highest qualities) will set the highest subsidies, which appears at odds with de Meza's principle. Most importantly, these results can be used not only to explain why some less efficient countries often tend to offer the greater subsidies, but also to explain why a high-quality country, like Japan, pays high subsidies.

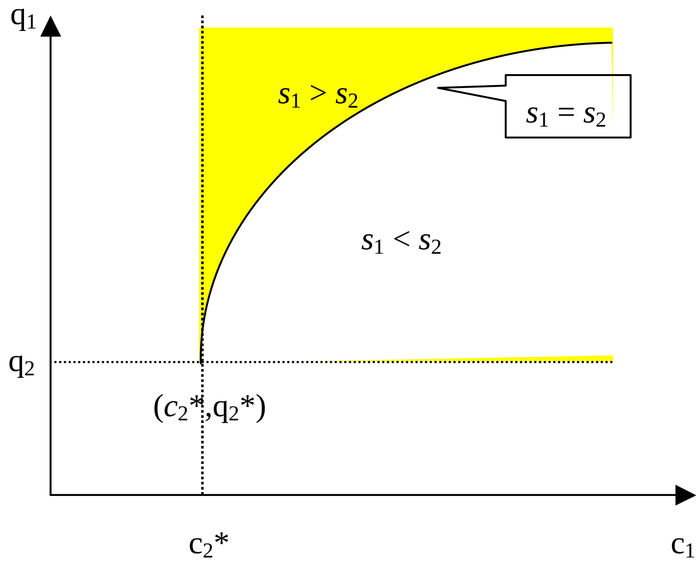

Figure 1 Cost/Quality Combinations Yielding the Same or Different Subsidy Rates: The Cournot Case

Under Bertrand price competiton we can define the profit functions of the two firms as follows:

$$\pi^1(p_1,p_2) = (p_1 - c_1 + s_1)x_1 = \frac{1}{A}(p_1 - c_1 + s_1)(\bar{\theta}A - p_1 + p_2) \qquad (14)$$

$$\pi^2(p_1,p_2)=(p_2-c_2+s_2)x_2=\frac{1}{Aq_2}(p_2-c_2+s_2)(q_2p_1-q_1p_2) \quad (15)$$

$$s_1-s_2=\frac{q_2}{2q_1}[(p_2-c_2)-(p_1-c_1)] \quad (16)$$

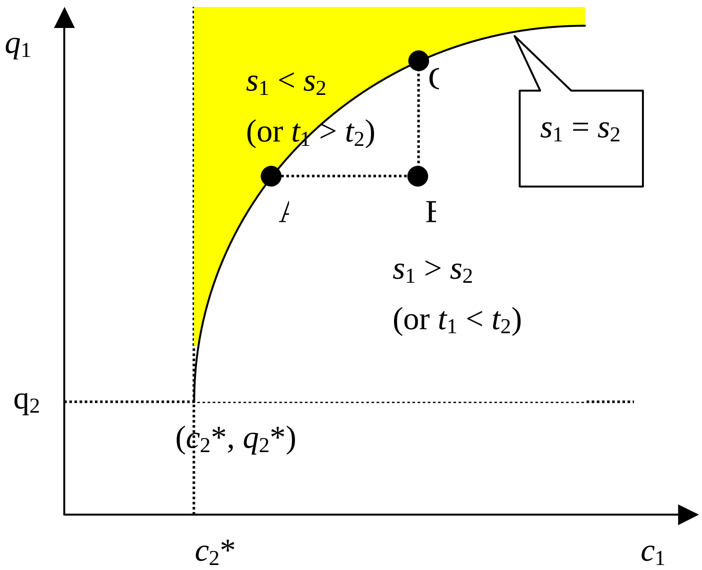

Figure2 Cost/Quality Combinations Yielding the same or Different Subsidy Rates: The Bertrand Case

Equation (16) shows that the greater the profit margin of the domestic firm, the larger is the welfare gain to the domestic country from an export tax. This seems to imply that the country with the lowest cost will offer the highest tax. To gain more insight, we let $(s_1-s_2)=0$ and draw the $(s_1-s_2)=0$ curve on the space of (c_1,q_1). Totally differentiating the $(s_1-s_2)=0$ curve with respect to c_1 and q_1 and proceeding as before, we can show that $(dq_1/dc_1) > 0$ which indicates that the $(s_1-s_2)=0$ curve is positively sloped, passing through the point (c_2^*, q_2^*) as shown in Figure 2. Any point locating below the curve has $s_1 > s_2$ (or $t_1 < t_2$), while any point locating above the curve has $s_1 < s_2$ (or $t_1 > t_2$), where t_i (i = 1,2) denotes the export tax on firm i. Comparing points A and B, for example, we see that for any given q_1, an increase in c_1 reduces the unit profit margin of the high-quality firm relative to that of the low-quality firm. As the profit margin declines, the high quality firm's government should impose a low export tax. For a given c_1 at point B, by comparison, an increase in q_1 (up to say point C) tends to increase the high-quality firm's profit margin, thereby calling for a high tax or low subsidy.

四、計劃成果自評

Our findings not only support some empirical evidence that the less efficient countries often tend to offer the greater subsidies; it can also explain why a high-quality country, like Japan, pays high subsidies.

Our study not only contribute to the literature, but also provides some policy implications for decision-makers. We wish to publish our work in international journal.

五、參考文獻

Brander, J. A. and B. J. Spencer (1985), "Export Subsidies and International Market Share Rivalry", *Journal of International Economics*, 18, 83-100.

de Meza, D. (1986), "Export Subsidies and High Productivity: Cause or Effect?", *Canadian Journal of Economics*, May, 347-350.

Eaton, J. and G. M. Grossman (1986), “Optimal Trade and Industrial Policy under Oligopoly”, *Quarterly Journal of Economics*, 101, 383-406.

Levhari, D. and T. N. Srinivasan (1969), “Durability of Consumption Goods: Competition Versus Monopoly”, *American Economic Review*, 59, 102-109.

Mai, C. C., and H. Hwang (1987), “Domestic Export Subsidy and Foreign Welfare”, *Economics Letters*, 23, 185-188.

Mai, C. C., and H. Hwang (1988), “Optimal Export Subsidies and Marginal Cost Differentials”, *Economics Letters*, 27, 279-282.

Motta, M (1993), “Endogenous Quality Choice: Price vs. Quantity Competition”, *Journal of Industrial Economics*, 41, 113-131.

Spencer, B. J. and J. A. Brander (1983), “International R&D Rivalry and Industrial Strategy”, *Review of Economic Studies*, 50, 707-722.

Swan, P. L. (1970), “Durability of Consumer Goods”, *American Economic Review*, 60, 884-894.

Zhou, D., B. J. Spencer and I. Vertinsky (2002), “Strategic Trade Policy with Endogenous Choice of Quality and Asymmetric Costs”, *Journal of International Economics*, 56, 205-232.