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Strategic Trade Policy in the Presence of International Outsourcing in a Duopoly Model

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Abstract

This paper analyzes how domestic government sets its optimal export policy in a duopoly model when its domestic firm can only outsource its input while the rival firm is able to both produce and outsource its input. First we analyze the strategic outsourcing behavior of the foreign firm. We find that the foreign firm's decisions on whether to outsource input or to make it by itself depend on the trade policy taken by the domestic government. The foreign firm will strategically outsource the entire quantity of its input production to the supplier with an input price higher than its in-house cost, if the domestic firm is subsidized by the domestic government. However, when the domestic firm is being charged a positive export tax by the domestic government, the foreign firm will decide to make input by itself despite the lower input price under the outsourcing regime. From the domestic government's point of view, we find that the conditions for the foreign firm's decisions correspond to the domestic social welfare maximization problem. When the foreign firm chooses to outsource its input to the supplier, the domestic government will impose a negative export tax on its firm, namely subsidy. While when the foreign firm chooses to make input by itself, the domestic government will impose an export tax on its firm as trade policy.

Keywords: Trade Policy, Export Tax, Subsidy, Outsourcing

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1. INTRODUCTION

Outsourcing activities have been growing recently in industrial organizations. Not only nationally, it also occurs internationally. Nowadays, every part of product is being outsourced. The benefits of outsourcing are among cost saving incentive[1] and globalization[2]. Organizations find that costs can be cut down by outsourcing one or more business processes.

An example of national outsourcing is the case of Mitsubishi and Honda.[3] Mitsubishi outsources its Gasoline Direct Injection (GDI) engines to Fiat Auto. Mitsubishi GDI engines would power several new Fiat models. Honda is famous for its unique and superior Direction of Crankshaft Rotation (DCR) engines, but the company decided to give up its DCR engine and instead outsource the traditional GDI engines to its rivals.

Another example of international outsourcing is "American" car that only 37% of the production value of a representative American car is generated domestically in the US. They outsource 30% of the car's value to Korea for assembly, 17,5% to Japan for components and advanced technology, 7,5% to Germany for design, 4% to Taiwan and Singapore for minor parts, 2,5% to the United Kingdom for advertising and marketing services and 1,5% to Ireland and Barbados for data processing[4].

There are two main motivations of outsourcing. First, outsourcing is a way for firms to seek cheaper suppliers, thus reduces production costs (Zhao, 2001). Second, outsourcing can be used for strategic considerations, such as for increasing rival's cost (Arya et al 2008), for obtaining a collusive effect (Chen, et.al. 2004) and Buehler and Haucap (2006), for market dominance (Chen, 2007), etc.

There exists a large literature now that analyzes the government behavior when facing international trade in globalization. Numerous papers analyzing strategic trade policies that focus on the horizontal aspects of market structures have been published[5]. In the case of vertically related markets, the behavior of government in setting trade policy on intermediate input and final product is analyzed by Bernhofen (1997), Ishikawa and Spencer (1999), Grossman and Helpman (2002), Qiu and Spencer (2002), Shy and Stenbacka (2003), Chen et al. (2004), and Skaksen (2005). In the case of international outsourcing, related research was conducted by Grossman and Helpman (2005), Chen (2007), Mukherjee and Tsai (2010).

Brander and Spencer (1985) is the pioneer of a third-country duopolistic model and show that the optimal export policy is a subsidy. Then, Eaton and Grossman

[1] See Grossman and Helpman (2002)
[2] See Grossman and Helpman (2005) and McLaren (2000)
[3] This example of outsourcing by using the case of Mitsubishi and Honda is given by Chen (2004).
[4] Grossman and Helpman (2005) citing Annual report of Wold Trade Organization (1998)
[5] For example, Brander and Krugman (1983), Dixit (1984), Brander and Spencer (1985), and Eaton and Grossman (1986).

(1986) analyze the welfare effects of trade and industrial policy under oligopoly and show that the optimal export policy is a tax. Bernhofen (1997) analyzes the role of a monopolist input supplier with linear demand and find that the optimal trade policy depends on the input price, such that the government will subsidize the domestic firm under price discrimination and impose export tax under uniform pricing. Ghosh et al., (2008) analyze strategic trade policy when technology is transferable via licensing and show that under Cournot competition, the optimal policy can be an export tax instead of an export subsidy. Ara and Ghosh (2016) analyze how bargaining power affects trade policy and find that when the home firms have full bargaining power, the optimal tariff becomes negative, namely subsidy.

The increase in international outsourcing has attracted attention of researcher. Chen (2007) is one of some literature related to outsourcing and trade. This paper investigates the cause of outsourcing other than cost reduction and strategic outsourcing, namely market dominance. The policy implication of the results derived in this paper is that apart from cost reduction, a firm trying to outsource abroad might be expecting to gain an advantage over its rivals through the subsidy on the intermediate good offered by the government in host country. Mukherjee and Tsai (2010) have shown that an international outsourcing can be employed as an entry deterring strategy. Their paper also finds that such outsourcing is also welfare reducing for the outsourcing country.

The integration of trade and the disintegration of production are the two most important features in the contemporary global economy (Feenstra, 1998). Globalization has led to international outsourcing such that businesses nowadays engage in purchasing intermediate inputs from affiliating foreign firms. We are facing a new era of trade. There exists integration between countries in the world economy such that countries engage one another in producing final goods directly and indirectly. In facing this, governments must consider welfare implications of alternative trade policies they take. The focus should shift from protecting sectors to improving access to its inputs and materials and to developing politics that promote human capital development, innovation, and all things that increase productivity (Pengestu et al 2015).

Traditional theory says that outsourcing is based on cost saving consideration only. But it turns out there is another important motivation of outsourcing namely strategic consideration. Since globalization has involved more countries in a trade, firms now are facing more competitive market both nationally and internationally. How do governments respond to this development? In most of the trade activities, of course governments must take certain policies to regulate the trade, including to protect and to help its company.

To the best of our knowledge there is still no paper analyzing how domestic government sets its optimal export policy when it faces strategic outsourcing by foreign firm. By combining Arya, et.al.'s (2008) and Bernhofen (1997) model to a three-firms trade framework, we consider a vertically integrated foreign firm which compete with a domestic downstream firm in the third country market, and meanwhile a monopolistic input supplier stands outside the three countries. We

use this trade model to examine the strategic trade policy of the domestic country government, when the foreign firm can either strategically outsource the entire quantity of its input production or make it by itself.

We obtain the following main results. First, the foreign firm will strategically outsource its input despite the higher input price under the outsourcing regime, if the domestic firm is subsidized by the domestic government. Second, the foreign firm will decide to make input by itself despite the lower input price under the outsourcing regime, if the domestic firm is being charged a positive export tax by the domestic government. Third, the domestic government will impose a negative export tax on its firm, namely subsidy when the foreign firm strategically outsources its input production. This subsidy is aimed to help the domestic market in competing in the final product market. These results are different with Bernhofen's (1998) which finds that the government will subsidize the domestic firm under price discrimination and impose export tax under uniform pricing. Using our model with uniform input price setting, we find that the government will subsidize the domestic firm under certain conditions. Fourth, under the making regime, the domestic government will impose a positive export tax on its firm. This is because the domestic firm has obtained benefit from the lower input price under the making regime, hence the domestic government will charge an export tax to take advantage of the international trade.

This paper is organized as follows. In section 2 we provide related literature. We introduce the basic model in section 3 and conduct the analysis to find the main results in section 4. We conclude the results of the paper in section 5.

2. RELATED LITERATURE

When a business organization decides to outsource input instead of doing in-house input production, the motivation is usually to get the input from outside at a lower cost. Grossman and Helpman (2002) find that the cost of vertically integrated firm can be very high because of incomplete contract and complexity of the organization. However outsourcing also incurs costs in searching the appropriate partner. By outsourcing the input, supplier maximizes its profits in which it shares but compromises its bargaining power with the outsourcer. McLaren (2000) studies the impact of international opening up on the vertical integration decision. Antras and Helpman (2004) analyze the decision to outsource from foreign or domestic suppliers. There is a trade-off between selecting partners that is from the south which has a lower variable cost and the north which has a lower fixed cost.

Another motivation of outsourcing is not because that in-house production is costlier, but rather because outsourcing gives some strategic advantages that benefit the firm. Shy and Stenbacka (2003) analyze how the degree of competition in the final goods market affects the incentive to outsource production of key components. Arya, et.al. (2008) investigate strategic outsourcing under a framework that includes upstream firms. The paper shows that even though the firm which can produce input by itself incurs a cost less than the input price

charged by the input supplier, it will outsource for strategic advantages which is obtained through the raise in its rival's cost. Mukherjee and Tsai (2010) have shown that an international outsourcing can be employed as an entry deterring strategy. Such outsourcing is also welfare reducing for the outsourcing country. Kabiraj and Sinha (2014) analyze strategic outsourcing based on a new dimension of technology transfer. The strategic outsourcing from the softening competition in the final goods market and the benefit in turn accrues through a payment for the patent sale to the independent input supplier. Chen, et.al. 2004 identify a strategic outsourcing which occurs with collusive effect when a domestic firm outsources to a more efficient foreign competitor.

3. THE BASIC MODEL

We follow Brander and Spencer (1985) by considering a framework with two firms in the downstream market, denoted by firm F and firm D. Both firms are located respectively in foreign country and in domestic country. Firm F is a vertically integrated firm competing with firm D in the linear final goods market in the third country. An outside firm, firm U, is an upstream firm which only produces inputs with marginal cost c_u. To simplify the analysis we assume that the production cost of firm U equals to zero.

The downstream firms produce homogeneous final products with certain production costs. One unit of final product requires one unit of intermediate input. To produce the final goods, firm F can produce intermediate goods by itself with a fixed marginal cost c, while firm D has to purchase inputs from the upstream firm U. For the sake of simplicity, intermediate input tariffs are ignored.

The regime will be classified into the making and the outsourcing regime, depending on firm F's decision, whether to outsource input from firm U with unit price w or to produce input by itself. We denote θ as an exogenous variable which serves as firm F's homemade ratio. Thus, it outsources inputs to the upstream firm U in proportion of $1-\theta$ and makes part of the input itself in proportion of θ.

Firm F and firm D export their products to the third country under assumption that all of the aforementioned countries belong to an international trade union which allows them to freely trade without any barrier. We further assume that both downstream firms only sell their product and compete in the third country market.

The objective of the domestic country's government is to maximize social welfare in its country by setting trade policy. It decides whether it would offer an export subsidy or charge an export tax to its domestic firms.

The game involves a sub-game perfect equilibrium with four decision stages. In the first stage, the domestic government decides a strategic trade policy. The input supplier sets input price w in the second stage. Firm F makes a decision either to buy the input from the supplier or to make the input by itself in the third stage. Finally the downstream firms compete under Cournot fashion in the fourth stage. The model is solved by using backward induction.

We start from the fourth stage, in which both of the downstream firms choose their quantities simultaneously. The objective functions of both of the firms are given by:

$$\pi_f = \left(P - \theta c - (1-\theta)w - t\right)q_f, \tag{1.1}$$

$$\pi_d = \left(P - w - s\right)q_d. \tag{1.2}$$

where the superscript "f" and "d" are used to denote the foreign and domestic firm respectively. Firm F incurs t and firm D incurs s which are export taxes charged by their each government. The quantity of final product produced by each firm is denoted by q.

By deriving the first order conditions for the profit maximization problems, we obtain the reaction functions of both firms as follows:

$$\frac{\partial \pi_f}{\partial q_f} = 1 - 2q_f - q_d - \theta c - (1-\theta)w - t = 0, \tag{2.1}$$

$$\frac{\partial \pi_d}{\partial q_d} = 1 - q_f - 2q_d - w - s = 0. \tag{2.2}$$

Solving the reactions function simultaneously results in the following equilibrium outputs of both firms:

$$q_f^* = \frac{1 + s - 2\theta c + (2\theta - 1)w - 2t}{3}, \tag{3.1}$$

$$q_d^* = \frac{1 - 2s + \theta c - (\theta + 1)w + t}{3}. \tag{3.2}$$

4. THE MAIN RESULTS

In the third stage the upstream supplier sets the input prices that it will charge. The profit function of firm U is given by:

$$\pi_u = w\left[q_d + (1-\theta)q_f\right]. \tag{4}$$

By substituting the equilibrium outputs in (3.1) and (3.2) to the firm U's objective function in (4), differentiating it with respect to w and setting the first order condition equals to zero, we obtain the input price in equilibrium as follows:

$$w^* = \frac{2 - s - \theta c - t - \theta - \theta s + 2\theta^2 c + 2\theta t}{4\left(\theta^2 - \theta + 1\right)}. \tag{5}$$

Note that the optimal input price under the outsourcing regime is higher than that under the making regime under assumption that c is larger than t with insignificant difference, i.e $(c - s < 1)$. Substituting (5) into the equilibrium outputs in (3.1) and (3.2) reveals that the optimal quantity and profits of firm F and firm D are as follows:

$$q_f^* = \frac{1}{12\left(\theta^2 - \theta + 1\right)}\left(-4\theta^3 c - 4\theta^2 t + 4\theta^2 c + 2\theta^2 s + 2\theta^2 - 7\theta c + 4\theta t - 5\theta s + \theta + 5s - 7t + 2\right), \tag{6.1}$$

$$q_d^* = \frac{1}{12(\theta^2-\theta+1)}\left(2\theta^3 c - 5\theta^2 c + 2\theta^2 t - 7\theta^2 s + 5\theta^2 + 5\theta c - 5\theta t + 10\theta s - 5\theta + 5t - 7s + 2\right), \quad (6.2)$$

$$\pi_f^* = \left[\frac{1}{12(\theta^2-\theta+1)}\left(-4\theta^3 c - 4\theta^2 t + 4\theta^2 c + 2\theta^2 s + 2\theta^2 - 7\theta c + 4\theta t - 5\theta s + \theta + 5s - 7t + 2\right)\right]^2, \quad (7.1)$$

$$\pi_d^* = \left[\frac{1}{12(\theta^2-\theta+1)}\left(2\theta^3 c - 5\theta^2 c + 2\theta^2 t - 7\theta^2 s + 5\theta^2 + 5\theta c - 5\theta t + 10\theta s - 5\theta + 5t - 7s + 2\right)\right]^2. \quad (7.2)$$

In the second stage the foreign firm decides whether to outsource its intermediate input from firm U or to produce input by its self. We consider two extreme cases, namely outsourcing regime $(\theta = 0)$and making regime $(\theta = 1)$.

Under outsourcing regime, we substitute $(\theta = 0)$ into the quantities and profits in (6.1) until (7.2), then we find the final optimal quantity and profit of each downstream firm:

$$q_f^{O*} = \frac{1}{12}(5s - 7t + 2), \quad (8.1)$$

$$\pi_f^{O*} = \left[\frac{1}{12}(5s - 7t + 2)\right]^2, \quad (8.2)$$

$$q_d^{O*} = \frac{1}{12}(5t - 7s + 2), \quad (9.1)$$

$$\pi_d^{O*} = \left[\frac{1}{12}(5t - 7s + 2)\right]^2. \quad (9.2)$$

Under the making regime, i.e. when $(\theta = 1)$ we find the following quantities and profits in equilibrium:

$$q_f^M = \frac{1}{12}(5 - 3s - 7c - 7t), \quad (10.1)$$

$$\pi_f^{M*} = \left[\frac{1}{12}(5 - 3s - 7c - 7t)\right]^2 \quad (10.2)$$

$$q_d^M = \frac{1}{12}(2c + 2t - 4s + 2), \quad (11.1)$$

$$\pi_d^{M*} = \left[\frac{1}{12}(2c + 2t - 4s + 2)\right]^2. \quad (11.2)$$

From (8.2) and (10.2), we find that the difference between firm F's profit under the outsourcing and the making regime is:

$$\pi_f^{O*} - \pi_f^{M*} = \frac{1}{144}(8s - 3 + 7c)$$

We can see that $\pi_f^{O*} > \pi_f^{M*}$ if $c > (3 - 8s)/7 \equiv c^*$. This upper bound of c implies that firm F will outsource its input to firm U if and only if $c > c^*$, otherwise it will make its own input. In other words, the decision of firm F over the making or the outsourcing regime will depend on its marginal cost under the making regime.

First, consider the case of $c > c^*$ such that firm F chooses outsourcing and takes w as given by firm U. When the input price is lower than the cost under the making regime, i.e $\left(w^O < c\right)$, it is a straightforward decision for firm F to choose outsourcing and no further explanation is needed. However, a striking outcome is found when $\left(w^O > c\right)$ yet firm F still decides to outsource, that is when $\left(s < \tilde{s} = 2 - 2c - t\right)$. For any positive value of c and t we know that $\tilde{s}$ is negative which refers to subsidy. This result is summarized as:

Proposition 1

The foreign firm will strategically outsource its input despite the higher input price under the outsourcing regime, if the domestic firm is subsidized by the domestic government.

The intuition behind this result is as follows. Remember that the optimal input price under the outsourcing regime is higher than that under the making regime. The foreign firm can take this opportunity to raise its rival's production cost. It could have produced its own input with a lower cost as compared to that under outsourcing. However, knowing that the domestic firm is being subsidized, the foreign firm will decide to outsource its input just like its rival does, in order to raise the optimal input price which hence increases its rival's cost. This benefit is known as rent shifting effect. To capture this benefit, then the foreign firm will give up saving the production cost. In this case, rent shifting effect outweighs cost-saving effect.

Now, consider the case of $c < c^*$ such that firm F decides to make input by itself. When the input price is higher than the cost under the making regime, i.e $\left(w^M > c\right)$, it is straightforward that firm F will choose to produce input by itself. However, there is a chance for the making regime to take place although the input price is lower than the cost under the making regime, that is when $\left(s > \hat{s} = \left(1 - c + t\right)/2\right)$. Assume that c is larger than t with insignificant difference, i.e. $\left(c - t < 1\right)$, we find $\hat{s}$ that is positive. So, we have:

Proposition 2

The foreign firm will decide to make input by itself despite the lower input price under the outsourcing regime if the domestic firm is being charged a positive export tax by the domestic government.

In this case, the fact that the domestic firm incurs an export tax will motivate the foreign firm to make input by itself although the input price under outsourcing is lower. The reason is, that under outsourcing both firms buy the input from the uptream firm and so face a harsh competition in obtaining the input. The foreign firm can instead choose to make input by itself to avoid the severe competition in

the upstream market. However, the foreign firm can still gain a stronger power in the final product market as the presence of export tax in the domestic country has already weakened the domestic firm market power. Alhough the domestic firm can enjoy a lower input price, it also suffers from the weaker competitiveness in the final market due to export tax. For the foreign firm, this benefit is known as competition effect. To capture this benefit, the foreign firm will give up saving the production cost. In this case, competition effect dominates cost-saving effect.

In the first stage, the domestic government sets its strategic trade policy. The objective of the domestic government is to maximize domestic social welfare, which is defined as the summation the domestic firm's profit and export tax revenues. Thus, the domestic country's social welfare function under the outsourcing regime is given by:

$$SW_d^O = \pi_d^O + sq_d^O. \tag{12}$$

Substituting equations (9.1) and (9.2) into (12), we can rewrite the domestic country's social welfare under the outsourcing regime as follows:

$$SW_d^O = \left[\frac{1}{12}(5s - 7t + 2)\right]^2 + s\left[\frac{1}{12}(5s - 7t + 2)\right]. \tag{13}$$

By differentiating (13) with respect to s, we obtain the optimal tax under the outsourcing regime as follows:

$$s^O = \frac{-5t - 2}{35} \tag{14}$$

From (14) we find that the tax is negative for any positive value of t. It means that under the outsourcing regime the domestic government will impose a negative tax or subsidy on its firm. Thus, we have:

Proposition 3

Under the outsourcing regime, the domestic government will impose a negative export tax on its firm, namely subsidy.

Looking back to proposition 1, subsidy for firm D is the necessary condition for firm F to outsource. This is confirmed by the domestic country's social welfare analysis, that subsidy is also the optimal trade policy for the domestic firm when the foreign firm outsources its output. Since the outsourcing decision by the foreign firm leads to a higher input price, the domestic government will give subsidy to the domestic firm to help it survive in the final product market. This result is sharply in contrast to that of Bernhofen (1997) which finds that the government will subsidize the domestic firm under price discrimination and impose export tax under uniform pricing.

Under the making regime, the domestic country's social welfare function is given by:

$$SW_d^M = \pi_d^M + sq_d^M. \tag{15}$$

Substituting equations (11.1) and (11.2) into (15), we can rewrite the domestic country's social welfare as follows:

$$SW_d^M = \left[\frac{1}{12}(2c + 2t - 4s + 2)\right]^2 + s\left[\frac{1}{12}(2c + 2t - 4s + 2)\right]. \tag{16}$$

By differentiating (16) with respect to s, we obtain the optimal tax under the making regime as follows:

$$s^M = \frac{c + t + 1}{8} \tag{17}$$

For any positive c and t, we find that the tax in (17) is positive. Hence, we obtain:

Proposition 4

Under the making regime, the domestic government will impose a positive export tax on its firm.

Recall Proposition 2 that the making regime will take place if the domestic government imposes a positive export tax on the domestic firm. This is exactly what we have by analyzing from the domestic government's point of view. We have known that the decision of the foreign firm to make input by itself leads to a lower input price. Since the domestic firm has already got benefit from this, the domestic government will take advantage of the trade by charging an export tax on the domestic firm.

5. CONCLUDING REMARKS

Globalization has led to more integrated trade between countries and international outsourcing has now become more common. Nowadays businesses engage in purchasing intermediate inputs from affiliating foreign firms. This countries integration in the world economy has also led to countries engagement in producing final goods directly and indirectly. In facing this new era of trade, governments must consider welfare implications of alternative trade policies they take, including when they have to protect their firms and when they can take advantage of the international trade.

This paper discusses strategic trade policy in a duopoly model in the presence of international outsourcing. In this model one firm is able to both produce and outsource its input while another one can only outsource its input. Both of the firm export the final product to another coutry. The choice of the foreign firm on outsourcing or making in-house input affects the trade policy of the domestic government. Outsourcing occurs not only for seeking cheaper input but also for

obtaining strategic advantage. In this paper we find that strategic advantage is acquired when the foreign firm chooses to outsource its input production and competition advantage is obtained when the foreign firm produces input by itself. In facing this behavior of the foreign firm, the domestic goverment must set its strategic trade policy.

The results obtained are as follows. First, the foreign firm will strategically outsource its input despite the higher input price under the outsourcing regime, if the domestic firm is subsidized by the domestic government. This is because by outsourcing its input, the foreign firm can benefit from the rent shifting effect by raising its rival's production cost. Second, The reason is that the foreign firm tries to lower competition in the upstream market to gain more market power in the downstream market. Third, under the outsourcing regime, the domestic government will impose a negative export tax on its firm, namely subsidy. This is aimed to increase the domestic firm's competitiveness in the final product market as it suffers from the higher input price under the outsurcing regime. Fourth, under the making regime, the domestic government will impose a positive export tax on its firm. This is because the domestic firm has obtained benefis from the lower input price under the making regime, hence the domestic government will charge an export tax to take advantage of the international trade. In short, the condition for outsourcing to take place is what the domestic needs to maximize the domestic social welfare under the outsourcing regime, namely subsidy. Similarly, the trade policy that the domestic government uses to maximize the domestic social welfare is what the foreign firm needs to undergo the making regime.

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