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Strategic Trade Policy and Location of the Upstream Firm

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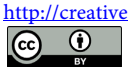

Abstract

This paper examines how the location of the upstream firm shapes optimal trade policy in a vertically related industry. Following the framework of Bernhofen (1997), when the upstream firm is located inside or outside the exporting country, trade policy affects welfare not only through horizontal competition in the final-good market but also through vertical interactions with an upstream firm possessing market power. In such a setting, export policies (tariffs or subsidies) influence the derived demand elasticity faced by the upstream firm, thereby altering its pricing behavior and the allocation of rents across countries.

Keywords

Location, Strategic Trade Policy, Tariff, Subsidy

1. Introduction

Strategic trade policy has been a central topic in international trade theory since the 1980s. Beginning with Brander and Spencer (1981), a large body of literature has systematically examined how governments can use policy instruments such as tariffs, subsidies, and quotas to influence firm behavior and national welfare in imperfectly competitive markets. Subsequent studies extended this line of inquiry to duopolistic and oligopolistic market structures, highlighting the profit-shifting effect of strategic trade policies and their welfare implications (Dixit & Kyle, 1985; Brander & Spencer, 1984a, 1984b, 1985; Eaton & Grossman, 1986; Cheng, 1988; Grossman & Helpman, 1995).

Building on this framework, Bernhofen (1997) demonstrates that once a vertically related industry structure is incorporated into the analysis, the traditional export-subsidy result based solely on horizontal competition no longer holds in general. When final-good producers rely on an intermediate input supplied by a

monopolist located in a third country, trade policy affects welfare not only through competition in the downstream final-good market but also by altering the derived demand elasticity faced by the upstream monopolist. As a consequence, part of an export subsidy may be absorbed by the upstream firm in the form of higher input prices, generating what is referred to as vertical rent leakage. The optimal direction of trade policy therefore depends critically on the upstream pricing regime: under uniform pricing, export subsidies may remain optimal but with substantially reduced magnitude, whereas under discriminatory pricing, export taxes may instead dominate. This finding overturns the standard Brander-Spencer prediction and underscores the importance of vertical market power in strategic trade policy analysis.

Extending the analysis to import policies, Yanase and Kawabata (2008) show that in a three-country model where the upstream firm is located in the importing country, the optimal import policy—whether a tariff or a subsidy—is jointly determined by horizontal and vertical effects. On the one hand, import policy can extract foreign profits or consumer surplus through its impact on competition in the final-good market. On the other hand, it affects upstream demand and pricing behavior, thereby influencing vertical rent allocation and productive efficiency. The relative strength of these two effects depends on the relative number of upstream and downstream firms, implying that optimal import policies may take the form of either tariffs or subsidies, and that policy directions across countries may differ in equilibrium.

More recent studies have further incorporated ownership structure into the analysis. Lee and Lee (2024), building on the framework of Bernhofen (1997), introduce forward cross-shareholding into a vertically related three-country model and show that the optimal export policy depends critically on both the degree of cross-ownership and the pricing regime of intermediate goods. In particular, under uniform pricing, the optimal policy switches from an export subsidy to an export tax once the cross-holding ratio exceeds a threshold level, highlighting the role of ownership-based internalization in shaping government policy incentives.

Despite these advances, most of the existing literature treats the upstream firm as being exogenously located in a third country, implicitly assuming that upstream profits cannot be internalized by the exporting country. In practice, however, the location choice of the upstream firm affects not only the allocation of vertical rents but may also fundamentally alter governments' incentives to intervene in downstream markets. When the upstream firm is located within the exporting country, the impact of export policy on upstream pricing and profit distribution is directly reflected in domestic welfare, potentially leading to systematic changes in both the direction and intensity of optimal trade policy.

Motivated by this gap in the literature, this paper builds on the vertically related three-country model of Bernhofen (1997) to examine how the location of the upstream firm affects the exporting country's optimal trade policy. Unlike Yanase and Kawabata (2008), who focus on the case in which the upstream firm is located

in the importing country and emphasize how the relative number of upstream and downstream firms determines the balance between vertical and horizontal effects, this paper explicitly incorporates the location of the upstream firm into the analysis of strategic trade policy. The results show that when the upstream firm is located in the exporting country, vertical rents are fully internalized, making an export subsidy the optimal policy. Moreover, such a policy may even drive the rival country out of the export market in the third country. This paper therefore contributes to the literature by showing that the location of the upstream firm can fundamentally change the direction of optimal trade policy, even under the same upstream pricing regime.

Following the industrial organization literature, the model also considers alternative pricing regimes in the intermediate-good market. As emphasized by DeGraba (1990), price discrimination may arise when sellers operate across multiple markets and arbitrage between buyers is limited. Bernhofen (1997) shows that the pricing regime of the intermediate good affects the relative importance of vertical and horizontal effects. By contrast, the present model demonstrates that when the upstream firm is located in the exporting country, the intermediate-good output expansion effect becomes dominant. As a result, the direction of optimal trade policy becomes more consistent across both discriminatory and uniform pricing regimes of the intermediate good.

The remainder of the paper is organized as follows. Section 2 presents the basic model. Section 3 analyzes equilibrium outcomes in the final and upstream markets. Section 4 reproduces the benchmark results from the existing literature. Section 5 examines the policy equilibrium when the upstream firm is located in the exporting country. Section 6 concludes with policy implications.

2. The Model

This study adopts a third-market model to analyze competition between two exporting firms in a third-country consumer market and assumes a vertically related industry structure. The market consists of one upstream firm and two downstream final-good exporting firms. The upstream firm is located in the rest of the world, while the two downstream firms are final-good producers based in the home country and the foreign country, denote h and f, respectively.

Demand in the third-country market is assumed to be linear, with the inverse demand function given by $p = A - bZ$, where p denotes the market price and Z represents total market demand. Consistent with the law of demand, price is decreasing in total output. The parameter A captures market size. Let z_h and z_f denote the export quantity supplied by the home and foreign downstream firms, respectively. Total market supply is therefore $Z = z_h + z_f$.

The upstream firm supplies the intermediate good to the home and foreign downstream firms at prices w_h and w_f, respectively. It is assumed that downstream firms incur no production costs other than the cost of the intermediate input. Accordingly, the profit functions of the home and foreign downstream firms

can be written as:

$$\pi_h = (A - bZ - w_h) z_h \tag{1}$$

$$\pi_f = (A - bZ - w_f) z_f \tag{2}$$

It is assumed that the production of one unit of the final good requires one unit of the intermediate good. Accordingly, the upstream firm's profit is generated from sales of the intermediate good to the home and foreign downstream firms. Assuming that the intermediate good is produced at a constant marginal cost k. To ensure positive output of the downstream firms, we assume $A - k > 0$. To guarantee an interior equilibrium, we assume that the demand intercept is sufficiently large relative to marginal cost and policy instruments so that equilibrium outputs and intermediate-good prices remain non-negative. If the subsidy becomes sufficiently large relative to the demand intercept, a boundary outcome may arise in which one of the downstream firms exits the market.

The profit function of the upstream firm can be expressed as:

$$\pi_u = (w_h - k) z_h + (w_f - k) z_f \tag{3}$$

Each government adopts a **per-unit (specific)** export policy for its downstream final-good exporter. The home government provides a per-unit export subsidy (or tax) s_h to the home firm, and the foreign government provides a per-unit export subsidy (or tax) s_f to the foreign firm. Specifically, $s_h > 0$ ($s_f > 0$) represents an export subsidy, whereas $s_h < 0$ ($s_f < 0$) represents an export tax.

Under these assumptions, the cost structures of the home and foreign downstream firms are given by $c_h(z_h) = (w_h - s_h) z_h$ and $c_f(z_f) = (w_f - s_f) z_f$. Accordingly, the profit functions of the home and foreign downstream firms can be written as:

$$\pi_h = (A - bZ - w_h + s_h) z_h \tag{4}$$

$$\pi_f = (A - bZ - w_f + s_f) z_f \tag{5}$$

Here, social welfare in the home and foreign countries is assumed to consist of firm profits and government expenditures on export subsidies. Since the final good is exported to a third-country market, consumer surplus does not need to be considered. Accordingly, social welfare in the two exporting countries can be expressed as:

$$SW_h = \pi_h - s_h z_h \tag{6}$$

$$SW_f = \pi_f - s_f z_f \tag{7}$$

When the upstream firm is located in the home country, the upstream firm's profit is also included in domestic welfare. Accordingly, social welfare in the home country can be rewritten as:

$$SW_h = \pi_h - s_h z_h + \pi_u \tag{8}$$

The model is a three-stage game (Figure 1). Since this study considers a **complete-information dynamic game**, the home and foreign governments choose their

optimal trade policies in the first stage. In the second stage, the upstream firm determines the price of the intermediate good. In the third stage, the two downstream final-good firms choose their optimal output levels. Accordingly, this study applies **backward induction** to derive the **subgame perfect Nash equilibrium** (SPNE).

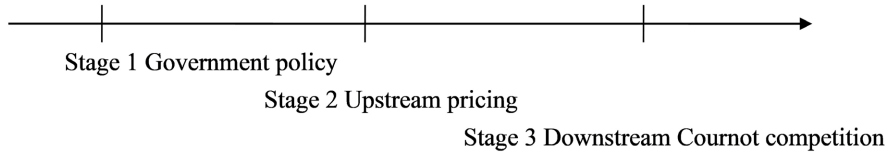

Figure 1. Timing of the game.

3. Market Equilibrium Analysis

3.1. Equilibrium in the Final-Good Market Stage

Under backward induction, we first solve for the equilibrium in the final-good market stage. The home and foreign downstream firms choose their output levels to maximize profits, thereby determining their respective optimal quantities. Taking the first-order derivatives of Equations (4) and (5) with respect to output yields the first-order conditions (F.O.C), which must satisfy the profit-maximization conditions:

$$\frac{\partial \pi_h}{\partial z_h} = A + s_h - w_h - b\left(z_f + 2z_h\right) = 0 \tag{9}$$

$$\frac{\partial \pi_f}{\partial z_f} = A + s_f - w_f - b\left(2z_f + z_h\right) = 0 \tag{10}$$

These conditions indicate that the resulting equilibrium outputs ensure profit maximization for the downstream firms. Accordingly, the optimal output levels of the home and foreign downstream firms, z_h and z_f, can be derived as follows:

$$z_h = \frac{A - s_f + 2s_h + w_f - 2w_h}{3b} \tag{11}$$

$$z_f = \frac{A + 2s_f - s_h - 2w_f + w_h}{3b} \tag{12}$$

3.2. Equilibrium in the Intermediate-Good Market Stage

3.2.1. Discriminatory Pricing of the Intermediate Good

Next, we consider the stage in which the intermediate-good price is determined and solve for the upstream firm's optimal pricing decision. Price discrimination may arise when intermediate-good markets are segmented and arbitrage across downstream firms is limited. Here, the upstream firm is assumed to adopt discriminatory pricing. Substituting Equations (11) and (12) into Equation (3) yields:

$$\pi_u = \frac{\left(w_h - k\right)\left(A - s_f + 2s_h + w_f - 2w_h\right)}{3b} + \frac{\left(w_f - k\right)\left(A + 2s_f - s_h - 2w_f + w_h\right)}{3b} \tag{13}$$

Taking the first-order derivatives of π_u with respect to the intermediate-good prices yields the optimal prices w_h and w_f charged by the upstream firm to the home and foreign downstream firms. The profit-maximization conditions must satisfy:

$$\frac{\partial \pi_u}{\partial w_h} = \frac{A + k - s_f + 2s_h + 2w_f - 4w_h}{3b} = 0 \tag{14}$$

$$\frac{\partial \pi_u}{\partial w_f} = \frac{A + k + 2s_f - s_h - 4w_f + 2w_h}{3b} = 0 \tag{15}$$

Accordingly, the optimal intermediate-good prices charged to the two downstream firms can be derived as:

$$w_h = \frac{1}{2}\left(A + k + s_h\right) \tag{16}$$

$$w_f = \frac{1}{2}\left(A + k + s_f\right) \tag{17}$$

It follows that, for the upstream firm, revenues from selling the intermediate good to either the home or the foreign downstream firm, as well as the intermediate-good prices, depend on the trade policies adopted by the two governments.

Substituting Equations (16) and (17) into Equations (11) and (12) yields the optimal output levels of the home and foreign downstream firms:

$$z_h\left(s_f, s_h\right) = \frac{A - k - s_f + 2s_h}{6b} \tag{18}$$

$$z_f\left(s_f, s_h\right) = \frac{A - k + 2s_f - s_h}{6b} \tag{19}$$

3.2.2. Uniform Pricing of the Intermediate Good

In the stage where the intermediate-good price is determined, if the upstream firm adopts uniform pricing when choosing the optimal price of the intermediate good, we can assume $w = w_h = w_f$. Under this assumption, substituting Equations (11) and (12) into Equation (3) yields the profit of the upstream firm as follows:

$$\pi_u = \frac{\left(w - k\right)\left(2A - 2w + s_f + s_h\right)}{3b} \tag{20}$$

Taking the first-order derivative of π_u with respect to the intermediate-good price w yields the upstream firm's optimal (uniform) intermediate-good price charged to the home and foreign downstream firms. The profit-maximization condition must satisfy:

$$\frac{\partial \pi_u}{\partial w} = \frac{2\left(A + k - 2w\right) + s_f + s_h}{3b} = 0 \tag{21}$$

Accordingly, the optimal intermediate-good price charged to the downstream firms in both countries is given by:

$$w = \frac{1}{4}\left(2\left(A + k\right) + s_f + s_h\right) \tag{22}$$

A comparison of Equations (16), (17), and (22) shows that under discriminatory pricing of the intermediate good (Equations (16) and (17)), the upstream firm sets prices based on the individual derived demand of each downstream firm. By contrast, under uniform pricing (Equation (22)), the upstream firm sets a common price based on the average derived demand of the downstream firms.

Substituting Equation (22) back into Equations (11) and (12) yields the optimal output levels of the home and foreign downstream firms, z_h^* and z_f^*, as follows:

$$z_h^* = \frac{2A - 2k - 5s_f + 7s_h}{12b} \tag{23}$$

$$z_f^* = \frac{2A - 2k + 7s_f - 5s_h}{12b} \tag{24}$$

4. Benchmark: The Upstream Firm Is Located in the Rest of the World

This section follows the framework of Bernhofen (1997) and examines the determination of the exporting country's optimal trade policy when the upstream firm is not located in the exporting country. In particular, we analyze cases in which the upstream firm adopts discriminatory pricing and uniform pricing, respectively. This section serves to reproduce the benchmark results of Bernhofen (1997) and provides a reference point for the subsequent analysis on firm location.

4.1. Trade Policy Analysis under Discriminatory Pricing of the Intermediate Good

In the trade policy stage, the home and foreign governments choose their optimal trade policies with the objective of maximizing social welfare, SW_h and SW_f, respectively. Substituting Equations (16) - (19) into Equations (6) and (7) yields the social welfare functions of the home and foreign countries as follows:

$$SW_h = \pi_h - s_h z_h = \frac{\left(A - k - s_f + 2s_h\right)^2}{36b} - \frac{\left(A - k - s_f + 2s_h\right)s_h}{6b} \tag{25}$$

$$SW_f = \pi_f - s_f z_f = \frac{\left(A - k + 2s_f - s_h\right)^2}{36b} - \frac{s_f\left(A - k + 2s_f - s_h\right)}{6b} \tag{26}$$

Taking the first-order derivatives of the welfare functions with respect to s_f and s_h yields the first-order conditions:

$$\frac{\partial SW_h}{\partial s_h} = \frac{A - k - s_f + 2s_h}{9b} - \frac{A - k - s_f + 4s_h}{6b} = 0 \tag{27}$$

$$\frac{\partial SW_f}{\partial s_f} = \frac{A - k + 2s_f - s_h}{9b} - \frac{A - k + 4s_f - s_h}{6b} = 0 \tag{28}$$

The first term in Equations (27) and (28) captures a ***positive (negative) profit-shifting effect with a positive subsidy (tax)***, which raises (reduces) domestic social welfare. A positive subsidy lowers the marginal cost of the domestic firm, thereby

expanding its market share and profit. The second term represents a ***negative subsidy-expenditure effect*** (***positive vertical rent extract effect***), which reduces (raises) social welfare because the subsidy requires government expenditure. These terms correspond to the downstream profit-shifting effect, the fiscal cost of export subsidies, and the change in upstream profits.

Solving Equations (27) and (28) jointly yields:

$$s_h^D = -\frac{A-k}{7} < 0 \tag{29}$$

$$s_f^D = -\frac{A-k}{7} < 0 \tag{30}$$

Let D denote the equilibrium under discriminatory pricing of the intermediate good. The following corollary can then be stated.

According to Bernhofen (1997), when the upstream monopolist can price discriminate between downstream firms, each government's policy affects only the intermediate-good price faced by its domestic firm. As a result, the government can directly extract rents from the upstream monopolist. In this case, the ***vertical effect*** dominates the ***horizontal profit-shifting effect***, and therefore the optimal policy is an ***export tax rather than an export subsidy***.

Corollary 1 (Benchmark: Bernhofen, 1997).

When the upstream firm is not located in the exporting country and the intermediate good is priced discriminatively, the optimal trade policy is an export tax.

We obtain the following equilibrium.

Lemma 1. *SPNE under discriminatory pricing of the intermediate good when the upstream firm is located in the rest of the world.*

$$s_h^D = \frac{-A+k}{7},\ s_f^D = \frac{-A+k}{7},\ z_h^D = \frac{A-k}{7b},\ z_f^D = \frac{A-k}{7b},\ Z^D = \frac{2(A-k)}{7b},$$

$$p^D = \frac{(5A+2k)}{7},\ w_h^D = \frac{(3A+4k)}{7},\ w_f^D = \frac{3A+4k}{7},\ \pi_u^D = \frac{6(A-k)^2}{49b},$$

$$\pi_h^D = \frac{(A-k)^2}{49b},\ \pi_f^D = \frac{(A-k)^2}{49b},\ SW_h^D = \frac{2(A-k)^2}{49b},\ SW_f^D = \frac{2(A-k)^2}{49b}.$$

4.2. Trade Policy Analysis under Uniform Pricing of the Intermediate Good

Next, this section considers the exporting country's trade policy when the upstream firm adopts uniform pricing. In the trade policy stage, the home and foreign governments choose their optimal trade policies with the objective of maximizing social welfare, SW_h and SW_f, respectively. Substituting Equations (22) - (24) into Equations (6) and (7) yields the social welfare functions of the home and foreign countries as follows:

$$SW_h = \pi_h - s_h z_h = \frac{(2A-2k-5s_f+7s_h)^2}{144b} - \frac{(2A-2k-5s_f+7s_h)s_h}{12b} \tag{31}$$

$$SW_f = \pi_f - s_f z_f = \frac{\left(2A-2k+7s_f-5s_h\right)^2}{144b} - \frac{s_f\left(2A-2k+7s_f-5s_h\right)}{12b} \tag{32}$$

Taking the first-order derivatives of the welfare functions with respect to s_f and s_h yields the first-order conditions:

$$\frac{\partial SW_h}{\partial s_h} = \frac{7\left(2A-2k-5s_f+7s_h\right)}{72b} - \frac{2\left(A-k+7s_h\right)-5s_f}{12b} = 0 \tag{33}$$

$$\frac{\partial SW_f}{\partial s_f} = \frac{7\left(2A-2k+7s_f-5s_h\right)}{72b} - \frac{2A-2k+14s_f-5s_h}{12b} = 0 \tag{34}$$

Solving Equations (33) and (34) jointly yields:

$$s_h^{NU} = \frac{A-k}{20} > 0$$

$$s_f^{NU} = \frac{A-k}{20} > 0$$

Let NU denote the equilibrium under uniform pricing of the intermediate good. The following corollary can then be stated. The welfare effects in Equations (33) and (34), as in Equations (27) and (28), consist of two components. When the upstream firm can charge only a uniform price to all downstream firms, a government's policy toward its domestic firm simultaneously affects the foreign firm. As a result, the ***vertical rent-extraction effect*** spills over to the foreign firm, thereby weakening the vertical effect. Under this circumstance, the horizontal profit-shifting effect dominates, and the optimal policy is therefore an export subsidy.

Corollary 2 (Benchmark: Bernhofen, 1997).

When the upstream firm is not located in the exporting country and the intermediate good is priced uniformly, the optimal trade policy for both countries is an export subsidy.

When the upstream firm is not located in the exporting country, export policy affects welfare not only through horizontal competition in the downstream final-good market but also by altering the derived demand elasticity faced by the upstream monopolist, thereby influencing its pricing behavior. Under discriminatory pricing, an export tax raises downstream demand elasticity and allows the government to extract rents directly from the upstream monopolist, making it the optimal policy. By contrast, under uniform pricing, part of the vertical rent leakage spills over to the foreign downstream firm, so that the horizontal profit-shifting effect remains dominant and export subsidies retain a relative advantage. These results reproduce the core findings of Bernhofen (1997) and serve as a benchmark for the subsequent analysis.

We obtain the following equilibrium.

Lemma 2. *SPNE under uniform pricing of the intermediate good when the upstream firm is located in the rest of the world.*

$$s_h^{NU} = \frac{A-k}{20},\quad s_f^{NU} = \frac{A-k}{20},\quad z_h^{NU} = \frac{7\left(A-k\right)}{40b},\quad z_f^{NU} = \frac{7\left(A-k\right)}{40b},$$

$$Z^{NU}=\frac{7(A-k)}{20b},\quad p^{NU}=\frac{(13A+7k)}{20},\quad w^{NU}=\frac{(21A+19k)}{40},\quad \pi_u^{NU}=\frac{147(A-k)^2}{800b},$$
$$\pi_h^{NU}=\frac{49(A-k)^2}{1600b},\quad \pi_f^{NU}=\frac{49(A-k)^2}{1600b},\quad SW_h^{NU}=\frac{7(A-k)^2}{320b},$$
$$SW_f^{NU}=\frac{7(A-k)^2}{320b}.$$

5. Trade Policy with the Upstream Firm Located in the Home Country

This section considers trade policy when the upstream firm is located in the home (exporting) country. Relative to the benchmark case in Section 4, the only change is the location of the upstream firm. We examine the exporting country's trade policy under uniform pricing and discriminatory pricing of the intermediate good. As discussed above, when the upstream firm is located in the home country, social welfare in the two exporting countries can be expressed as Equations (7) and (8).

5.1. Trade Policy Equilibrium under Discriminatory Pricing of the Upstream Firm

At the policy stage, the home and foreign governments choose their optimal trade policies with the objective of maximizing social welfare, SW_h and SW_f, respectively. Substituting Equations (16) - (19) into Equations (7) and (8) yields the social welfare functions of the home and foreign countries as follows:

$$SW_h=\pi_h-s_hz_h+\Pi_u=\frac{\left(A-k-s_f+2s_h\right)^2}{36b}+\frac{\left(A-k-s_f+2s_h\right)s_h}{6b}+\frac{(A-k)^2+s_f\left(A-k+s_f\right)+\left(A-k-s_f\right)s_h+s_h^2}{6b} \tag{35}$$

$$SW_f=\pi_f-s_fz_f=\frac{\left(A-k+2s_f-s_h\right)^2}{36b}+\frac{s_f\left(A-k+2s_f-s_h\right)}{6b} \tag{36}$$

Taking the first-order derivatives of the welfare functions with respect to s_f and s_h yields the first-order conditions:

$$\frac{\partial SW_h}{\partial s_h}=\frac{A-k-s_f+2s_h}{9b}-\frac{A-k-s_f+4s_h}{6b}+\frac{A-k-s_f+2s_h}{6b}=0 \tag{37}$$

$$\frac{\partial SW_f}{\partial s_f}=\frac{A-k+2s_f-s_h}{9b}-\frac{A-k+4s_f-s_h}{6b}=0 \tag{38}$$

The first and second terms in Equation (37) capture the **profit-shifting effect** and the **subsidy-expenditure effect (or positive tax-revenue effect)**, respectively. The third term represents the **intermediate-good output expansion effect**. A subsidy increases the derived demand for the final good, thereby expanding the demand for the intermediate good and improving domestic welfare.

Solving Equations (37) and (38) jointly yields:

$$s_h^{HD}=A-k>0$$

$$s_f^{HD} = 0$$

Let HD denote the equilibrium in which the upstream firm is located in the home country and adopts **discriminatory pricing**. The following proposition can then be stated.

Proposition 1.

When the upstream firm is located in the home country and the intermediate good is priced discriminatively, the optimal trade policy for the home country is an export subsidy, while the optimal trade policy for the foreign country is neither a subsidy nor a tax.

When the upstream firm is located in the exporting country, its profits are fully internalized in the domestic social welfare function. As a result, the exporting country's government takes into account both downstream competitive effects and changes in upstream profits when formulating trade policy. In this case, export subsidies no longer generate vertical rent leakage; instead, by stimulating downstream output expansion, they indirectly increase upstream sales and profits, creating a positive vertical feedback effect. Compared with the case in which the upstream firm is located in a third country, the incentive for the exporting country to adopt export subsidies is therefore stronger.

We obtain the following equilibrium.

Lemma 3. *SPNE under discriminatory pricing of the intermediate good when the upstream firm is located in the home country.*

$$s_h^{HD} = A-k,\ s_f^{HD} = 0,\ z_h^{HD} = \frac{A-k}{2b},\ z_f^{HD} = 0,\ Z^{HD} = \frac{A-k}{2b},\ p^{HD} = \frac{A+k}{2},$$

$$w_h^{HD} = A,\ w_f^{HD} = \frac{A+k}{2},\ \pi_u^{HD} = \frac{(A-k)^2}{2b},\ \pi_h^{HD} = \frac{(A-k)^2}{4b},\ \pi_f^{HD} = 0,$$

$$SW_h^{HD} = \frac{(A-k)^2}{4b},\ SW_f^{HD} = 0.$$

5.2. Trade Policy Equilibrium under Uniform Pricing of the Upstream Firm

In this stage, the home and foreign governments choose their optimal trade policies with the objective of maximizing social welfare, SW_h and SW_f, respectively. Substituting Equations (22) - (24) into Equations (7) and (8) yields the social welfare functions of the home and foreign countries as follows:

$$\begin{aligned} SW_h = \pi_h - s_h z_h + \Pi_u &= \frac{\left(2A-2k-5s_f+7s_h\right)^2}{144b} \\ &+ \frac{\left(-2A+2k+5s_f-7s_h\right)s_h}{12b} + \frac{\left(2A-2k+s_f+s_h\right)^2}{24b} \end{aligned} \tag{39}$$

$$SW_f = \pi_f - s_f z_f = \frac{\left(2A-2k+7s_f-5s_h\right)^2}{144b} + \frac{s_f\left(-2A+2k-7s_f+5s_h\right)}{12b} \tag{40}$$

Taking the first-order derivatives of the welfare functions with respect to s_f

and s_h yields the first-order conditions:

$$\frac{\partial SW_h}{\partial s_h} = \frac{7\left(2A-2k-5s_f+7s_h\right)}{72b} + \frac{5s_f-2\left(A-k+7s_h\right)}{12b} + \frac{2A-2k+s_f+s_h}{12b} = 0 \tag{41}$$

$$\frac{\partial SW_f}{\partial s_f} = \frac{7\left(2A-2k+7s_f-5s_h\right)}{72b} - \frac{2A-2k+14s_f-5s_h}{12b} = 0 \tag{42}$$

Solving Equations (41) and (42) jointly yields:

$$s_h^{HU} = \frac{41\left(A-k\right)}{85} > 0 \tag{43}$$

$$s_f^{HU} = \frac{-\left(A-k\right)}{85} < 0 \tag{44}$$

Let HU denote the equilibrium in which the upstream firm is located in the home country and adopts **uniform pricing**. The following proposition can then be stated.

Proposition 2.

When the upstream firm is located in the home country and the intermediate good is priced uniformly, the optimal trade policy for the home country is an export subsidy, while the optimal trade policy for the foreign country is an export tax.

Under uniform pricing, the positive effects of export subsidies on both upstream and downstream firms are internalized by the home (exporting) country. By contrast, the foreign government faces the possibility that export subsidies may worsen the competitive position of its downstream firm and therefore adopt an export tax to mitigate the unfavorable output allocation.

Substituting Equations (43) and (44) into Equations (11) and (12) yields $z_h^{HU} = \frac{77\left(A-k\right)}{170b}$ and $z_f^{HU} = -\frac{7\left(A-k\right)}{170b} < 0$. This implies that the foreign firm is driven out of the market.

Imposing the non-negativity constraint on output, we obtain the following equilibrium.

Lemma 4. *SPNE under uniform pricing of the intermediate good when the upstream firm is located in the home country.*

$$s_h^{HU} = A-k,\ s_f^{HU} = 0,\ z_h^{HU} = \frac{A-k}{2b},\ z_f^{HU} = 0,\ Z^{HU} = \frac{A-k}{2b},$$

$$p^{HU} = \frac{A+k}{2},\ w^{HU} = A,\ \pi_u^{HU} = \frac{\left(A-k\right)^2}{2b},\ \pi_h^{HU} = \frac{\left(A-k\right)^2}{4b},\ \pi_f^{HU} = 0,$$

$$SW_h^{HU} = \frac{\left(A-k\right)^2}{4b},\ SW_f^{HU} = 0.$$

6. Conclusion

This paper examines how the location of the upstream firm affects optimal trade

policy in a strategic trade framework with third-market competition. The results show that when the upstream firm is not located in the exporting country, the optimal policy outcomes are consistent with those of Bernhofen (1997), with the choice between export subsidies and export taxes depending on the upstream pricing regime.

By contrast, when the upstream firm is located in the exporting country, vertical rents are fully internalized. In this case, the government takes into account both downstream competitive effects and upstream profit considerations when formulating export policy, leading to systematic changes in the direction of the optimal policy. These findings indicate that the location of the upstream firm affects not only the allocation of rents but also fundamentally alters the incentive structure underlying strategic trade policy.

The analysis suggests that ignoring the location of upstream firms and the vertical market structure may result in misleading policy conclusions when evaluating the effects of export subsidies or export taxes. Future research may further endogenize the location choice of intermediate-good firms or incorporate cross-shareholding and competition among multiple upstream firms to better reflect actual industrial structures.

Although the model adopts linear demand and a one-to-one input requirement for tractability, the qualitative results are expected to remain unchanged as long as upstream market power persists. Similar qualitative results are expected to hold even when the upstream marginal cost is positive.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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