Strategic Trade Policy and Managerial Delegation in a Mixed Duopoly *

Fang Wei †

June, 2011

Abstract

This paper incorporates the separation of ownership and management as well as strategic trade policy when a home semipublic firm competes with a foreign private firm. We show that the presence of separation of ownership and management weakens the home government’s tariff imposition incentive and increases the home country’s welfare much more when increasing the weight on welfare of the semipublic firm. We further examine how the move advantage of the home government and firm owners affects their payoffs. It is shown that for the home government and firm owners, acting as the first mover yields a higher payoff than acting as the second mover. The optimal tariff rates in three cases (no delegation, government moves first, owners move first) are unambiguously determined when the home firm is nationalized, but dependent on the cost conditions when the home firm is privatized.

Keywords: strategic trade policy, managerial incentives, mixed duopoly

JEL Classification: C72, F13, L22, L32

*This work was financially supported by the Grants-in-Aid for Scientific Research, JSPS.
†The paper is very primitive.
‡Faculty of Economics and Business Administration, The University of Kitakyushu. E-mail address: fwei@kitakyu-u.ac.jp. Corresponding address: Kitagata 4-2-1, Kokuraminamiku, Kitakyushu City, Fukuoka Prefecture, Japan, 802-8577.
1 Introduction

In the traditional economic and industrial organization literature, firms were represented as pure profit maximizers. However, modern enterprises are characterized by the separation of ownership and management, which was first argued by Berle and Means (1932). Later on, a number of papers\textsuperscript{1} examined different objective functions to analyze firms’ optimal behavior; however, they focused on the internal organization of the firm and neglected the role of market structure. When the market is in imperfect competition, each firm’s managerial decision is dependent on the rival firm’s behavior. Early literature on analyzing the separation of ownership and management in the oligopolistic market was started by Vickers (1985) and stylized by Fershtman and Judd (1987) and Sklivas (1987) (the FJS model hereafter). They considered a two-staged model where, in the first stage, profit-maximizing owners offer compensation schemes to their managers and in the second stage, managers compete in quantities under precommitted compensation schemes. The FJS model clarified that delegating a manager with a distorted (nonprofit-maximizing) objective function causes the firm to yield a Stackelberg leader profit.

Recently, a few papers analyzed strategic managerial delegation involving international trade. Das (1997) applied an FJS-style delegation to a strategic trade policy model and clarified that managerial delegation reduces the scale of trade intervention in the quantity competition. Miller and Pazgal (2001) introduced the “relative performance” contract, which is a linear combination of own profit and the rival firm’s profit, to discuss the effects of traditional strategic trade policies. Wei (2008) reexamined the results of Das (1997) by focusing on the owner’s subsidy effect hidden in the managerial delegation process and indicated that managerial delegation induces the firm to act as though it were subsidized with an optimal government subsidy in Brander and Spencer (1985).

This paper incorporates the separation of ownership and management as well as strate-

\textsuperscript{1}See Baumol (1958), Simon (1964), Williamson (1964), etc.
gic trade policy into a home market model with a home semi-public firm. We apply the results of Chao and Yu (2006) and Chang (2009) and focus on the strategic relationship of home government and firm owners. On the basis of Brander and Spencer (1984), we examine two models considering the move timing of the home government and firm owners, that is, the model wherein the home government moves first and that wherein the firm owners move first. We elucidate that the presence of separation of ownership and management always weakens the home government’s tariff imposition incentive and increases the home country’s welfare, while reduces the foreign firm’s profit. We further investigate how the move advantage of the home government and firm owners affects their payoffs. It is shown that given the separation of ownership and management, when the home government moves first, the home country’s welfare increases, whereas when the firm owners move first, both firms’ profits increase. That is, for the home government and firm owners, acting as the first mover yields a higher payoff than acting as the second one. The owners’ incentives to delegate a manager are also verified in our examination of the model wherein the owners move first. Another important result in our paper is that the mutual relationship between the import tariff policy and managerial delegation is dependent on their move timing. When home government moves first, the tariff policy strengthens the own firm’s managerial delegation incentive. However, when owners move first, domestic firm’s managerial delegation weakens the government’s tariff imposition incentive.

The rest of the paper is organized as follows. Section 2 introduces the setup of the model. Sections 3 and 4 investigate two models considering the different timing of import tariff and managerial delegation decisions. Section 5 summarizes the equilibrium results in the three cases. The concluding remarks are summed in Section 6.
2 Model Setup

Following the home market model in Brander and Spencer (1984), we assume two countries in the world, a home country and a foreign country, labelled as H and F respectively. The home country has a semi-public firm and the foreign country has a private firm. Both firms produce a homogeneous product and competing à la Cournot in the home market. The home government imposes a specific tariff \( t \) to the foreign firm. Each firm has a constant unit cost \( c^0_i \) \((i = H, F)\). We assume that the cost addition satisfies \( c^0_F < c^0_H < a \).\(^2\)

Let \( q_i(i = H, F) \) denote the output produced by firm \( i \). We assume a linear inverse demand function in the home market throughout the paper:

\[
  p = P(Q) = a - q_H - q_F,
\]

where \( Q = q_H + q_F \) denotes the total output.

**Assumption 1** The home semi-public firm’s cost is not large enough, that is, \( c^0_H < \frac{a + c^0_F}{2} \).

Or, equivalently, \( 0 \leq \Delta c < \frac{1}{2} (a - c^0_F) \), where \( \Delta c := c^0_H - c^0_F \).

The above assumption ensures that the market demand is sufficiently large. The cost conditions for \( c^0_H \) and \( c^0_F \) are depicted in Figure 1.

Denote \( c_i \) as firm \( i \)’s effective (tax-inclusive) cost, i.e., \( c_H = c^0_H, c_F = c^0_F + t \). Firm \( i \)’s profit function is given by

\[
  \pi_i(q, c_i) = (P(Q) - c_i) q_i
\]

where \( q = (q_H, q_F) \) denotes the output profile.

The home country’s welfare is a sum of consumer surplus, home firm’s profit and tax.

\(^2\)Many papers adopted that the public firm is not efficient as the private firm.
Figure 1: Cost Conditions for $c_H^0$ and $c_F^0$

revenue.

$$W_H(q, t) = \int_0^Q P(z)dz - P(Q)Q + (P(Q) - c_H^0)q_H + tq_F$$

3 Case N: No Managerial Delegation: Chao and Yu (2006)

Let $k$ be the share of government’s ownership in the home semi-public firm. $k \in [0, 1]$ is exogenously given and regarded as the degree of nationalization of the home firm. The home firm maximizes a weighed average of home welfare and the firm’s profit.

$$U_H(q, t; k) = kW_H(q, t) + (1 - k)\pi_H(q, c_H^0)$$

The above objective function shows that when $k = 0$, the home firm is a purely public firm and when $k = 1$, the home firm is a totally private firm.
The first-order conditions for the home semi-public firm and foreign firm are given by

\[
0 = \frac{\partial U_H(q,t;k)}{\partial q_H} = P(Q) - c_H^0 + q_H P'(Q) - k Q P'(Q),
\]

\[
0 = \frac{\partial \pi_F(q,t)}{\partial q_F} = P(Q) - c_F^0 - t + q_F P'(Q).
\]

Under linear demand function, the second-order condition is held, i.e., \(\frac{\partial^2 U_H(q,c;k)}{\partial q_H^2} = (2 - k)P'(Q) < 0\). Denote \(R^H(q_F;k)\) as home semi-public firm’s, and \(R^F(q_H,t)\) as foreign firm’s reaction function, then firm \(i\)'s equilibrium output \(q^*_i(t,k) (i = H, F)\) should satisfy:

\[
q^*_H(t;k) = r^H(q^*_F(t;k);k)
\]

\[
q^*_F(t;k) = r^F(q^*_H(t;k),t),
\]

where \(r^H_q = -\frac{1-k}{2-k} < 0\), \(r^F_q = -\frac{1}{2} < 0\), \(r^H_k = \frac{Q}{2-k} > 0\) and \(r^F_t = -\frac{1}{2} < 0\). Figure 2 depicts the home and foreign firm’s reaction curve. Increasing \(k\) shifts the home reaction curve outward and increasing \(t\) shifts the foreign reaction curve downward.

Figure 2: Home and Foreign Firm’s Reaction Curve
Comparative statics results yield:

\[
\frac{\partial q_H^*(t; k)}{\partial t} = \frac{r^F q^H}{1 - r^H q^F} = \frac{1 - k}{(3 - k)} > 0
\]

\[
\frac{\partial q_F^*(t; k)}{\partial t} = \frac{r^F}{1 - r^H q^F} = \frac{2 - k}{(3 - k)} < 0
\]

\[
\frac{\partial q_H^*(t; k)}{\partial k} = \frac{r^H}{1 - r^H q^F} = \frac{2Q}{(3 - k)} > 0
\]

\[
\frac{\partial q_F^*(t; k)}{\partial k} = \frac{r^H q^F}{1 - r^H q^F} = -\frac{Q}{(3 - k)} < 0
\]

The import tariff always increases the home firm’s output and reduces the foreign firm’s output due to the strategic rent-shifting effect. The higher weight of welfare in the semi-public firm, the larger the home firm’s output and the lower the foreign firm’s output. That is because increasing the degree of nationalization makes the home firm produce more so as to lower the market price. The result has been verified in Chao and Yu (2006) with n foreign firms. The next two cases consider managerial delegation with different move advantage.

4 Case G: Government Moves First (Chang (2009))

We assume that each firm has one owner and one manager. Each owner designs an incentive contract to compensate its manager, which is expressed as a weighted-average combination of the firm’s profit and sales, as given in Fershtman and Judd (1987).

\[
M_i(q, \beta_i, c_i) = \beta_i \pi_i(q, c_i) + (1 - \beta_i)P(Q)q_i
\]

\[
= [P(Q) - \beta_i c_i] q_i, \tag{2}
\]

where \(\beta_i\) is the weight on the firm’s profit in the contract.
Note that $M_i$ does not represent a manager’s rewards in general. In fact, the manager is paid $A_i + B_i M_i$ for some constants $A_i$ and $B_i$, with $B_i > 0$. The owner must offer his/her manager a contract under which the participation constraint is satisfied, i.e., $A_i + B_i M_i = K$ such that $K$ equals the manager’s reservation income or opportunity cost and is a constant. Without loss of generality, we normalize $K$ to 0, i.e., $A_i + B_i M_i = 0$.

In view of (2), each firm faces an effective cost of $\beta_i c_i$ under managerial delegation. Comparing (2) to the pure profit function of (1), each firm acts as though it were subsidized (or taxed) by an amount equivalent to the cost difference between the actual effective cost $c_i$ and the managerial effective cost $\beta_i c_i$. Wei (2008) termed this effective cost difference as owner’s subsidy (or tax) equivalent of firm $i$, $\sigma_i$:

$$\sigma_i := c_i - \beta_i c_i = (1 - \beta_i) c_i.$$  \hspace{1cm} (3)

Note that $\sigma_i$ defined above does not represent the pecuniary subsidy outlays. It represents the nonpecuniary subsidy caused by the owner’s manipulated incentive contract designed in the delegation stage and captures the cost difference between the owner’s delegation and nondelegation behavior. Owing to the separation of ownership and management, the owner can divert the manager’s objective from strict profit maximization to attain the subsidization objective.

We adopt the owner’s subsidy equivalent approach in Wei (2008) in the rest of the paper. In view of the definition of $\sigma_i$ in (3), we rewrite (2) as follows:

$$M_i(q_i, c_i, \sigma_i) = [P(Q) - c_i + \sigma_i] q_i.$$  \hspace{1cm} (4)

Following Chang (2009), we first consider a three-staged game wherein the home gov-

---

4We regard $\sigma_i$ as the owner’s subsidy equivalent if $\sigma_i > 0$ and as the owner’s tax equivalent if $\sigma_i < 0$. 

8
ernment moves first. The timing of the game is as follows. In the first stage, the home
government sets the import tariff rate. In the second stage, each firm’s owner employs a
manager and decides its optimal contract. In the third stage, each manager determines its
production quantity competing à la Cournot. We solve the game by backward induction.

4.1 Output Stage Equilibrium

In view of (4), the managers decide their optimal outputs satisfying the following first order
condition (FOC hereafter):

\[ 0 = \frac{\partial M_i(q_i, c_i, \sigma_i)}{\partial q_i} = P(Q) + q_i P'(Q) - (c_i - \sigma_i). \]  

(5)

Denote \( \tilde{c}_i := c_i - \sigma_i \). Manager \( i \)'s reaction function is as follows:

\[ R^i(q_j, \tilde{c}_i) = \frac{1}{2}(a - q_j - \tilde{c}_i). \]

which shows that each firm’s optimal output is a strategic substitute for the other’s.

Solving for each firm’s optimal output yields

\[ q^*_i(\bar{c}) = \frac{1}{3}(a - 2\bar{c}_i + \bar{c}_j), \]

(6)

where \( \bar{c} = (\bar{c}_i, \bar{c}_j) \) denotes the effective cost profile under managerial delegation. Comparative
statics results show that managerial delegation expands the own firm’s best response
output and reduces the rival firm’s output.
4.2 Contract Stage Equilibrium

In the second stage, each owner decides $\sigma_i$ in the incentive contract to maximize the firm’s objective function. Because we assume that the cost of delegating a manager is zero, i.e., $A_i + B_i M_i = 0$, each owner acts to maximize its own objective function.

Evaluating the equilibrium output in (6) yields firm $i$’s objective function as follows:

$$U^*_H(\sigma, t; k) = kW_H(q^*_H(c - \sigma), q^*_F(c - \sigma), t) + (1 - k)\pi_H(q^*_H(c - \sigma), q^*_F(c - \sigma), c^0_H),$$

$$\pi^*_F(\sigma, t) = \pi_F(q^*_F(c - \sigma), q^*_H(c - \sigma), c^0_F + t)$$

where $\sigma = (\sigma_H, \sigma_F)$ denotes the owner’s subsidy equivalent profile.

The FOC for maximizing home semi-public firm’s objective function is given by

$$0 = \frac{\partial U^*_H(\sigma, t; k)}{\partial \sigma_H} = \frac{\partial U_H}{\partial q_H} \left( - \frac{\partial q^*_H}{\partial c_H} \right) + \frac{\partial U_H}{\partial q_F} \left( - \frac{\partial q^*_F}{\partial c_F} \right)$$

$$= [P(Q) - c_H + q_H P'(Q) - kQ P'(Q)] \left( - \frac{\partial q^*_H}{\partial c_H} \right) + [-kQ P'(Q) + kt + q_H P'(Q)] R^F_q \left( - \frac{\partial q^*_H}{\partial c_H} \right).$$

(7)

The FOC for maximizing foreign firm’s profit function is given by

$$0 = \frac{\partial \pi^*_F(\sigma, t)}{\partial \sigma_F} = \frac{\partial \pi_F}{\partial q_F} \left( - \frac{\partial q^*_F}{\partial c_F} \right) + \frac{\partial \pi_F}{\partial q_H} \left( - \frac{\partial q^*_H}{\partial c_F} \right)$$

$$= [P(Q) - c_F + q_F P'(Q)] \left( - \frac{\partial q^*_F}{\partial c_F} \right) + q_F P'(Q) R^H_q \left( - \frac{\partial q^*_F}{\partial c_F} \right)$$

(8)

Since $\frac{\partial q^*_F}{\partial c_F} \neq 0$, (7) and (8) yield

$$P(Q) - c_H + q_H P'(Q) - kQ P'(Q) + R^F_q [-kQ P'(Q) + kt + q_H P'(Q)] = 0$$

(9)

$$P(Q) - c_F + (1 + R^H_q) q_F P'(Q) = 0.$$  

(10)
In view of (5), (9) and (10) can be rewritten as below in the linear demand function.

\[-\sigma_H - \frac{3}{2}kQ^*(c - \sigma) - \frac{1}{2}[kt - q^*_H(c - \sigma)] = 0\]

\[-\sigma_F + \frac{1}{2}q^*_F(c - \sigma) = 0\]

Denote \(\gamma^H(\sigma_F, t; k)\) as home owner’s and \(\gamma^F(\sigma_H, t)\) as foreign owner’s reaction function. Depict the two owners’ reaction curves in Figure 3. The two reaction curves are downward sloping since \(\gamma^H_\sigma = -\frac{1-k}{4-k} < 0\) and \(\gamma^F_\sigma = -\frac{1}{4} < 0\). An increase in the degree of nationalization \(k\) always shifts the home reaction curve outward. That is, the public firm strengthens the owner’s subsidy incentive to increase the output, i.e., \(\gamma^H_k = \frac{3(3a-2c^0_F-c^0_F+\sigma_F-5t)}{(4-k)^2} > 0\) without government intervention. The import tariff always shifts the foreign reaction curve downward as \(\gamma^F_t = -\frac{1}{2} < 0\), but the effect to the home reaction curve is dependent on the value of \(k\) as \(\gamma^H_t = \frac{1-4k}{4-k}\) is positive if \(k < 1/4\) and negative if \(k > 1/4\). When the degree of nationalization is large enough, an increase in the import tariff shifts the home reaction curve inward since reducing the home firm’s subsidization incentive expands the foreign firm’s output.

![Diagram](image-url)
The optimal owner’s subsidy equivalent is derived as follows:

\[
\sigma_H^e(t; k) = \frac{(1-k)(a-3c_H^0+2c_F^0+2t)+4k(a-c_H^0-t)}{5-k},
\]

\[
\sigma_F^e(t; k) = \frac{(1-k)(a-3c_F^0-3t+2c_H^0)+k(2c_H^0-2c_F^0-t)}{5-k}.
\]

In the presence of semi-public firm, the optimal owner’s subsidy equivalent is always positive without government intervention.

The comparative statics results yield the following:

\[
\frac{\partial \sigma_H^e(t; k)}{\partial t} = \frac{2(1-3k)}{5-k}, \quad \frac{\partial \sigma_F^e(t; k)}{\partial t} = -\frac{(3-2k)}{5-k} < 0.
\]

\[
\frac{\partial \sigma_H^e(t; k)}{\partial k} = \frac{4(4a-2c_H^0-2c_F^0-7t)}{(5-k)^2} > 0, \quad \frac{\partial \sigma_F^e(t; k)}{\partial k} = -\frac{4a-2c_H^0-2c_F^0-7t}{(5-k)^2} < 0
\]

An increase in the import tariff rate makes the foreign firm less efficient due to the increase in marginal cost. Thus, the foreign owner has a weaker subsidization incentive as indicated by de Meza (1986). However, the effect to the home semi-public firm is dependent on the degree of nationalization. When \(k\) is large is enough, the home firm concerns more on the home welfare which includes the consumer surplus and tax revenue. The home owner’s subsidization incentive becomes weaker to expand the foreign firm’s output to improve the home welfare.

The resulting second-stage equilibrium output can be rewritten as \(q_i^e(t; k) = q_i^*\left(c - \sigma^e(t; k)\right)\).

\[
q_H^e(t; k) = \frac{2(a-3c_H^0+2c_F^0+2t)+k(2a-2c_F^0-5t)}{5-k},
\]

\[
q_F^e(t; k) = \frac{2(a+2c_H^0-3c_F^0-3t)-2k(a-c_F^0-2t)}{5-k}.
\]

Differentiating with respect to \(t\) yields \(\frac{\partial q_i^e(t; k)}{\partial t} = \frac{4-5k}{5-k}\) and \(\frac{\partial q_i^e(t; k)}{\partial t} = \frac{4k-6}{5-k} < 0\). An increase
in the import tariff rate always reduces foreign product, increases domestic production if the degree of nationalization is not large enough. In the case of public firm, an increase in the import tariff reduces the public firm’s output. Correspondingly, the resulting total output can be rewritten as $Q^e(t; k) = q^e_H(t; k) + q^e_F(t; k)$.

### 4.3 Tariff Stage Equilibrium

The home country’s welfare function is defined as the sum of the consumer surplus, home firm’s profit, and tax revenue.

$$W_H(t; k) = CS(Q^e(t; k)) + \pi_H(q^e_H(t; k), q^e_F(t; k), c^0_H) + tq^e_F(t; k),$$

where $CS(Q) = \int_0^Q P(z)dz - P(Q)Q$ denotes the home country’s consumer surplus.

Differentiating with respect to $t$ yields

$$0 = \frac{\partial W_H(t; k)}{\partial t} = -q_F \left( \frac{\partial P(Q^e)}{\partial t} - 1 \right) + (p - c_H) \frac{\partial q^e_H}{\partial t} + t \frac{\partial q^e_F}{\partial t} \tag{13}$$

The first item in (13) captures the terms-of-trade effect that if the tariff raises the market price higher than the tariff, it decreases domestic welfare. The second item shows the resource allocation effect that imposing import tariff increases the domestic firm’s output and thus increases domestic welfare. The third item reflects the tariff revenue effect.

Comparing (13) to the home government’s import tariff incentive in Brander and Spencer (1984), the second effect is weakened because managerial delegation expands production and leads to a decrease in marginal revenue. More directly, in the absence of separation of ownership and management, $p - c_H = -q_H P'(Q)$ wherein marginal revenue equals the effective cost. However, in the presence of separation of ownership and management as well as semi-public firm, $p - c_H = -q_H P'(Q) - \sigma_H$, wherein marginal revenue
equals the owner’s subsidy equivalent inclusive cost. Because the second effect is weakened, the home government has a weaker incentive to tax the imports under managerial delegation.

The optimal tariff

\[ t^G = \frac{(1-k)(10-9k)(a - c^0_H) + (4k^2 - 8k + 10)(c^0_H - c^0_F)}{40 - 44k + 17k^2} > 0, \]

is positive since \(4k^2 - 8k + 10 > 0\) and \(40 - 44k + 17k^2 > 0\) if \(k \in [0, 1]\).

The superscript \(G\) denotes the results under Case G. The equilibrium tariff is positive, but lower than the one in Brander and Spencer (1984), i.e., \(t^N = \frac{1}{3}(a - c^0_F)\).

Solving for the owner’s subsidy equivalent in equilibrium yields

\[ \sigma^G_{H} = \sigma^e_{H}(t) = \frac{(12 - 2k + 3k^2)(a - 2c^0_H + c^0_F) + 7k(2 - k)(c^0_H - c^0_F)}{40 - 44k + 17k^2} > 0, \]

\[ \sigma^G_{F} = \sigma^e_{F}(t) = \frac{(2 - k - k^2)(a - c^0_F) + (16 - 21k + 10k^2)(c^0_H - c^0_F)}{40 - 44k + 17k^2} > 0. \]

\[ q^G_{H} = \frac{(24 - 22k + 11k^2)(a - 2c^0_H + c^0_F) + k(8 - 3k)(c^0_H - c^0_F)}{40 - 44k + 17k^2} > 0, \]

\[ q^G_{F} = \frac{(2 - k - k^2)(a - c^0_F) + (16 - 21k + 10k^2)(c^0_H - c^0_F)}{40 - 44k + 17k^2} > 0. \]

In view of the owner’s subsidy equivalent, which promotes the foreign firm’s exports, the effective tariff rate to the foreign firm can be defined as below.

\[ T^G := t^G - \sigma^G_{F} = \frac{(5k - 4)[(2k - 2)a + (4 - 3k)c^0_H + (k - 2)c^0_F]}{40 - 44k + 17k^2} \]

Define \(A \overset{\text{def}}{=} (2k - 2)a + (4 - 3k)c^0_H + (k - 2)c^0_F\). Note that \(A\) is increasing with \(k\) since \(2a - 3c^0_H + c^0_F = 2(a - 2c^0_H + c^0_F) + (c^0_H - c^0_F) > 0\). However, when \(k = 0\), \(A < 0\) and when \(k = 1\), \(A > 0\), so the sign of \(A\) is ambiguous. When \(k\) is large enough, \(t^G > \sigma^G_{F}\) and when \(k\) is small enough, the opposite result holds. The effective tariff rate to the foreign firm is
dependent on the degree of home firm’s nationalization.

The equilibrium outputs are summarized in Table 1 when $k = 0$. Under a symmetric cost function, the home firm’s output increases and the foreign firm’s output decreases compared to the case without managerial delegation in Brander and Spencer (1984). The intuition can be explained as follows. Since import tariff strengthens the home firm’s subsidization incentive when $k = 0$, it leads to a further increase in home production. Although the effective tariff rate is lower when compared to that in Brander and Spencer (1984) when $k = 0$, the foreign firm does not expand its output because the expansion leads to a lower market price and reduces its profit. Thus, the foreign firm’s output decreases.

5 Case O: Owners Move First

Next, consider the case when the owners move first against home government. The timing of the game is as follows. In the first stage, the owners determine their optimal incentive contracts. In the second stage, the home government sets the import tariff rate, and the third stage is the same as Case T in the previous section.

5.1 Tariff Stage Equilibrium

The equilibrium output in the third stage is the same as $q^*_t(c)$ as in Case G. The home country’s welfare function is rewritten as follows.

$$W_H(t, \sigma) = CS(Q^*(c-\sigma)) + \pi_H(q^*_H(c-\sigma), q^*_F(c-\sigma), c^0_H) + tq^*_F(c-\sigma)$$
The FOC in the tariff stage yields
\[
\frac{\partial W_H(t, \sigma)}{\partial t} = -q_F \left( \frac{\partial P(Q^*)}{\partial \bar{c}_F} \right) - 1 + (p - c_H) \frac{\partial q_H^*}{\partial \bar{c}_F} + t \frac{\partial q_F^*}{\partial \bar{c}_F} \\
= -q_F P'(Q) \frac{\partial q_F^*}{\partial \bar{c}_F} - (QP'(Q) + \sigma_H) \frac{\partial q_H^*}{\partial \bar{c}_F} + q_F + t \frac{\partial q_F^*}{\partial \bar{c}_F}. 
\]

Denote the equilibrium tariff rate in the second stage as \( t^e(\sigma) \):
\[
\begin{align*}
  t^e(\sigma) &= q_F P'(Q) + QP'(Q) \bar{r}_q^H + \sigma_H - \frac{q_F}{\partial q_F^*/\partial \bar{c}_F} \\
  &= \frac{1}{3} (a - \sigma_H + \sigma_F - c_F^0) 
\end{align*}
\]

Note that in the absence of separation of ownership and management, \( t^e(0, 0) = t^N \). Comparative statics results show that the home firm’s managerial delegation reduces the equilibrium import tariff rate since managerial delegation expands the home firm’s production and weakens its resource allocation effect. However, the foreign firm’s managerial delegation increases the equilibrium import tariff rate since the expansion of foreign production strengthens the tariff revenue effect.

Comparing to the comparative statics results in (11), the mutual relationship between the import tariff policy and managerial delegation is dependent on their move timing. When home government moves first in Case T, the tariff policy strengthens the home owner’s subsidization incentive. However, when owners move first, home managerial delegation weakens the home government’s tariff imposition incentive.

**Proposition 1** When the home government moves first, the tariff policy is a complement to managerial delegation. When owners move first, managerial delegation is a substitute for the tariff policy.

Since \( \bar{c}_H(\sigma_H) = c_H^0 - \sigma_H \) and \( \bar{c}_F(\sigma) = c_F^0 - \sigma_F + t^e(\sigma) \), the equilibrium output can
be rewritten as $q^*_i(\sigma) = q^*_i(\tilde{c}_H(\sigma_H), \tilde{c}_F(\sigma))$. Differentiating with respect to $\sigma_k(k = H, F)$ yields

\[
\frac{\partial q^*_i(\sigma)}{\partial \sigma_H} = - \frac{\partial q^*_i(\tilde{c})}{\partial \tilde{c}_H} + \frac{\partial q^*_i(\tilde{c})}{\partial \tilde{c}_F} \frac{\partial \tau^e(\sigma)}{\partial \sigma_H}, \\
\frac{\partial q^*_i(\sigma)}{\partial \sigma_F} = - \frac{\partial q^*_i(\tilde{c})}{\partial \tilde{c}_F} \left(1 - \frac{\partial \tau^e(\sigma)}{\partial \sigma_F}\right).
\]

The owner’s managerial delegation affects the equilibrium output in two ways: the direct effect and the indirect effect through tariff imposition. Due to the latter indirect effect, the managerial delegation of both, the home firm and the foreign firm, makes the output change smaller compared to the case without government intervention in Fershtman and Judd (1987). This is because, in view of (14), the home owner’s managerial delegation weakens the home government’s incentive to levy a tariff. Such a negative effect does not lead to either a substantial increase in the home firm’s production or a substantial decrease in the foreign firm’s production. The corresponding intuitions also apply to the foreign firm’s managerial delegation.

5.2 Contract Stage Equilibrium

Each firm’s profit function in the first stage is rewritten as follows:

\[
U^e_H(\sigma; k) = U_H(q^e_H(\sigma), q^e_F(\sigma), \tau^e(\sigma); k) \\
\pi^e_F(\sigma) = \pi_F(q^e_F(\sigma), q^e_H(\sigma), \tau^e(\sigma)).
\]

For the home semi-public firm, the FOC is given by

\[
\frac{\partial U^e_H(\sigma; k)}{\partial \sigma_H} = \frac{\partial U_H}{\partial q^e_H} \frac{\partial q^e_H}{\partial \sigma_H} + \frac{\partial U_H}{\partial q^e_F} \frac{\partial q^e_F}{\partial \sigma_H} + \frac{\partial U_H}{\partial \tau} \frac{\partial \tau^e(\sigma)}{\partial \sigma_H} \tag{15}
\]

\(^{5}\)The second order conditions for both firms are satisfied, i.e., $\frac{\partial^2 \pi^e_H}{\partial \sigma_H^2} = \frac{\partial^2 \pi^e_F}{\partial \sigma_F^2} = -\frac{40}{81} < 0$. 

17
The above FOC can also be decomposed into three effects. The first item in (15) shows the excess competition effect. The second item represents the marginal gain due to the rent-shifting effect. The third item shows the home welfare loss due the import tariff imposition.

The optimal owner’s subsidy equivalent for the home firm can be derived as follows:

$$\sigma^O_H = \frac{(9a - 13c^0_H + 4c^0_F)(2 + 7k)}{178 - 97k}.$$  

The domestic owner’s subsidy equivalent is positive, i.e., $$\sigma^O_H > 0$$ in view of Assumption 1. That is, the weighed-average payoff gain outweighs the loss through home managerial delegation. The equilibrium value maybe lower or higher than that in case T wherein the owners play Stackelberg followers to the home government, which is dependent on the following cost condition.

For the foreign firm, the FOC is given by

$$\frac{\partial \pi^e_F(\sigma)}{\partial \sigma_F} = \frac{\partial \pi_F}{\partial q_F^e} \frac{\partial q_F^e}{\partial \sigma_F} + \frac{\partial \pi_F}{\partial q_H^e} \frac{\partial q_H^e}{\partial \sigma_F} + \frac{\partial \pi_F}{\partial t^e} \frac{\partial t^e}{\partial \sigma_F}$$

$$= -\frac{\partial q_F^e}{\partial \sigma_F} + q_F P'(Q) \frac{\partial q_H^e}{\partial \sigma_F} - q_F \frac{\partial t^e}{\partial \sigma_F},$$

where the first two items show the negative excess competition effect and the positive rent-shifting effect as in the FOC for the home firm. However, there is a third item, which shows the profit loss due to tariff imposition. Managerial delegation expands the firm’s production and thus increases its tariff expenses.

The optimal foreign firm’s owner’s subsidy equivalent can be derived as follows:

$$\sigma^O_F = -\frac{2(1-k)(2a + 7c^0_H - 9c^0_F) + 9k(c^0_H - c^0_F)}{178 - 97k} < 0$$

The foreign firm’s owner’s subsidy equivalent is negative, i.e., $$\sigma^O_F < 0$$. Managerial dele-
gation not only expands the production but also increases the tariff expenses; the sum of the profit loss outweighs the profit gain. Therefore, foreign owner has tax incentives in its managerial contract to reduce production.

**Proposition 2** The foreign firm’s owner’s subsidy equivalent is negative, i.e., \( \sigma_F^O < 0 \) if owners play Stackelberg leaders against the home government.

The equilibrium government tariff is given by

\[
t_O = \frac{4[(1-k)(13a + c_H^0 - 14c_F^0) + 9k(c_H^0 - c_F^0)]}{178 - 97k} > 0.
\]

Needless to say that \( t_O > \sigma_F^O \). The effective tariff rate to the foreign firm is as follows.

\[
T_O := t_O - \sigma_F^O = \frac{(56a + 18c_H^0 - 74c_F^0)(1-k) + 45k(c_H^0 - c_F^0)}{178 - 97k}
\]

Because the foreign firm’s owner designs a tax equivalent contract, effective tariff rate which includes owner’s subsidy equivalent, is higher than the one in Case T, i.e., \( T_O > T^G \).

The equilibrium outputs are summarized in Table 1 when \( k = 0 \). Under the symmetric cost function, the home firm’s output increases and the foreign firm’s output decreases compared to those in the absence of separation of ownership and management in Brander and Spencer (1984). The intuition behind is that although the home firm’s managerial delegation weakens the government’s tariff incentive, managerial delegation effects outweigh the tariff effects to the home production. Thus, home production increases further. Meanwhile, the foreign owner’s tax equivalent effects outweigh the tariff effects, and foreign production decreases.
6 Summary

6.1 Optimal Tariff Result under Privatization when $k = 0$

We summarize the equilibrium results of government tariff, owner’s subsidy equivalent, individual output and total output in the three cases in the following tabular. Case N is the model in Brander and Spencer (1984) without managerial delegation.

<table>
<thead>
<tr>
<th>Case</th>
<th>Owners Move First (Case O)</th>
<th>Gov. Moves First (Case G)</th>
<th>No Delegation (Case N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t$</td>
<td>$\frac{7}{89}(13a + c_H^0 - 14c_F^0)$</td>
<td>$\frac{1}{4}(a - c_F^0)$</td>
<td>$\frac{1}{4}(a - c_F^0)$</td>
</tr>
<tr>
<td>$\sigma_H$</td>
<td>$\frac{1}{89}(9a - 13c_H^0 + 4c_F^0)$</td>
<td>$\frac{7}{10}(a - 2c_H^0 + c_F^0)$</td>
<td>$\frac{7}{10}(a - 2c_H^0 + c_F^0)$</td>
</tr>
<tr>
<td>$\sigma_F$</td>
<td>$\frac{1}{89}(2a + 7c_H^0 - 9c_F^0)$</td>
<td>$\frac{7}{10}(a + 8c_H^0 - 9c_F^0)$</td>
<td>$\frac{7}{10}(a + 8c_H^0 - 9c_F^0)$</td>
</tr>
<tr>
<td>$q_H$</td>
<td>$\frac{1}{89}(9a - 13c_H^0 + 4c_F^0)$</td>
<td>$\frac{7}{10}(a - 2c_H^0 + c_F^0)$</td>
<td>$\frac{7}{10}(a - 2c_H^0 + c_F^0)$</td>
</tr>
<tr>
<td>$q_F$</td>
<td>$\frac{1}{89}(2a + 7c_H^0 - 9c_F^0)$</td>
<td>$\frac{7}{10}(a + 8c_H^0 - 9c_F^0)$</td>
<td>$\frac{7}{10}(a + 8c_H^0 - 9c_F^0)$</td>
</tr>
<tr>
<td>$Q$</td>
<td>$\frac{1}{89}(53a - 37c_H^0 - 16c_F^0)$</td>
<td>$\frac{1}{10}(7a - 4c_H^0 - 3c_F^0)$</td>
<td>$\frac{1}{10}(5a - 3c_H^0 - 2c_F^0)$</td>
</tr>
</tbody>
</table>

Table 1: Equilibrium Results when $k = 0$

In view of the equilibrium tariff rate results, we have the following proposition.

**Proposition 3** $t^N > t^O > t^G$ holds under Assumption 1 when $k = 0$.

That is, when the home firm is privatized, the presence of managerial delegation always weakens the importing country’s tax incentive; therefore, the optimal tariff rate in Case N is the highest. With managerial delegation, when the owners move first against home government, the government sets the tariff rate without considering its effects on the firms’ managerial delegation decisions. Thus, the optimal tariff rate under Case O is higher than the one under Case G.

**Proposition 4** $t^N > t^O > t^G > 0$ holds under Assumption 1 when $k = 0$.

6.2 Optimal Tariff Result under nationalization when $k = 1$

When $k = 1$, the corresponding results are summarized in the following tabular.

In view of the equilibrium tariff rate results, we have the following proposition.
\[ k = 1 \]

<table>
<thead>
<tr>
<th>t</th>
<th>Owners Move First (Case O)</th>
<th>Gov. Moves First (Case G)</th>
<th>No Delegation (Case N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t )</td>
<td>( \frac{2}{5}(c_H^0 - c_F^0) )</td>
<td>( \frac{2}{13}(c_H^0 - c_F^0) )</td>
<td>( \frac{1}{3}(c_H^0 - c_F^0) )</td>
</tr>
<tr>
<td>( \sigma_H )</td>
<td>( \frac{1}{5}(9a - 13c_H^0 + 4c_F^0) )</td>
<td>( \frac{1}{13}(13a - 19c_H^0 + 6c_F^0) )</td>
<td>-</td>
</tr>
<tr>
<td>( \sigma_F )</td>
<td>( -\frac{1}{5}(c_H^0 - c_F^0) )</td>
<td>( \frac{2}{13}(c_H^0 - c_F^0) )</td>
<td>-</td>
</tr>
<tr>
<td>( q_H )</td>
<td>( \frac{1}{5}(9a - 13c_H^0 + 4c_F^0) )</td>
<td>( \frac{1}{13}(13a - 21c_H^0 + 8c_F^0) )</td>
<td>( a - c_H^0 )</td>
</tr>
<tr>
<td>( q_F )</td>
<td>( \frac{4}{5}(c_H^0 - c_F^0) )</td>
<td>( \frac{4}{13}(c_H^0 - c_F^0) )</td>
<td>( a - c_H^0 )</td>
</tr>
<tr>
<td>( Q )</td>
<td>( a - c_H^0 )</td>
<td>( \frac{1}{13}(13a - 11c_H^0 - 2c_F^0) )</td>
<td>( \frac{1}{3}(3a - 2c_H^0 - c_F^0) )</td>
</tr>
</tbody>
</table>

Table 2: Equilibrium Results when \( k = 1 \)

**Proposition 5** \( t^G > t^O > t^N > 0 \) when \( k = 1 \).

That is, when the home firm is nationalized, the presence of managerial delegation always strengthens the importing country’s tax incentive; therefore, the optimal tariff rate in Case N is the lowest. With managerial delegation, when the owners move first against home government, the government sets the tariff rate without considering its effects on the firms’ managerial delegation decisions. Thus, the optimal tariff rate under Case O is lowerer than the one under Case G.

**Proposition 6** In the symmetric cost function, \( t^G = t^O = t^N = 0 \). The domestic produces under marginal cost pricing and the foreign firm does enter the market.

### 6.3 Profit and Welfare Analysis under the Symmetric Cost Condition

When the home firm is privatized, the equilibrium profit results yield \( \pi_H^O > \pi_H^N > \pi_H^G \) and \( \pi_F^N > \pi_F^O > \pi_F^G \) under the symmetric cost condition. The home firm yields the largest profit under Case O wherein the owners move first. The foreign firm yields the largest profit under Case N without managerial delegation. Thus, the presence of separation of ownership and management reduces the foreign firm’s profit.

Since consumer capture a large portion of home country’s welfare, total output result \( Q^G > Q^O > Q^N \) leads to home country’s welfare ranking as \( W^G > W^O > W^N \). Home
country yields the highest welfare under case G wherein home government moves first and the lowest welfare under Case N without managerial delegation.

Summarizing the above results, we get:

**Proposition 7** The presence of separation of ownership and management increases the home country’s welfare and reduces the foreign firm’s profit.

Furthermore, it is shown that the move advantage of the home government and firm owners affects their payoffs. Given the separation of ownership and management, when the home government moves first, the home country’s welfare improves, whereas when the firm owners move first, both home and foreign firms’ profits increase.

**Proposition 8** Given the separation of ownership and management, acting as the first mover yields a higher payoff for the home government and firm owners than acting as the second one.

7 Concluding Remarks

This paper examines the government’s import tariff policy with the separation of ownership and management in a home market model. We focus on the move timing of the government and firm owners and elucidate that acting as a Stackelberg leader mover leads to the higher payoff in view of the strategic behaviors of government and owners. We also find that the mutual relationship between the import tariff policy and managerial delegation is dependent on their move timing. When home government moves first, the tariff policy works as a complement to managerial delegation. However, when owners move first, managerial delegation works as a substitute for the tariff policy.

The analysis can be extended to some more complicated games that the two firms move successively against the home government. Furthermore, we do not consider the foreign
country’s trade policy in this paper. If foreign country, for example, subsidizes its exports, both owners’ managerial delegation incentives are affected. These additional analyses are left for future research.

REFERENCE


