Tariff Setting under Incomplete Information and Lobbying as Signals∗

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August 16, 2011

Abstract

This paper considers the effects of firms’ lobbying activities on the domestic government’s tariff setting in the case where there exists asymmetric information between firms and the government about the competitiveness of domestic or foreign firms. Under the existence of asymmetric information, firms’ lobbying activities play a role of signals about their private information to the government. As a result, if domestic or foreign firms’ marginal costs are small, domestic firms pay more contributions and make the domestic government set higher tariff levels. Additionally, we show that the amount of contributions from domestic firms under incomplete information compared to that under complete information depends on the government’s bargaining power in the lobbying negotiation.

JEL Classification: D82, F12

Key Words: Lobbying, Duopolistic Competition, Tariff Setting, Incomplete Information

∗All errors are mine.
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1 Introduction

As shown in earlier studies about trade policies, it is well known that free trade is the best international trade policy for small open economies from the viewpoint of social welfare. However, in fact, almost all the countries take somewhat protectionism and it is very difficult to realize a free trade system completely. Some theories about trade policies have been newly developed in the last one or two decades in order to explain the differences between practice and theory, and one of these theories is the political economic analysis of trade policies. This analysis includes various approaches and we intend to focus on one of them, which is the political contribution approach suggested by Grossman and Helpman (1994).\textsuperscript{1} They analyzed the effects of endogenous firms’ lobbying activities on domestic government’s trade policy decisions and clarified why almost all the countries continue to practice some kind of protective trade policies that benefit domestic industries. Our motivation is to consider, with this approach, what effects firms’ lobbying activities for the domestic government’s trade policy decisions have under the existence of asymmetric information between firms and the government.

A considerable amount of researches have been conducted in order to analyze the implications of incomplete information for strategic trade policy.\textsuperscript{2} Some of these researches are about export subsidies (or export tariff setting), and the others are about import tariff setting. Brander and Spencer (1985) analyzes the oligopolistic industries under complete information and shows that each government gives more subsidies to the domestic firm in order to enhance its profits when its firm is more competitive. Collie and Hviid (1993) analyzes their oligopolistic model under incomplete information and shows that the amount of subsidies that the government gives the domestic firm plays a role of signals about the competitiveness of its firm. That is, the government gives more subsidies to the domestic firm when its firm is more competitive. Whereas, Brander and Spencer (1984) analyzes the duopolistic industries under complete information and shows that each government sets the import tariff irrespective of the domestic firm’s competitiveness. Collie and Hviid (1999) analyzes their duopolistic model under incomplete information and shows that the import tariff level which the government imposes plays a role of signals about the uncompetitiveness of the domestic firm. That is, the government sets a higher import tariff level when the domestic firm is less competitive.

This paper considers the effects of firms’ lobbying activities for the domes-

\begin{footnotesize}
\textsuperscript{1}Literature reviews on these approaches can be found in detailed surveys conducted by Hillman (1989), Rodrik (1995), and Helpman (1996).

\textsuperscript{2}The literature on strategic trade policy is briefly surveyed by Brander (1995).
\end{footnotesize}
tic government’s tariff setting under the situation where there exists asymmetric information between the firms and the government. Under incomplete information, the amount of firms’ political contributions paid to the local government plays a role of signals about their competitiveness to the government. Generally, politicians tend to protect the domestic industry which is less competitive than that of other countries. For example, in Japan, agricultural industries have strong influences on the agricultural administration. Therefore, it is difficult for Japanese government to open up their agricultural markets to foreign countries whose agricultural industries are more competitive than those of Japan. Meanwhile, politicians sometimes intend to protect certain industries which are relatively competitive. For example, in Korea and India, textile industries have enough competitiveness but their governments impose a tariff of high level on imported goods. Using our political-economic model, we show that domestic firms pay more contributions and make the domestic government set higher tariff levels, if domestic or foreign firms are more competitiveness in costs.

The remainder of this paper is organized as follows. Section 2 presents the basic formulation of the model. In Section 3, we analyze the situation where both the domestic firm and its government have complete information about foreign firm’s production costs. In Section 4, we analyze the situation where the domestic firm has the information about its or foreign firm’s production costs, but its government is not entirely informed this information. Section 5 summarizes our main conclusions.

2 The Model

We formulate the model based on the works of Brander and Spencer (1983). We consider an duopolistic competitive environment in which each market is segmented. There are two countries; \( i = \{A, B\} \). Here, \( A \) means the home country and \( B \) means the foreign country.

The meanings of the main notations are as follows: \( x_i \) is the quantity of the goods supplied by country \( i \)’s firm in country \( A \)’s market, \( P \) is the equilibrium price of the duopolistically supplied goods in the domestic market, and \( x \) denotes the total sales of these goods in this market; therefore, \( x = x_A + x_B \). The inverse demand function of these goods in the home country’s market is represented as follows:

\[
P = \alpha - x,
\]

(1)

where \( \alpha \) means the home country’s market size.
We consider the case where the domestic and foreign firms only own their private information about domestic firm’s marginal costs $c_A$ or foreign firm’s marginal costs $c_B$. In such a case, the domestic firm’s marginal costs are either high (say, $c_A^H$) or low (say, $c_A^L$), and our analysis is restricted to the case where $c_A^H > c_A^L$. Likewise, the foreign firm’s marginal costs are either high (say, $c_B^H$) or low (say, $c_B^L$), and we assume that $c_B^H > c_B^L$. Which type of costs is actually realized is known by both firms, but the domestic government does not have this information.

We consider the following four stage noncooperative game under incomplete information.

0 Nature decides the type of domestic firm’s marginal costs $c_A \in \{c_A^H, c_A^L\}$ or foreign firm’s marginal costs $c_B \in \{c_B^H, c_B^L\}$.

1 Country A’s firm proposes its contribution schedule $C_A(c_A, c_B, t)$ to the home country’s government.

2 Country A’s government determines its specific tariff level $t$ imposed on imported goods.

3 Both domestic and foreign firms simultaneously determine the Cournot-Nash output levels.

For simplicity, we assume that the foreign government does not impose any tariffs on imported goods and the foreign firm does not engage in any lobbying activities.

3 Lobbying under Complete Information

First, we consider the game where both firms and governments have all information about each firm’s marginal costs. It is possible to solve this game using backward inductions. Here, the equilibrium concept of this game is Subgame-Perfect Nash Equilibrium.

Country A’s government imposes the specific tariff $t$ on the imported goods. This tariff is simply added to foreign firm’s marginal costs, so the effective marginal costs of exports from country B to country A become $c_B + t$. Therefore, we can represent the profits made by each country’s firm.
in country A’s market as follows:

\[
\pi_A(c_A, c_B, t) = [P(c_A, c_B, t) - c_A]x_A(c_A, c_B, t)
= [\alpha - x(c_A, c_B, t) - c_A]x_A(c_A, c_B, t), \quad (2)
\]

\[
\pi_B(c_A, c_B, t) = [P(c_A, c_B, t) - c_B - t]x_B(c_A, c_B, t)
= [\alpha - x(c_A, c_B, t) - c_B - t]x_B(c_A, c_B, t). \quad (3)
\]

We can solve the Cournot-Nash equilibrium output levels from these equations,

\[
x_A(c_A, c_B, t) = \frac{\alpha - 2c_A + c_B + t}{3}, \quad (4)
\]

\[
x_B(c_A, c_B, t) = \frac{\alpha + c_A - 2c_B - 2t}{3}. \quad (5)
\]

Substituting them into equations (2) and (3), we can easily obtain the domestic firm’s profits earned in country A’s market,

\[
\pi_A(c_A, c_B, t) = \left[ x_A(c_A, c_B, t) \right]^2 = \frac{(\alpha - 2c_A + c_B)^2}{9} + \frac{2(\alpha - 2c_A + c_B)}{9} t + \frac{1}{9} t^2. \quad (6)
\]

We assume that all tariff revenues are equally distributed to the domestic consumers and their preferences are quasi-linear, then home country’s welfare is represented as follows:

\[
W_A(c_A, c_B, t) = CS_A(c_A, c_B, t) + \pi_A(c_A, c_B, t) + t \cdot x_B^A(c_A, c_B, t), \quad (7)
\]

where \(CS_A\) is home country’s consumer surplus and \(\pi_A\) is the profits of country A’s firm. We represent the domestic firm’s profits earned by exporting to country B as \(\pi_B^A\), then \(\pi_A = \pi_A^A + \pi_B^A\). By above equation, we can calculate country A’s welfare as follows:

\[
W_A(c_A, c_B, t) = \frac{2\alpha^2 + 3c_A^2 - 4\alpha c_A - 2c_A c_B + c_B^2}{6} + \frac{(\alpha - c_B)}{3} t - \frac{1}{2} t^2 + \pi_B^A(c_A, c_B), \quad (8)
\]

where the last term is independent of \(t\). Solving the first-order condition with respect to the tariff level, we obtain the optimal tariff level,

\[
t^*(c_B) = \frac{\alpha - c_B}{3}. \quad (9)
\]
From equation (9), we can confirm that $t^*$ is independent of the home firm’s marginal costs. We denote the domestic firm’s and government’s reservation payoff by $V_A^0(c_A, c_B) = \pi_A(c_A, c_B, t^*)$ and $G_A^0(c_A, c_B) = W_A(c_A, c_B, t^*)$, respectively.

When organized lobbies pay campaign contributions to politicians, country A’s government has the following two concerns: (i) social welfare and (ii) gathering support for the purpose of holding their office. Therefore, the government’s objective function can be represented as follows:

$$G_A(c_A, c_B, t) = W_A(c_A, c_B, t) + \beta \cdot C_A(c_A, c_B, t), \quad \beta \geq 0. \quad (10)$$

Substituting $C(c_A, c_B, t) = \pi_A(c_A, c_B, t) - V_A^0(c_A, c_B)$ into equation (10) and maximizing this objective function with respect to $t$, we can solve the home country’s equilibrium tariff level under complete information as follows:

$$t^P(c_A, c_B) = \frac{(2\beta + 3)\alpha - 4\beta c_A - (3 - 2\beta)c_B}{9 - 2\beta}. \quad (11)$$

Here, we restrict that the weight for campaign contributions $\beta$ is smaller than $\frac{1}{2}$ in order to ensure inner Cournot-Nash equilibrium solutions for any marginal costs of both firms.

The domestic industry makes use of campaign contributions for the sake of protectionism trade policies. By following Maggi and Rodriguez-Clare (1998), the firm’s contribution schedule is simply determined according to its bargaining power in the lobbying negotiation between the government and the industry.

The net payoff of the domestic industry is equal to its total profits across markets minus the campaign contributions given to the local government; therefore,

$$V_A(c_A, c_B, t) = \pi_A(c_A, c_B, t) - C_A(c_A, c_B, t). \quad (12)$$

If the government does not possess its bargaining power at all, then the contribution schedule of the firm is customized so that campaign contributions leave the government with its reservation payoff $G_A^0$; therefore, we can obtain the minimum campaign contributions as

$$C_A^{\text{min}}(c_A, c_B, t^P) = \frac{W_A(c_A, c_B, t^*) - W_A(c_A, c_B, t^P)}{\beta}. \quad (13)$$

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3Such a form of the objective function is called the political support function. Here, $\beta$ means the weight the government attaches to campaign contributions compared to the aggregate welfare. See Hillman (1982), Grossman and Helpman (1994).

4The political tariff is strictly increasing in $\beta$. If $\beta$ is too high, a prohibitive tariff is realized and the Cournot-Nash equilibrium output levels take corner solutions.
If the firm has no bargaining power, then the contribution schedule of the firm is customized so that campaign contributions leave the firm with its reservation payoff $V_0^A$, therefore, we can obtain the maximum campaign contributions as

$$C_{A}^{\text{max}}(c_A, c_B, t^P) = \pi_A^A(c_A, c_B, t^P) - \pi_A^A(c_A, c_B, t^*) .$$

(14)

Since the precise bargaining agreement between the government and the firm is not our focus, we simply assume that the equilibrium contribution schedule of the firm lies between these two values. Letting $\gamma$ and $1 - \gamma$ denote respectively the government’s and the firm’s bargaining power, for any $\gamma \in [0, 1]$, the equilibrium contribution schedule of country A’s firm is represented as

$$C_{A}^*(c_A, c_B, t^P) = (1 - \gamma)C_{A}^{\text{min}}(c_A, c_B, t^P) + \gamma \cdot C_{A}^{\text{max}}(c_A, c_B, t^P).$$

(15)

We can derive the following lemma from equations (13)(14)(15).

**Lemma 3.1** When the domestic or foreign firm’s marginal costs are small, the domestic firm pays more campaign contributions and make the domestic government set a higher tariff level.

![INSERT FIGURE 1 HERE](image)

Figure 1 shows indifference curves for country A’s firm and government in the plane $t \times C_A$. The firm’s net payoff $V_A$ increases if either $t$ rises or $C_A$ falls. Whereas, the government’s net payoff $G_A$ increases either the tariff level comes close to $t^*$ or $C_A$ increases. If there are no lobbying activities, then the firm will pay no contributions and the government will set the tariff level which equals to the optimal tariff level $t^*$. As a result, the government’s reservation payoff is $G_0^A = W_A(c_A, c_B, t^*)$ and the firm’s reservation payoff is $V_0^A = \pi_A^A(c_A, c_B, t^*)$.

The minimum amount of contributions is illustrated as the point where the government’s reservation payoff curve and the firm’s indifference curve are tangent to each other. By contrast, we can show the maximum amount of contributions by the point where the firm’s reservation payoff curve and the government’s indifference curve are tangent to each other. The equilibrium amount of contributions is determined according to the government’s bargaining power. We can illustrate the range of contributions as the heavy line. If domestic or foreign firm’s marginal costs become small, then this line moves to the direction of upper right and the domestic industry can make the local government set a higher tariff level by paying more campaign contributions.

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5About the proof of this lemma, see APPENDIX A.

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4 Lobbying under Incomplete Information

In this section, we consider the situation where both domestic and foreign firms have information about domestic or foreign firm’s marginal costs but the domestic government does not have it. Here, the equilibrium concept of this game is Perfect Bayesian Equilibrium, which can be solved by backward inductions.

In the stage 3 of this game, we can solve the same Cournot-Nash output levels as under complete information.

We can solve the home country’s equilibrium tariff level under incomplete information about domestic firm’s marginal costs as follows:

\[
t^o = \frac{2\beta + 3}{9 - 2\beta} \alpha - 4\beta \cdot E[c_A] - (3 - 2\beta)c_B.
\]

(16)

Likewise, the home country’s equilibrium tariff level under incomplete information about foreign firm’s marginal costs becomes

\[
t^o = \frac{2\beta + 3}{9 - 2\beta} \alpha - 4\beta c_A - (3 - 2\beta)E[c_B].
\]

(17)

Since the domestic government does not possess any information about domestic or foreign firm’s marginal costs, the optimal tariff level depends on the government’s belief about the type of domestic or foreign firms. Denoting the domestic government’s belief about \(c_A = c_A^H\) by \(\mu(c_A)\), we can solve the equilibrium tariff level according to the value of this belief,

\[
t^o = \mu \cdot t^P(c_A^H, c_B) + (1 - \mu) t^P(c_A^L, c_B).
\]

(18)

Likewise, denoting the domestic government’s belief about \(c_B = c_B^L\) by \(\rho(c_A)\), we can solve the equilibrium tariff level as follows:

\[
t^o = \rho \cdot t^P(c_A, c_B^L) + (1 - \rho) t^P(c_A, c_B^H).
\]

(19)

There exist the following two kinds of equilibria in an incomplete information game: pooling and separating equilibria. Here, we only focus on the separating equilibrium in our game.\(^6\)

In the separating equilibrium under incomplete information about the domestic firm’s marginal costs, each type of firms selects a different amount of campaign contributions. Therefore, the domestic government may exactly infer the domestic firm’s marginal costs from its contributions and set the political tariff level separately according to its type.

\(^6\)We can eliminate the pooling equilibrium with Cho and Krep(1987)’s intuitive criterion, because such equilibrium is incredible. See APPENDIX B.
We can analyze the situation where \( \pi_A(c_A^H, t^o) - \pi_A(c_A^L, t^o) \geq \pi_A(c_B^H, t^P(c_A^H)) - \pi_A(c_B^L, t^P(c_A^H)) \). Then, the optimal amount of contributions for the domestic firm is determined according to the domestic firm’s marginal costs \( c_A \). If its marginal costs are \( c_A^H \), then the domestic firm’s optimal contributions are determined such that

\[
C_A = C^*_A(c_A^H, t^P(c_A^H)) .
\]  

(20)

Whereas, if its marginal costs are \( c_A^L \), then the domestic firm’s optimal contributions are determined such that

\[
C_A = \max \{ \pi_A(c_A^H, t^P(c_A^H)) - V_A(c_A^H, t^P(c_A^H)), C^*_A(c_A^H, t^P(c_A^H)), C_A(c_A^H, t^P(c_A^H)) \} .
\]  

(21)

Likewise, in the separating equilibrium under incomplete information about the foreign firm’s marginal costs, the domestic firm selects a different amount of campaign contributions according to the foreign firm’s types. Therefore, once its particular contribution proposal is observed, the domestic government may exactly infer the foreign firm’s marginal costs and set the political tariff level separately according to its types.

- If \( c_B = c_B^H \), then the amount of contributions paid by the domestic firm is \( C_A^*(c_B^H, t^o) = C_A \). Whereas, if \( c_B = c_B^L \), the amount of it is \( C_A^*(c_B^L, t^o) = C_A \). Here, \( 0 \leq C_A < \pi_A(c_B^H, t^P(c_B^H)) - \pi_A(c_B^L, t^P(c_B^H)) < \pi_A(c_B^L, t^P(c_B^H)) - \pi_A(c_B^L, t^P(c_B^H)) \).

- If \( C_A(t^o) < C_A \), then the political tariff level is \( t^o = t^P(c_A^H) \). Whereas, if \( C_A(t^o) \geq C_A \), this level is \( t^o = t^P(c_A^L) \).

- If \( C_A(t^o) < C_A \), then the domestic government’s belief is \( \rho = 1 \). Whereas, if \( C_A(t^o) \geq C_A \), this belief is \( \rho = 0 \).
We can analyze the situation where $\pi_A(c_L, t^P(c_L)) - \pi_A(c_L, t^c) \geq \pi_A(c_H, t^P(c_H)) - \pi_A(c_H, t^P(c_H))$. Then, the optimal amount of contributions for the domestic firm is determined according to the foreign firm’s marginal costs $c_B$. If its marginal costs are $c_H$, then the domestic firm’s optimal contributions are determined such that

$$C_A^* = C_A(c_H, t^P(c_H)).$$

(22)

Whereas, if its marginal costs are $c_L$, then the domestic firm’s optimal contributions are determined such that

$$\overline{C_A} = \max \{\min \{\pi_A(c_H, t^P(c_L)) - V_A(c_H, t^P(c_H)), C_A^\max(c_H, t^P(c_H))\}, C_A^*(c_H, t^P(c_H))\}. \tag{23}$$

These equilibria satisfy the intuitive criterion suggested by Cho and Kreps (1987). Therefore, we can derive the following propositions.

**Proposition 4.1** The firm’s lobbying activity for the local government plays a role of signals about the production costs of itself in the case where these costs are the firm’s private information. Then, this firm pays more contributions and make the government set a higher tariff, when the firm’s production costs are small.

**Proposition 4.2** The domestic firm’s lobbying activity for the local government plays a role of signals about the foreign firm’s production costs in the case where these costs are domestic firm’s private information. Then, the domestic firm pays more contributions and make the government set a higher tariff, when the foreign firm’s production costs are small.

The equilibrium amount of contributions under incomplete information depends on the government’s bargaining power.

**Proposition 4.3** If the government’s bargaining power is small, then there is a positive correlation between the amount of contributions and its bargaining power, and the amount of contributions is larger than that under complete information. If the government’s bargaining power is medium, then there is no correlation between the amount of contributions and its bargaining power, and the amount of contributions is larger than that under complete information. If the government’s bargaining power is large, then there is a positive correlation between the amount of contributions and its bargaining power, and the amount of contributions is equal to that under complete information.
Figure 2 shows the difference of the industry’s campaign contributions between complete and incomplete information, when the government has a small bargaining power against the industry. In this case, the industry can ensure more profits by its lobbying activities for the government; therefore, the industry pays a larger amount of contributions under incomplete information in order to signal its type to the government. Figure 3 shows the difference of the industry’s campaign contributions between complete and incomplete information, when the government’s bargaining power against the industry is medium. In this case, the high cost type of industry is required to pay more campaign contributions than the maximum of them under complete information in order to pretend that it is a low cost type of industry. Then, the amount of contributions paid by this industry is same as $C_{A}^{\text{max}}$. Figure 4 shows the difference of the industry’s campaign contributions between complete and incomplete information, when the government has an enough bargaining power against the industry. In this case, the industry’s lobbying activities increases its profits but a large part of these profits is distributed to the government through the lobbying negotiations. As a result, the campaign contributions paid by this industry under incomplete information is same as that under complete information; therefore, we can derive that $C_{A}^{c} = C_{A}^{*}$. We can summarize the relations between the amount of contributions and the government’s bargaining power in Figure 5.

5 Concluding Remarks

In this paper, we consider the effects of industry’s lobbying activities on the domestic government’s tariff setting, when only the industry knows its or foreign firm’s marginal costs but the domestic government is not informed them. Under incomplete information, the amount of the domestic firm’s political contributions paid to the domestic government plays a role of signals about its private information to the government. When the domestic or foreign industry is more competitive in costs, the domestic industry pays more contributions and the domestic government imposes a higher tariff on imports.

Additionally, we compare the amount of industry’s campaign contributions paid to the domestic government under incomplete information with that under complete information. The difference in the level of contributions between complete and incomplete information depends on the government’s bargaining power in the lobbying negotiation. If the government’s bargain-
ing power is small, then the amount of contributions under incomplete information is larger than that under complete information. On the contrary, if the government’s bargaining power is large enough, then the amount of contributions under incomplete information is same as that under complete information.

APPENDIX A: The Proof of Lemma 3.1

Proof: Substituting equations (13)(14) into (15), we can get the contribution schedule of country A’s firm as follows:

\[
C^*_A(c_A, c_B, t^P) = (1 - \gamma)C^\text{min}_A(c_A, c_B, t^P) + \gamma \cdot C^\text{max}_A(c_A, c_B, t^P)
\]

\[
= \frac{1 - \gamma}{\beta} [W_A(c_A, c_B, t^*) - W_A(c_A, c_B, t^P)] + \gamma [\pi^A_A(c_A, c_B, t^P) - \pi^A_A(c_A, c_B, t^*)]
\]

\[
= \frac{1 - \gamma}{\beta} \left[ \frac{\alpha - c_B}{3} (t^* - t^P) - \frac{1}{2} (t^* + t^P)(t^* - t^P) \right] + \gamma \left[ \frac{2(\alpha - 2c_A + c_B)}{9} (t^P - t^*) + \frac{1}{9} (t^P + t^*) (t^P - t^*) \right].
\]

(24)

Substituting equations (9) and (11) into (24), and differentiating \(C^*_A\) with respect to each firm’s marginal costs respectively, we can obtain that \(\frac{\partial C^*_A}{\partial c_A} < 0\) and \(\frac{\partial C^*_A}{\partial c_B} < 0\).

Additionally, differentiating equation (11) with respect to each firm’s marginal costs respectively, we can obtain that \(\frac{\partial t^P}{\partial c_A} < 0\) and \(\frac{\partial t^P}{\partial c_B} < 0\).

As a result, we can derive the statements in lemma 3.1.

APPENDIX B: Pooling Equilibrium

In this appendix, we analyze the pooling equilibrium in our game. First, we consider the case where the domestic firm’s marginal costs is both firms’ private information but the domestic government does not have it. In the pooling equilibrium, it is fully impossible for the domestic government to discriminate whether domestic firm’s costs are high or low, because both types pool at the same amount of contributions. Therefore, after observing the common amount of contributions, the government maintain its initial subjective probabilities, \(q\) and \(1 - q\), on the firm’s costs being high or low.

- In spite of the domestic firm’s marginal costs, the amount of firm’s campaign contributions is realized such that \(C^*_A(c^H_A, t^P) = C^*_A(c^L_A, t^P) = \hat{C}_A\), where \(C^*_A(c^H_A, t^P(c^H_A)) \leq \hat{C}_A < \pi_A(c^H_A, t^P(c^H_A)) - \pi_A(c^L_A, t^P(c^L_A)).\)
• If $C_A(t^e) = \hat{C}_A$, then the equilibrium tariff level is $t^e = q \cdot t^p(c^H_A) + (1 - q)t^p(c^L_A)$. On the contrary, if $C_A(t^e) \neq \hat{C}_A$, then this level is $t^e = t^p(c^H_A)$.

• If $C_A(t^e) = \hat{C}_A$, then the domestic government’s belief is $\mu(C_A) = q$. On the contrary, if $C_A(t^e) \neq \hat{C}_A$, then this belief is $\mu(C_A) = 1$.

The common amount of contributions for the domestic government paid by both types of the firms is

$$\hat{C}_A = \pi_A(c^L_A, t^p(c^L_A)) - \pi_A(c^H_A, t^e),$$

when $\pi_A(c^L_A, t^p(c^L_A)) - \pi_A(c^H_A, t^e) < \pi_A(c^H_A, t^p(c^L_A)) - \pi_A(c^H_A, t^p(c^H_A))$.

Next, we consider the case where the foreign firm’s marginal costs is only known to both firms but not to the domestic government. In the pooling equilibrium, the domestic government is fully unable to discriminate whether foreign firm’s costs are high or low, because both types pool at the same amount of contributions. Therefore, after observing that common amount of contributions, the government maintains its initial subjective probabilities, $r$ and $1 - r$, on the firm’s costs being high or low.

• In spite of the type of marginal costs, the amount of firm’s campaign contributions is realized so that $C_A^0(c^H_B, t^e) = C_A^0(c^L_B, t^e) = \hat{C}_A$, where $C_A^*(c^H_B, t^p(c^H_B)) \leq \hat{C}_A < \pi_A(c^H_B, t^p(c^L_B)) - \pi_A(c^H_B, t^p(c^H_B))$.

• If $C_A(t^e) = \hat{C}_A$, then the equilibrium tariff level is $t^e = r \cdot t^p(c^H_B) + (1 - r)t^p(c^L_B)$. On the contrary, if $C_A(t^e) \neq \hat{C}_A$, then this level is $t^e = t^p(c^H_B)$.

• If $C_A(t^e) = \hat{C}_A$, then the domestic government’s belief is $\rho(C_A) = r$. On the contrary, if $C_A(t^e) \neq \hat{C}_A$, then this belief is $\rho(C_A) = 1$.

The amount of contributions for the domestic government paid by the domestic firm is irrespective of the foreign firm’s type, and it is represented as follows:

$$\hat{C}_A = \pi_A(c^L_B, t^p(c^L_B)) - \pi_A(c^H_B, t^e),$$

when $\pi_A(c^L_B, t^p(c^L_B)) - \pi_A(c^L_B, t^e) < \pi_A(c^H_B, t^p(c^L_B)) - \pi_A(c^H_B, t^p(c^H_B))$.

[INSERT FIGURE 6 HERE]

Figure 6 shows this equilibrium. Here, if the low cost firms pay more contributions than $\hat{C}_A$, then the domestic government’s belief is updated as $\mu(C_A) = 0$ or $\rho(C_A) = 1$. The intuitive criterion suggested by Cho and Kreps (1987) is useful for us to rule out incredible equilibria. This pooling equilibrium does not satisfy this criterion in such a case; therefore, we can eliminate it.
References


Figure 1: Equilibria under Complete Information
Figure 2: Separating Equilibrium (Government’s bargaining power is small)
Figure 3: Separating Equilibrium (Government’s bargaining power is medium)
Figure 4: Separating Equilibrium (Government’s bargaining power is large)
Figure 5: Amount of Contributions and Bargaining Power

--- The type of costs is high under both complete and incomplete information

--- --- The type of costs is low under complete information

--- --- The type of costs is low under incomplete information
Figure 6: Pooling Equilibrium