Strategic Trade Policies and Food Trade

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1. Introduction (1)

- There is some possibility that the wrong foods are produced in order to reduce production cost.
- The consciousness on the food safety.
- The food standards differ among countries.

Thus, the government should intervene in the market.

1. Introduction(2)

- By the economic globalization, the volume of food trade is increasing, the inspection cost against foreign food has been becoming larger or the inspection quality getting down.
- The U.S. government is facing a difficulty to keep the sound inspection system of the imported food, for example.

1. Introduction (3)

- Australian government charges a whole inspection cost to food importers (the imported food control regulations of 1993).
- Japanese government adopts the system to protect from inflows of wrong food by requiring the foreign high risk food companies the certificate.

1. Introduction (4)

- Thus, it is necessary to evaluate the policies of sound food trade in the economic point of view.
- We deal with the food trade by focusing on this safety aspect and evaluate the food inspection policy where the inspection cost is charged to the trading companies.
- It is revealed that the policy is reasonable in the economic efficiency of an importing country.

1. Introduction (5)

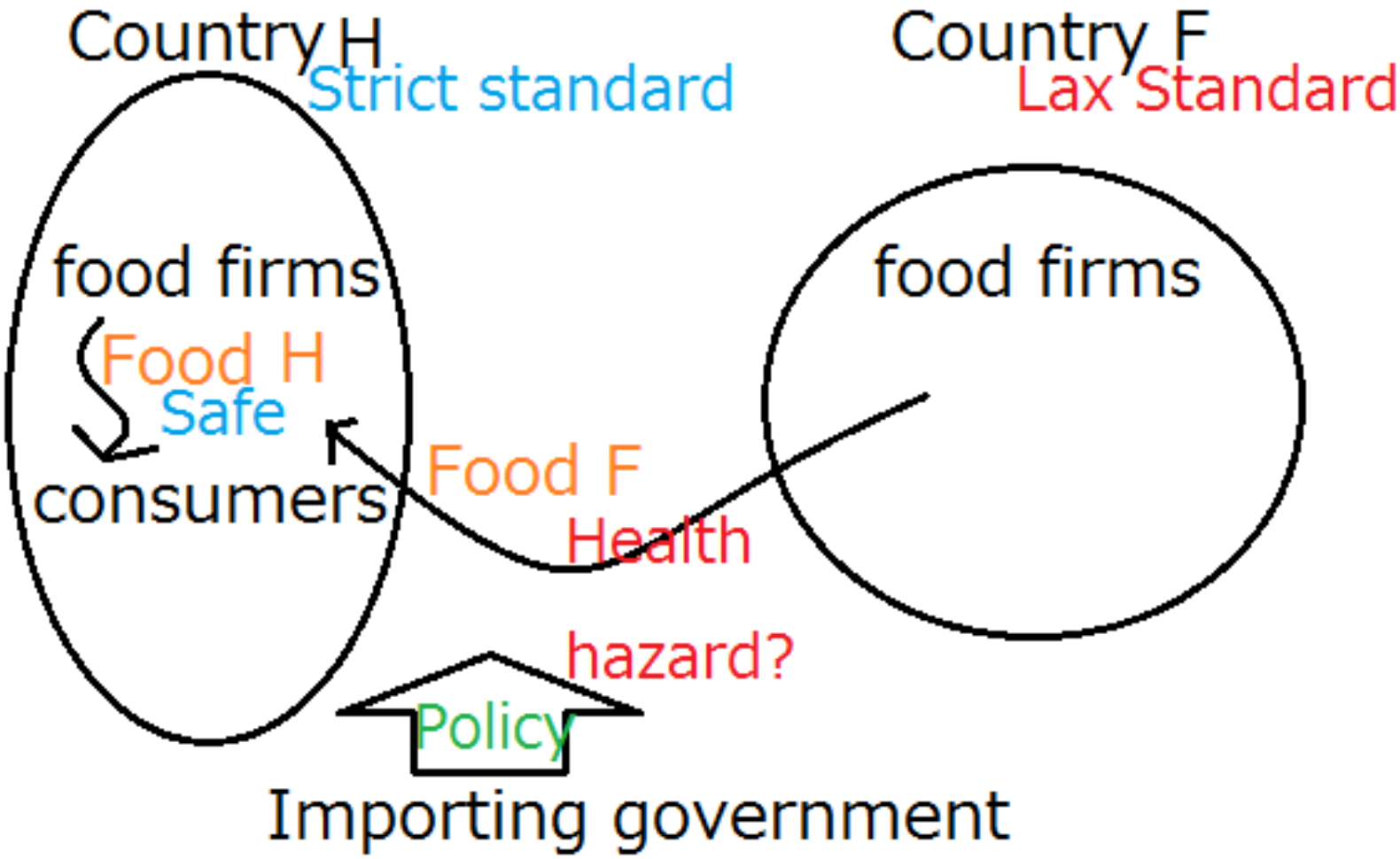
- G. Calzolari and G. Immordino (2005), “Hormone Beef, Chlorinated Chicken and International Trade”, *European Economic Review*, 49, 145-172.
- J. M. Cardebat and P. Cassagnard (2010), “North South Trade and Supervision of the Social Quality of Goods from the South”, *Review of International Economics*, 18(1), 168-178.
- D. Zhou, B. J. Spencer and I. Vertinsky (2002), “Strategic Trade Policy with Endogenous Choice of Quality and Asymmetric Costs”, *Journal of International Economics*, 205-232.

2. The Model (Outline)

- Home Country … Home food firms (perfectly competitive, producing Home Food), Consumers
- Foreign Country … Foreign food firms (perfectly competitive, producing Foreign Food)

- Foreign Firms may mix wrong food in their exports in order to reduce their production cost.
- Home food and Foreign food are identical in quality.

2. The Model (Outline) cont.



2. The Model (Outline 2)

- Home government executes two policies,

  (1) Inspection Policy

  (2) Import Tax Policy.
- The detected wrong food cannot be sold in the Home market and is disposed completely.
- Home government never impose the penalty or fine on the foreign firms producing wrong food.

2. The Model (Outline 3)

- β : the probability for the foreign firms to produce the wrong food
- $c^F(\beta)$: the expected marginal cost of the foreign firms.
- g : the average budget for the inspection at the border
- $\sigma(g)$: the detection rate of wrong food.

2. The Model (Outline 4)

- $\frac{\sigma(g)\beta x^F}{x^F} = \beta\sigma(g) \equiv \delta$: the probability for the foreign wrong food to be detected
- $\frac{\beta(1-\sigma(g))x^F}{x^F} = \beta(1-\sigma(g)) \equiv \alpha$: the probability for consumers of Foreign Food to consume the wrong food

3. The Model (Consumer side)

- Consumers are uniformly distributed in $[0,1]$.
- Each consumer is labelled by θ. A consumer labelled by higher θ is more averse to the risk of taking wrong food.
- Each consumer buys one unit of food at most.
- The consumer surpluses by Domestic and Foreign Food

$$CS^H(\theta) = U - p^H$$
$$CS^F(\theta) = U - (1+\theta)\alpha b - p^F$$

(p^i: price, U: utility, b: disutility,
ab: expected disutility by taking wrong food,
θab: expected disutility against facing the risk)

3. The Model (Consumer side 2)

- Each consumer will buy Home food or Foreign food, alternatively, if consumer surplus is positive and the food yields higher consumer surplus than the other.
- The conditions for a consumer with θ to buy a food is

(1) $CS^H(\theta) = U - P^H \geq 0$

(2) $CS^F(\theta) = U - (1+\theta)\alpha b - P^F \geq 0$

$$\Leftrightarrow \frac{U - p^F - \alpha b}{\alpha b} > \theta$$

3. The Model (Consumer side 3)

- The level of θ of marginal consumer is

$$CS^H(\theta) = CS^F(\theta)$$

$$\Leftrightarrow U - P^H = U - (1+\theta)\alpha b - P^F$$

$$\Leftrightarrow \theta = \frac{P^H - P^F - \alpha b}{\alpha b}$$

where $\alpha = \beta\left(1 - \sigma(g)\right)$

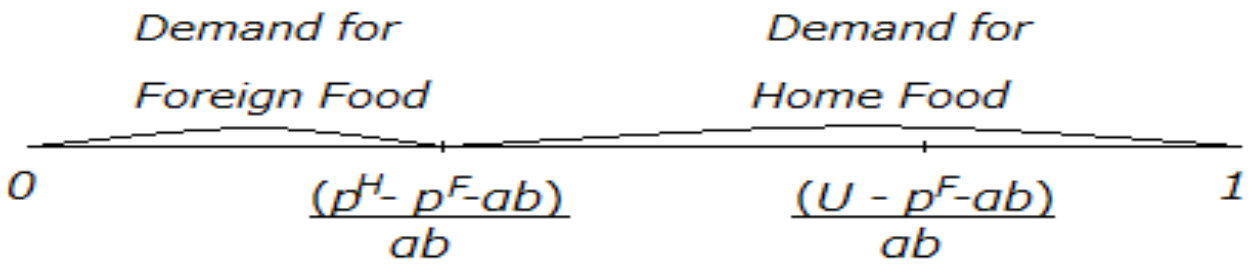
- **Assumption 1:**

$U - p^H > 0$ and $p^H - p^F - \alpha b > 0$

3. The Model (Consumer side 4)

- Under Assumption 1
  consumer θ buys the Home (Foreign) Food,

$$\text{if} \qquad \theta \geq (\leq) \frac{(p^H - p^F - \alpha b)}{ab}$$



4. The Model (Producer side)

- c^H : Home firms have identical constant marginal cost
- $c^F(\beta)$: Foreign firms have exported marginal cost
  depending on the mixed rate of wrong food,
  where $c^F{}'(\beta) < 0$ and $c^F{}''(\beta) > 0$

4. The Model (Producer side 2)

- The profit maximizing behavior of a typical home firm:

$$\underset{x^H}{Max}\,\pi^H = p^H x^H - c^H x^H$$

- The expected profit maximizing behavior of a typical risk-neutral foreign firm:

$$\underset{x^F,\beta}{Max}\,\pi^F = (1-\delta)\hat{p}^F x^F - c^F(\beta)x^F$$

(x^i : the amount of food produced by the firm.

$\hat{p}^F$: the export price of Foreign Food,

δ : the probability for the wrong food to be detected)

5. The Model (Home Government)

- Home government maximizes the expected social welfare

  g : the budget for the inspection per one unit of importing food

  t : the tariff rate

$$SW = \int_T^1 (U - p^D)d\theta + \int_0^T [U - (1+\theta)ab - p^F]d\theta$$
$$- gX^F + tT$$

($p^F \equiv \hat{p}^F + t$: the consumer price, $T \equiv \frac{p^D - p^F - ab}{ab}$: the total demand for Foreign Food, $X^F \equiv \frac{T}{1-\beta\sigma(g)}$: the total output of Foreign Food)

6. The Preliminary Analysis

- The zero profit condition for the home firms

$$p^H = c^H$$

- The zero profit condition for the foreign firms

$$(1-\delta)\hat{p}^F - c^F(\beta) = 0 \Leftrightarrow \hat{p}^F = \frac{c^F(\beta)}{1-\beta\sigma(g)}$$

- The profit maximization condition for the foreign firms with respect to β

$$-\sigma(g)\hat{p}^F - c^{F\prime}(\beta) = 0$$

7. The Game (1)

- Game between the home gov. and the foreign firms.

(a) Given g, home determines t

(b) Given t, home determines g

(c) Home determines g and t

7. The Game (2)

- Behavior of the home gov.

  Given g, home determines t in order to maximize its country welfare.

- The optimal condition for the government

$$\frac{dSW}{dt} = \frac{1}{\alpha b}(p^D - p^F - \alpha b)(-1)$$
$$+ \frac{1}{\alpha b}(p^D - p^F - \alpha b) + t\frac{dT}{dt} - g\frac{dX^F}{dt}$$
$$= 0 \qquad \Leftrightarrow \qquad t = \frac{g}{1 - \beta\sigma(g)}$$

8. The Game (Foreign Reaction)

- The foreign firms reaction function

$$\beta(t;g) \ : \ -\sigma(g)\hat{p}^F - c^{F\prime}(\beta) = 0 \Rightarrow$$

$$\frac{d\beta}{dt} = 0, \quad \frac{d\beta}{dg} < 0$$

Theorem 1

(I) The foreign firms determine β , independently of the level of t.

(II) When the home government adopts more sever g $\rightarrow$ $\beta \downarrow$

8. The Game (Foreign Reaction 2)

(I) of Theorem 1

- t only affects the amount of Foreign Food
- Perfect competition implies the foreign firms do not care about the output amount.

(II) of Theorem 1

- $g\uparrow \rightarrow$ the risk for the wrong food to be detected $\uparrow \rightarrow \beta\downarrow$

9. The Game (Home Reaction)

- The home government reaction function

$$t(\beta;g)\ :tT - gx^F = \left[t - \frac{g}{1-\beta\sigma(g)}\right]\mathrm{T} = 0$$

$$\Rightarrow \qquad t = \frac{g}{1-\beta\sigma(g)} > 0$$

$$\Rightarrow \quad \frac{\partial t}{\partial \beta} > 0, \frac{\partial t}{\partial g} > 0,$$

9. The Game (Home Reaction 2)

Theorem 2

(I)For any given $\beta > 0$ and $g > 0$, $t > 0$

(II)The tariff reaction against β

… The tariff revenue = The inspection cost

(III) $\beta\uparrow \rightarrow t\uparrow$

(IV) $g\uparrow \rightarrow t\uparrow$

9. The Game (Home Reaction 3)

(III) of Theorem 2

- $\beta \uparrow$

  → the risk for consumers to consume wrong food ↑

  → t↑ to control the imports of the foreign food

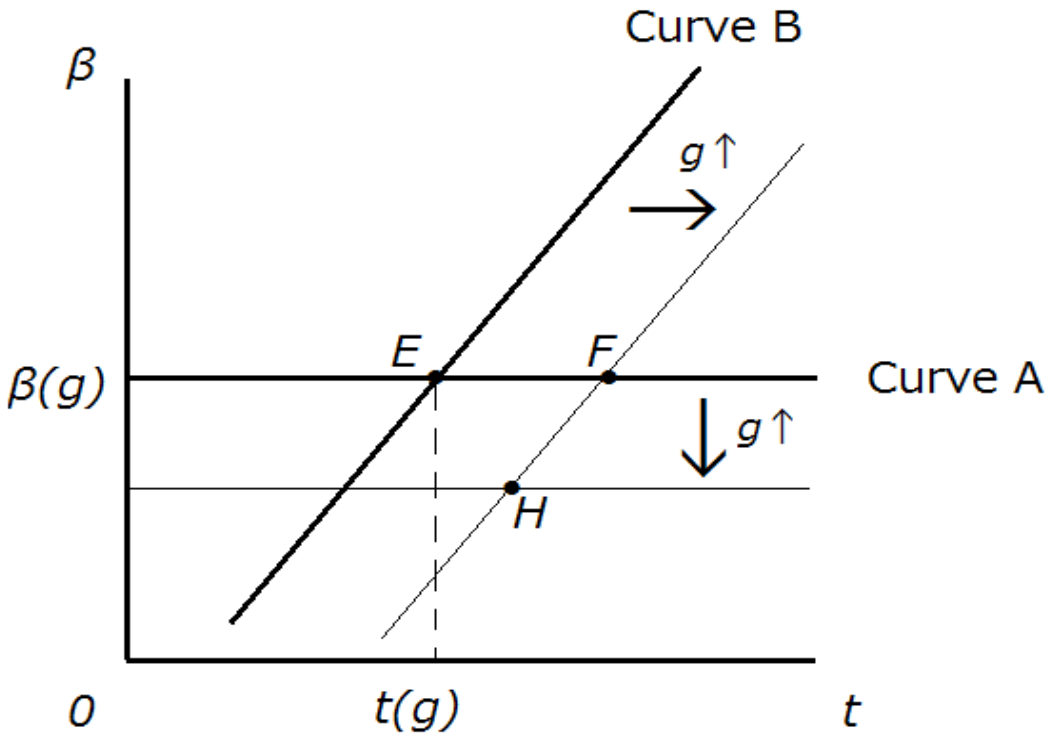
(IV) of Theorem 2

- g↑ should be converted by t ↑

because of (II): $tT - gx^F = \left[t - \frac{g}{1-\beta\sigma(g)}\right] \mathrm{T} = 0$

10. The Game (Full Equilibrium)

- Equilibrium of the game



10. The Game (Full Equilibrium 2)

- $\frac{d\beta}{dg} < 0$
- As for $\frac{dt}{dg}$,

$$dt = \frac{\partial t}{\partial \beta}\left|\frac{d\beta}{dg}\right| dg + \frac{\partial t}{\partial g}\left| dg \right|$$

(B +)(A -) (B +)

F → G E → F

Indirect Effect (-) Direct Effect(+)

10. The Game (Full Equilibrium 3)

Theorem 3 (a summary of the results)

For a full equilibrium of the game,

- $\frac{d\beta}{dg} < 0$
- $\frac{dt}{dg} > 0 (< 0)$ *according to*

  Direct Effect > Indirect Effect
- $\frac{d\beta}{db} = \frac{dg}{db} = 0$

11. Conclusion and Remarks (1)

- There are several suppositions concerning the home government behavior as follows:

(a) Given the budget for the inspection, the home government determines the tariff rate.

(b) Given the tariff rate, the home government determines the budget scale for the inspection.

(c) The home government determines both.

11. Conclusion and Remarks (2)

- Under a given unit inspection budget, an optimal tariff rate is the one to make the whole inspection cost balanced with the tariff revenue.
- A unit inspection budget ↑,

(1)the mixed rate ↓

(2)the tariff rate ↑(↓)

if the direct effect >(<) the indirect effect.

- the equilibrium values of the mixed rate and the tariff rate are never affected by the degree of consumer disutility caused by taking wrong food.

11. Conclusion and Remarks (3)

- The analysis of a strategic inspection policy is another interesting and important topic.
- We examined this topic in the present framework but the optimal condition to obtain the government reaction function was so complicated.
- In order to tackle this case, we need a simplification of the model.

11. Conclusion and Remarks (4)

- If we consider the case that the importing country fines to the foreign firms exporting wrong food
- We might infer from our analysis that the optimal fine is such that the total revenue from the fine is balance to the total inspection cost.