

# Selective Promotion of Industries and Picking Winners

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## **Abstract**

Can export subsidies raise domestic welfare even when the government does not know how profit-shifting potential varies by industry? If many oligopolies all use a factor available in fixed supply, the government needs to give larger export subsidies to industries with larger profit-shifting potential. Although the government cannot tell how industries differ, suppose the industries do know how much each subsidy level will increase their profits. If each industry can lobby the government over the level of subsidy received, the equilibrium matches the allocation of subsidies under full information. Lobbying reveals the information required to properly allocate subsidies across industries.

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## 1. Introduction

Brander and Spencer (1985) model how export subsidies can increase national welfare. Such subsidies shift profits from foreign to domestic firms in Cournot oligopolies. However, the government must have extensive knowledge of the industry to discern the profit-shifting potential of possible subsidies: “an important assumption is that the government understands the structure of the industry.” Brander and Spencer note that informational requirements may impede implementation of export subsidies: “in a world of imperfect information and imperfect governments, any argument indicating a plausible national motive for subsidies may open the door for various kinds of socially wasteful rent-seeking.” These statements raise doubts regarding whether a government can use export subsidies to raise national welfare in situations of imperfect information.

Moore and Suranovic (1993) suppose that the government has selected which industry to subsidize, but cannot credibly commit to a subsidy level. Once a proposed subsidy level is announced, the domes-

tic firm can lobby the government to increase its subsidy. As a result, the government must propose a lower subsidy level to offset the lobbying pressure expected from the targeted industry. The lobbying there plays *no informational role* in helping the government select the subsidy level that maximizes domestic welfare.

Governments may also experience difficulty in determining *which* industries to target. Dixit and Grossman (1986) demonstrate that when multiple oligopolistic industries use a common factor available in fixed supply, a uniform subsidy to all industries promotes none and merely bids the price of the fixed factor higher by the amount of the subsidy. To raise domestic welfare, the government must target the industries with the greatest profit-shifting potential (per unit of the common fixed factor). Dixit and Grossman acknowledge that “the correct calculation of the choice of industries for targeted subsidies involves some subtle reasoning and quite demanding information.” Most oligopolistic industries do employ scientists and other common factors available in fixed supply. Thus the informational difficulties inherent

in targeting the right industries do appear to reduce the benefits of export subsidies in practice.

This paper suggests lobbying may reduce the informational burden facing governments trying to target industries that share a common fixed factor. Export subsidies can raise national welfare despite the government's imperfect information about which industries have the greatest profit-shifting potential. Rent-seeking behavior can guide the government towards an allocation of subsidies across industries that raises domestic welfare. Brander and Spencer's fears that rent seeking may be socially wasteful ignore that rational lobbying equates the cost of lobbying with the benefits and thus reveals useful information about profit shifting potential.

Suppose the government lacks the information needed to select which industries to subsidize. The government announces that it seeks information from industries concerning their suitability for receiving an export subsidy. Firms respond by lobbying the government to give them their ideal subsidy, the subsidy level that most benefits

their lobby. Each industry offers an implicit contribution schedule, offering larger donations the larger the increase in profits due to the government's chosen allocation of export subsidies.

Being influenced by industry lobbying permits the government to properly select the subsidy level for each industry that maximizes overall domestic welfare. Lobbying reveals private industry information. Industries with larger profit-shifting potential offer larger contributions for each subsidy level. The government must simply allocate subsidies to maximize the contributions it receives. Consequently, export subsidies can increase domestic welfare even when the government has incomplete information if the government allocates subsidies in response to lobbying pressures.

Section 2 expands the Brander and Spencer (1985) model for the production stage to include the resource constraint described by Dixit and Grossman (1986) limiting the effectiveness of uniform subsidies across all industries. Section 3 adds a lobbying stage where firms lobby the government by offering to make contributions reflecting their

profit performance based on the allocation of export subsidies. Thus, in the lobbying equilibrium, lobbying the government for subsidies reveal private industry information. This equilibrium implements the allocation of targeted subsidies (as described by Dixit and Grossman 1986) that raises domestic welfare, but in the absence of any government information concerning each industry's profit-shifting potential. Finally, Section 4 draws conclusions and extensions.

## **2. Production**

The model considers a continuum of Cournot duopolies, each with an opportunity to lobby the government for an export subsidy. The industries are each composed of a domestic firm competing against a foreign firm. All sales occur in a third country, eliminating effects on national welfare through consumer surplus. Since all production is exported, export subsidies are equivalent to production subsidies in this setting.

As Cournot duopolists, each of these firms earns positive profits.

Each (domestic) firm earns more profits if subsidized by the government. Firms can help persuade the government to subsidize their exports by offering contributions conditional on subsidy levels. The government sets subsidies across industries and collects the contributions indicated for its allocation of subsidies chosen. Then each firm chooses its quantity to produce given the level of its subsidy (if any) and the quantity chosen by its foreign rival. Foreign firms do likewise, but for simplicity, the foreign government does not subsidize its firms.

The production stage is the Brander and Spencer (1985) model of Cournot duopoly for each of the high-technology industries. Production of high-technology goods uses a common factor available in fixed supply as in Dixit and Grossman (1986). All other industries are combined into one numeraire good produced with only workers under constant returns to scale (one worker produces one unit of output) and perfect competition. Consequently, workers earn a wage of one in equilibrium.

### 2.1. Firm Behavior

Let  $x$  denote output of the numeraire good. One unit of each high-technology good  $i \in [0, 1]$  is produced under constant returns to scale using one unit of scientific labor and  $a$  units of workers. Let  $z$  denote the wage scientists earn, so the marginal cost of production is  $c = a + z$ . Each firm is small relative to the market for scientists, so each firm takes the scientific wage as given. Let  $y_i$  denote output of the domestic firm in high-technology industry  $i$ .

Each domestic firm  $i$  chooses its quantity  $y_i$  to maximize its profits

$$\pi_i = [p_i + s_i - a - z] y_i \quad (1)$$

given production of its foreign rival  $Y_i$  and specific subsidy  $s_i$  from its own government, where  $p_i$  is the inverse demand function for product  $i$ . To permit an explicit solution (resembling Dixit and Grossman's section 4), assume linear inverse demand function

$$p_i = b - \tau y_i - \kappa Y_i \quad (2)$$

The first order condition for domestic profit maximization is

$$b - 2\tau y_i - \kappa Y_i + s_i - a - z = 0 \quad (3)$$

which generates the domestic reaction function

$$y_i = \frac{b + s_i - a - z - \kappa Y_i}{2\tau} \quad (4)$$

where firms take the scientific wage  $z$  as given.

Similarly, each foreign firm chooses quantity to maximize its profits

$$\Pi_i = [P_i - C_i] Y_i \quad (5)$$

given production of its domestic rival  $y_i$ , where  $C_i$  is the exogenous constant marginal cost of the foreign firm. Assuming linear inverse demand function

$$P_i = b - TY_i - \kappa y_i \quad (6)$$

the first order condition for foreign profit maximization is

$$b - 2TY_i - \kappa y_i - C_i = 0 \quad (7)$$

which generates the foreign reaction function

$$Y_i = \frac{b - C_i - \kappa y_i}{2T} \quad (8)$$

For simplicity, foreign firms are assumed to neither face any resource constraint due to limited availability of scientific labor nor have any prospect of receiving an export subsidy from the foreign government.

## 2.2. Product Market Equilibrium

The intersection of the domestic and foreign reaction curves (4) and (8) occurs at domestic production

$$y_i = \frac{2T(b + s_i - a - z) - \kappa(b - C_i)}{4\tau T - \kappa^2} \quad (9)$$

and foreign production

$$Y_i = \frac{2\tau(b - C) - \kappa(b + s_i - a - z)}{4\tau T - \kappa^2} \quad (10)$$

where the scientific wage is determined by the scientific labor constraint to follow and  $\tau T - \kappa^2 \geq 0$ . Dixit and Grossman demonstrate that if all sectors receive a uniform subsidy, the allocation of scientists across sectors and thus output remains unchanged. To prove effective, some industries must be subsidized at the expense of others.

While export subsidies increase the profits of subsidized firms, the amount that profits increase for any chosen subsidy level (the profit-shifting potential) differs across industries. For simplicity, assume profit-shifting potential differs across industries due to differences in only the costs of foreign rivals. Other sources of differences in profit-shifting potential such as own costs and own price elasticity of demand are straightforward to add, but would complicate the expressions.

Having a foreign rival with high costs makes a domestic firm a good candidate for an export subsidy. Receiving a larger subsidy raises a

domestic firm's profits by

$$\frac{\partial \pi_i}{\partial s_i} = \frac{4\tau T (b + s_i - a - z) - \kappa (b - C_i)}{(4\tau T - \kappa^2)^2} > 0 \quad (11)$$

However, the increase in domestic firm profits from the subsidy will be larger the larger the foreign rival's costs.

$$\frac{\partial^2 \pi_i}{\partial s_i \partial C_i} = \frac{4\kappa\tau T}{(4\tau T - \kappa^2)^2} > 0 \quad (12)$$

Thus, an industry with high foreign costs experiences a larger increase in profits than an industry with low foreign firm costs receiving the same subsidy. Figure One illustrates that the increase in profits from receiving a subsidy  $s_i > 0$  are greater the larger the foreign rival's costs for any positive subsidy level. This dominance of profit increases enables lobbying to indirectly convey information regarding profit-shifting potential to the government. From the viewpoint of a firm, an increase in its subsidy increases its profits by (11), since the firm views the scientific wage as given. However, in general equilibrium,

increasing the subsidy to all industries would raise the scientific wage due to the fixed supply of scientific labor.

### 2.3. Resource Constraints

Factors are available in fixed supply: the fixed supply of workers is  $l$  and the fixed supply of scientists is  $k$ . Labor demand for workers cannot exceed the fixed supply  $x + a \int_i y_i di = l$  and labor demand for scientists cannot exceed the fixed supply  $\int_i y_i di = k$  for factor markets to be in equilibrium. The resource constraint for workers determines the output of the numeraire good  $x = l - ak$ . The resource constraint for scientists determines the scientific wage and dictates that all high-technology sectors cannot expand in unison.

Applying (9), the resource constraint for scientific labor is

$$2T(b + \tilde{s} - a - z) - \kappa(b - \tilde{C}) = k(4\tau T - \kappa^2) \quad (13)$$

where the average subsidy level is  $\tilde{s} \equiv \int_0^1 s_i di$  and the cost of the average foreign rival is  $\tilde{C} \equiv \int_0^1 C_i di$ . The scientific wage  $z$  that satisfies

the resource constraint for scientists

$$z = b + \tilde{s} - a - \frac{\kappa(b - \tilde{C}) + k(4\tau T - \kappa^2)}{2T} \quad (14)$$

must rise as the average subsidy  $\tilde{s}$  is raised  $\frac{\partial z}{\partial \tilde{s}} = 1 > 0$ . Since total output cannot change, a uniform subsidy merely raises the scientific wage by the magnitude of the subsidy. Consequently, some industries need to be favored over others.

#### 2.4. *Optimal Policy*

The government lacks the information needed to accurately pick winners, industries with the best profit shifting potential. The objective of the domestic government is to allocate subsidies to maximize domestic welfare, the sum of factor incomes plus domestic firm profits net of subsidy payments.

$$w = l + zk + \int_0^1 (\pi_i - s_i y_i) di \quad (15)$$

Domestic welfare is maximized by allocating the subsidies

$$s_i - \tilde{s} = \frac{\kappa^3 (C_i - \tilde{C})}{4\tau T - \kappa^2} > 0 \iff C_i > \tilde{C} \quad (16)$$

so that allocate greater subsidies to industries where the foreign rival has higher cost. What if the government cannot determine the costs  $C_i$  of each foreign rival? The next section shows that industry lobbying activity can signal profit-shifting potential and thus enable the government to target the right industries for export subsidies.

### 3. Lobbying

Due to the fixed supply of scientific labor, not all high-technology industries can expand simultaneously, so the government must target some industries for larger subsidies than others to raise domestic welfare. Due to lack of information about industry conditions, the government cannot determine which industries have superior profit-shifting potential. Instead, the government is influenced by the lobbying activities of industries. Lobbying reveals profit-shifting potential

in equilibrium.

### 3.1. Lobbying Behavior

Each domestic firm in an oligopolistic industry has a lobby organized to represent its interests. Each firm in each oligopolistic industry is owned by a measure  $f_i > 0$  of domestic residents such that  $\int_0^1 f_i di = 1$ . These residents earn dividends  $\pi_i$  in each period. They also earn a wage of one on  $\ell$  units of labor and a wage of  $z$  on  $k$  units of scientific labor. Domestic citizens each own a representative share of the domestic country's general and scientific labor, but differ in ownership of firms. Each citizen is also lump sum taxed by the government to raise the funds needed for subsidy payments. Of the total subsidy payments

$$t = \int_0^1 s_i y_i di \tag{17}$$

residents associated with the lobby of each industry share equally in paying taxes  $t_i \equiv f_i t$  to support the subsidy payments. Thus welfare

of the lobby associated with industry  $i$  is

$$W_i = f_i(l + zk - t) + \pi_i \quad (18)$$

When a firm lobbies, it offers contributions to the government conditional on the allocation of subsidies  $s_i, i \in [0, 1]$ . In the lobbying stage, each domestic firm chooses its contribution schedule  $\chi_i$  to maximize the welfare of the members of its lobby  $W_i$  net of contributions  $\chi_i$ .

$$V_i(s_i) = W_i(s_i) - \chi_i(s_i) \geq 0 \quad (19)$$

given the contribution schedules of the other domestic firms. Contributions are restricted to nonnegative values and cannot exceed the lobby's total income. Industries that stand to gain a larger increase in profits from a subsidy are willing to make a larger contribution to gain a subsidy.

### 3.2. *Revelation Equilibrium*

In the lobbying stage, domestic firms select their contribution schedules to maximize their values, given the contribution schedules chosen by other domestic firms. Then the domestic government allocates export subsidies to domestic industries to maximize the contributions it receives. Finally, in the production stage, domestic and foreign firms choose their production levels to maximize their values, given the production levels chosen by their rivals.

Domestic firms offer contributions to influence the government's allocation of subsidies in their favor. Firms have different gains from being subsidized, so industries with the largest gains can offer the largest contributions. The government succeeds in allocating subsidies to the correct industries, even though it lacks the information that would have been needed to make the proper selections in the absence of lobbying. Lobbying creates competition between industries that induces them to reveal their profit-shifting potential in equilibrium.

The ability of lobbying to convey information on which industries

have the greatest profit-shifting potential is clearly evident if the government were to set a subsidy level and let the firms lobby to convince the government to give them the subsidy. The amount a firm's profits increase due to a subsidy is larger the larger its foreign rival's costs, so these firms will be willing to make larger contributions to secure a given subsidy. The best candidates for the subsidies receive them.

Lobbying has the potential not only to provide efficient allocation of a uniform subsidy, but also to provide efficient allocation of asymmetric subsidy levels. The optimal subsidy (16) requires larger subsidies for domestic firms whose foreign rivals have higher costs. Thus, the government needs to determine how to vary subsidy levels across industries.

Allowing industries to offer a menu of contributions helps guide the government to the optimal subsidy levels for each industry. Consider small increases in the subsidy for each industry. Recall that a small increase in the subsidy in an industry raises industry profits by (11).

The total effect on lobby welfare is

$$\frac{\partial W_i}{\partial s_i} = f_i \left( k \frac{\partial z}{\partial s_i} + \frac{\partial t}{\partial s_i} \right) + \frac{\partial \pi_i}{\partial s_i} \quad (20)$$

The effects of a small increase in a subsidy on the scientific wage and subsidy payments are spread evenly over the population, but the effects on profits are concentrated on owners of the domestic firm. In the neighborhood of the equilibrium, contributions truthfully reveal gains from a subsidy.

$$\frac{\partial \chi_i}{\partial s_i} = \frac{\partial W_i}{\partial s_i} \quad (21)$$

For a small increase in subsidy, an industry will offer a larger increase in its contribution  $\partial \chi_i / \partial s_i$  if its foreign rival has larger cost. While the government does not know whether each industry has above average profit-shifting potential initially, industry type is revealed through lobbying.

The equilibrium mimics the equilibrium were the government to know each industry's type. Given the contribution schedules offered

by each industry, the government's problem of allocating subsidies to maximize the contributions it receives  $\chi = \int_0^1 \chi_i di$  has first order condition

$$\int_0^1 \frac{\partial \pi_i}{\partial s_j} di = k \frac{\partial z}{\partial s_j} + \frac{\partial t}{\partial s_j} \forall j \in [0, 1] \quad (22)$$

since each lobby alters its contribution to convey the extent that raising the subsidy to industry  $i$  alters its profits plus its share of factor income and subsidy payments. Adding up contributions across all industries captures all effects on domestic welfare, so the allocation of subsidies that emerges matches the full information solution for maximizing domestic welfare (16). Figure Two illustrates how a loser's contribution falls and a winners contribution rises as the subsidy to a winner industry increases. The maximum total contribution occurs at the optimal subsidy level conditional on the average subsidy level to other industries. Thus, industry contribution schedules convey sufficient information for the government to allocate subsidies across industries properly.

#### 4. Conclusions

Lobbying can alleviate the difficulties imperfect information creates for the choice of which industries to promote. If governments have imperfect information regarding which industries are the best candidates for an export subsidy, firm lobbying activity can reveal firm types (profit-shifting potential) to the government.

The government may have more profound imperfections in its information than discussed here. Dixit (1984) shows that adding more domestic firms weakens the benefit of export subsidies. Eaton and Grossman (1986) demonstrates that if firms choose prices instead of quantities, then export taxes are needed in place of subsidies so the government may be unsure whether subsidies should even be positive. Qui (1994) examines the government's choice between a single rate policy and a policy menu and finds that a menu is better under Cournot but a single rate policy under Bertrand behavior. Maggi (1996) suggests the government use capacity subsidies in place of export subsidies where imperfect information exists with respect to the

mode of oligopolistic competition.

The analysis could be expanded to permit other distinguishing features for targeting industries. Accounting for additional differences discussed in Dixit and Grossman (1986) such as own cost and elasticity of demand is straightforward. Other types of information could be revealed through lobbying such as whether the industry is indeed characterized by Cournot (rather than Bertrand) behavior to address the critique of Eaton and Grossman (1996) or the relevant number of competitors to address the critique of Dixit (1984). Other type of information could also include risk of retaliation, potential entry, and cross-ownership of firms. The ability of lobbying to reveal information on differing foreign rival costs is meant to illustrate the ability of lobbying to reveal any differences in profit-shifting potential (static or dynamic), whatever the source.

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Figure 1: Increase in Profit of Domestic Firm due to Subsidy

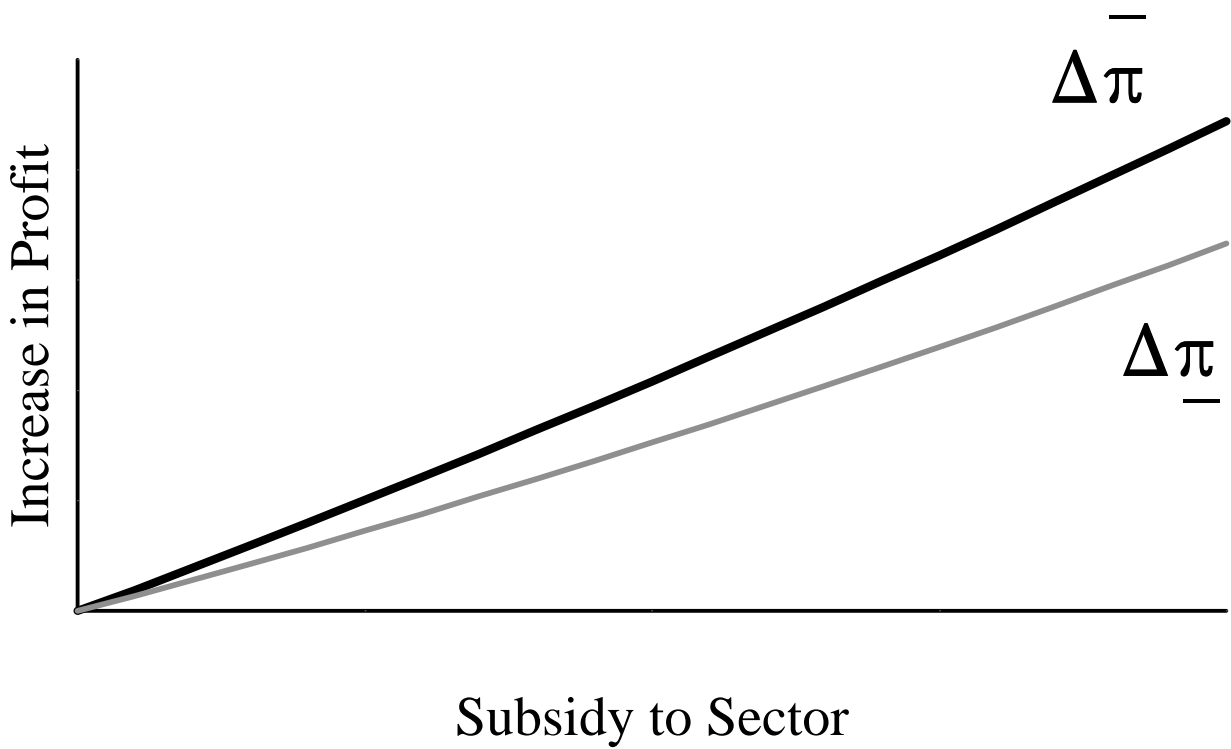


Figure 2: Increase in Contribution  
for Increase in Subsidy to Sector

