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Commercial Policy under Cross-Border Ownership and Control*

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Abstract

It is often observed that in order to serve the domestic market, foreign firms not only export but also control domestic firms through foreign direct investment (FDI). This paper examines the effects of tariffs, production subsidies, and foreign ownership regulation on prices, outputs, profits, and welfare when both exports and FDI coexist. Cross-border ownership on the basis of both financial interests and corporate control leads to horizontal market-linkages through which tariffs and production subsidies may not benefit locally-owned firms, because the foreign firm shifts production across borders to evade the burden or even take advantage of commercial policies. The effects of ownership regulation depends on both the initial ownership share and the substitutability between goods.

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Keywords: foreign direct investment, corporate control, tariffs, production subsidies, ownership regulation

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1 Introduction

Cross-border ownership (CBO) is wide spread in this age of globalization. According to Kang and Sakai (2000), cross-border strategic alliances worldwide increased from 860 in 1989 to 4400 in 1999. From an index compiled by Morgan Stanley Capital International (MSCI), Wojcik (2002, table 1) documents that 711 companies had foreign ownership in 16 northern and western European countries. The share of foreign ownership varies with an average of 61 percent. The highest is Norway at 91 percent and the lowest is Switzerland at 23 percent.

Although there are various CBO arrangements, an interesting fact is that foreign direct investment (FDI) often coexists with exports. A typical example is the automobile industry. General Motors (GM) is the 100 percent shareholder of Opel in Germany and Saab in Sweden and a heavy shareholder of Suzuki, Isuzu, Subaru (Fuji) in Japan, Daewoo in Korea, and Fiat in Italy.¹ To serve the Japanese market, GM directly exports large and luxury cars such as Cadillac and Corvette and supplies compact cars through Suzuki, Isuzu, and Subaru.² Moreover, Shanghai GM is a 50-50 joint venture (JV) between GM and Shanghai Automotive Industry Corporation. Since the Chinese government does not allow foreign auto makers to have their own subsidiaries in China, world leading makers have been forming JVs with Chinese auto makers as well as exporting to China.³

Several authors have analyzed the relationship between collusion/competition and partial ownership within a country. For instance, Reynolds and Snapp (1986), Farrell and Shapiro (1990), Malueg (1992), and Reitman (1994) model horizontal partial ownership; Morita (2001) investigates the Japanese manufacturer-supplier relationship; and Alley (1997) finds empirically that Japanese firms form partial ownership to collude in the domestic market, but not in the export market.

When partial ownership schemes are across country borders, they have important consequences on trade and foreign investment. For instance, by forming CBO schemes, firms can not only share profits, but also shift production to meet local demands and to avoid high cost regions. Those involved in CBO may be able to prey on independent rival firms through production shifting.

The present paper examines the effects of import tariffs, production subsidies, and

¹GM owns respectively 20% of Suzuki, 12% of Isuzu, 21% of Subaru, 67% of Daewoo, and 20% of Fiat.

²Similar strategies can be seen between Ford and Mazda.

³The upper limit of foreign ownership imposed by the Chinese government is 50 percent.

foreign ownership regulation when both exports and FDI coexist. We are interested in how outputs, profits, consumer prices and national welfare change when a certain commercial policy is adopted, with particular emphasis on the impacts on independent rival firms.

Although there are several papers which analyze commercial policies under CBO in the framework of international oligopoly (see, for example, Lee, 1990; Weltzel, 1995; and Long and Soubeyran, 2001), our analysis is distinguished from these studies. We explicitly incorporate the fact that foreign firms control domestic ones through FDI, following Krugman and Obstfeld (2003, p.171): “The distinctive feature of direct foreign investment is that it involves not only a transfer of resources but also the acquisition of *control*. That is, the subsidiary does not simply have a financial obligation to the parent company; it is part of the same organization structure.”⁴

Firms are independent to each other without any ownership relationships, while the parent firm has complete control power under full ownership. In the case of partial ownership, therefore, it is inferred that the partial owner has some control power under certain cases.⁵ In fact, it is widely observed that the principal shareholder sends executives such as the chief executive officer and chief operating officer to the partially owned company.⁶ Thus, we assume that the foreign firm has some corporate control over a domestic firm by undertaking FDI. Then, the domestic firm under foreign ownership cares about the profits of the foreign firm as well as its own; And the higher the foreign ownership, the more the domestic firm takes into account the foreign firm’s profit.

We show that CBO on the basis of both financial interests and corporate control leads to horizontal market-linkages through which import tariffs and production subsidies may not benefit firms that are 100% locally-owned. Further, regulating CBO may hurt local firms in terms of market share and profits when foreign ownership is low. However, the opposite is true when foreign ownership is sufficiently high. These arise because CBO and corporate control enable the foreign firm to shift production so as to evade the burden or even take advantage of commercial policies such as import tariffs and subsidies to

⁴In fact, there are few studies that explicitly consider corporate control when analyzing partial ownership. An exception is Bresnahan and Salop (1986) which examines the relationship between corporate control and the Herfindahl index.

⁵Krugman and Obstfeld (2003, p.171) says “In U.S. statics, a U.S. company is considered foreign-controlled, ..., if 10 percent or more stock is held by a foreign company; the idea is that 10 is enough to convey effective control”.

⁶For example, Ford, which has Mazda’s 33% stocks, and Renault, which has Nissan’s 44% stocks, have sent presidents to Mazda and Nissan, respectively.

local production. Thus, our analysis and result lead to important policy implications for countries intending to develop local industries. In this sense, the present paper is related to Markusen and Venables (1999), who establish circumstances under which FDI is complementary to local industries in developing countries.

The rest of the paper is organized as follows. Section 2 sets up the basic model. Section 3 investigates the effects of import tariffs and production subsidy under foreign ownership and control. Section 4 introduces regulation on foreign ownership. Section 5 looks into the impact on national welfare. And section 6 concludes the paper.

2 Model Setup

2.1 Basic Structure

Consider two goods X (say, a large car) and Y (say, a small car), which are imperfect substitutes. Good X is made by a foreign firm f , who exports to the domestic market for sales. There are also two domestic firms d and h , that produce and sell good Y locally. Let us denote the marginal cost of firm i as c^i ($i = f, d$ and h), which is constant. We wish to model the fact that firm f has financial interest in firm d , specifically, it holds firm d 's stocks, by a share k ($0 \leq k \leq 1$).

We assume that the domestic government imposes a specific tariff t on the imported good X and provides a specific subsidy s to the locally produced good Y . Based on the tariff and subsidy, the firms compete in a Cournot fashion.

The inverse demands for the imperfectly substitutable goods X and Y are given respectively as

$$p_x = a - x - \gamma(y^d + y^h), \quad (1a)$$

$$p_y = b - (y^d + y^h) - \gamma x, \quad (1b)$$

where p_x and p_y are the prices of goods X and Y , $0 < \gamma < 1$ is a parameter indicating the degree of substitutability between the two goods, a and b are parameters, and x , y^d and y^h are, respectively, the outputs of firms f , d and h . We define $Y \equiv y^d + y^h$.

Given the above structure, the profit functions of firms f , d and h can be written respectively

$$\pi^f = (p_x - c^f - t)x + k\pi^d = \pi^x + k\pi^d, \quad (2a)$$

$$\pi^d = (p_y - c^d + s)y^d, \quad (2b)$$

$$\pi^h = (p_y - c^h + s)y^h. \quad (2c)$$

where π^x is the profit earned by selling good X , i.e., $\pi^x \equiv (p_x - c^f - t)x$.

2.2 Foreign firm's control over the domestic firm

In this subsection, we model the relationship between partial ownership and corporate control in detail. The Industrial Organization literature and the Antitrust literature distinguish between financial interest and corporate control (e.g., O'Brien and Salop, 2000). Financial interest refers to the right to receive the stream of profits generated by the firm from its operations and investments. Corporate control refers to the right to make the decisions that affect the firm. In a sole proprietorship, a single individual has the right to 100 percent of the profit of the firm. The same individual also has complete control over the company, making the decisions about levels of prices, outputs, investments and where to purchase inputs and locate plants, etc. In the case of a partial ownership, nobody has 100 percent ownership. However, a principal shareholder may have 100 percent corporate control and the others have none. Generally, higher ownership share brings greater corporate control.

In our model, since firm f holds firm d 's stocks, the former may also affect the latter's corporate control. For instance, it may be able to constrain firm d from taking any action which is harmful to firm f . Specifically, we assume that the objective function of firm d , $\tilde{\pi}^d$, is the weighted average of firm d 's and firm f 's profit functions:⁷

$$\tilde{\pi}^d \equiv (1 - v)\pi^d + v\pi^f, \quad 0 \leq v \leq 1. \quad (3)$$

The parameter v represents the degree of firm f 's control over firm d 's decision. In other words, parameters k and v respectively represent firm f 's financial interest ("ownership share" in our terminology) and corporate control ("control power" in our terminology) of firm d . The objective of firm d is to maximize its own profit when $v = 0$ (i.e., without

⁷For example, Carlos Ghosn, whom Renault has sent to Nissan as President and Chief Executive Officer, will consider Renault's profit as well as Nissan's in his management. Nissan says "Both companies share a single joint strategy of profitable growth and a community of interests" (<http://www.nissan-global.com/EN/HOME/0,1305,SI9-LO3-MC92-IFN-CH120,00.html>).

any control power) and firm f 's profit when $v = 1$ (i.e., with full control). Firm d takes into account both firms' profits when v is in between.

We next formulate the relationship between firm f 's ownership share k and control power v . It seems reasonable that control power v is weakly increasing in ownership share k . Thus, we assume that the weight firm d puts on the profit from good X is not decreasing in k . For simplicity, we assume that v is determined by the following continuous function of k :⁸

Assumption 1

$$v = \begin{cases} v(k), v' \geq 0 & \text{if } 0 \leq k < \bar{k} \\ 1 & \text{if } \bar{k} \leq k \leq 1 \end{cases}$$

where $v(0) = 0$ and $v(\bar{k}) = 1$.

Note that when firm f holds more than a critical share \bar{k} , it fully controls firm d . As pointed out by O'Brien and Salop (2000), $v = 1$ could hold even if $k < 1/2$. Figure 1 illustrates the relationship between firm f 's ownership share k and its control power v . v increases as k does until \bar{k} when v reaches 1.

Figure 1 around here

From (2b) and (3), firm d maximizes

$$\tilde{\pi}^d = \lambda(k)[\pi^d + \eta(k)\pi^x], \tag{4}$$

where $\lambda(k) \equiv 1 - v(k) + v(k)k > 0$ and $\eta(k) \equiv v(k)/\lambda(k)$. We can regard η as firm d 's weight attached to π^x . Thus, we formally state:⁹

Assumption 2

$$\theta \equiv \frac{d\eta(k)}{dk} = \frac{v' - v^2}{(1 - v + vk)^2} \geq 0 \quad \text{if } 0 \leq k < \bar{k}.$$

Note that η has the following characteristics:

Lemma 1 (i) $\eta > 1$ if and only if $v > 1/(2 - k) \equiv e(k)$; (ii) if $\bar{k} \leq k \leq 1$, then $\eta = 1/k$ and hence $\theta < 0$.

⁸What is crucial for our results is that v is weakly increasing in k . Note that $v(k) = 0$ may arise when k is small, which is called "silent interests". Also, $v(k)$ could be a step function. Even if these are the cases, the essence of our results would not change.

⁹For example, $v(k) = (k/\bar{k})^\beta$, $\beta \geq 1$ satisfies Assumption 2.

$\eta > 1$ means that firm d cares about π^x more than π^d . Assumption 2 and Lemma 1 imply that η reaches its maximum value, $1/\bar{k}$, at \bar{k} . Once $k = \bar{k}$ (i.e., $v = 1$) holds, the objective function of firm d , $\tilde{\pi}^d$, becomes identical with that of firm f . In view of (2a), firm d 's weight (as well as firm f 's) on π^x becomes smaller as k further increases.

Finally, firm d maximizes (4), and firms f and h maximize their own profits simultaneously and independently, giving rise to the following first order conditions respectively:

$$\frac{d\pi^f}{dx} = -x + p_x - c^f - t - k\gamma y^d = 0, \quad (5a)$$

$$\frac{d\tilde{\pi}^d}{dy^d} = \lambda(-y^d + p_y - c^d + s) - v\gamma x = 0, \quad (5b)$$

$$\frac{d\pi^h}{dy^h} = -y^h + p_y - c^h + s = 0. \quad (5c)$$

Before going on to the analysis of commercial policies, we establish a lemma on the changes of firms' profits. Totally differentiating π^d , π^x and π^f and substituting them into the first order conditions above, we obtain

$$\begin{aligned} d\pi^d &= y^d(dp_y + ds) + (y^d + \gamma x\eta)dy^d, \\ d\pi^x &= x(dp_x - dt) + (x + k\gamma y^d)dx, \\ d\pi^f &= d\pi^x + kd\pi^d + (\pi^d - \rho)dk, \end{aligned}$$

where ρ is the price of firm d 's stock. Differentiating firm h 's first order condition and the demand functions, we obtain $dp_y + ds = dy^h$, $dp_x = -dx - \gamma dY$, and $dp_y = -dY - \gamma dx$. Thus, the following lemma is straightforward:

Lemma 2 *The changes of firm profits are decomposed as:*

$$d\pi^d = y^d dY + \gamma x \eta dy^d, \quad (6)$$

$$d\pi^x = k\gamma y^d dx - x(\gamma dY + dt), \quad (7)$$

$$d\pi^f = -\left(\frac{\gamma x(1-v)}{\lambda}\right) dy^d - (\gamma x + ky^d) dy^h + ky^d ds - xdt + (\pi^d - \rho)dk. \quad (8)$$

3 Trade policies under foreign ownership and control

In this section, we analyze the effects of the import tariff imposed on good X and the production subsidy to good Y . Totally differentiating the first order conditions (5a),

(5b) and (5c) to derive:

$$\begin{pmatrix} 2 & \gamma(1+k) & \gamma \\ \gamma(1+kv) & 2\lambda & \lambda \\ \gamma & 1 & 2 \end{pmatrix} \begin{pmatrix} dx \\ dy^d \\ dy^h \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \\ 0 \end{pmatrix} dt + \begin{pmatrix} 0 \\ \lambda \\ 1 \end{pmatrix} ds.$$

Stability requires

$$\Delta \equiv \lambda(6 - 2\gamma^2 - k\gamma^2) - v\gamma^2(1 + 2k) > 0. \quad (9)$$

3.1 Import Tariffs

The tariff has the following effects on outputs.

$$\frac{dx}{dt} = -\frac{3\lambda}{\Delta} < 0, \quad (10)$$

$$\frac{dy^d}{dt} = \frac{\gamma(1+v+kv)}{\Delta} > 0, \quad (11)$$

$$\frac{dy^h}{dt} = \frac{\gamma\{1-v(2-k)\}}{\Delta}, \quad (12)$$

$$\frac{dY}{dt} = \frac{dy^d + dy^h}{dt} = \frac{\gamma(2-v+2kv)}{\Delta} > 0. \quad (13)$$

Figure 2 around here

Conditions (10) and (11) say respectively that an increase in the tariff reduces the output of the foreign firm f but increases that of domestic firm d , which are as expected. However, we find a counter-intuitive result: dy^h/dt in (12) is negative if and only if $v > 1/(2-k)(= e(k))$. Note that when $v > 1/(2-k)(= e(k))$, firm d 's weight attached to π^x (i.e., η) is greater than 1 and thus is greater than that attached to π^d (recall Lemma 1). Figure 2 depicts the relationship between $e(k)$ and $v(k)$. Assumption 2 assures that curve $v(k)$ intersects with curve $e(k)$ once in $[0, \bar{k}]$. They intersect at $k = k_1$ in the figure. Thus, we obtain

Proposition 1 *An increase in the import tariff on good X reduces firm h 's output if and only if $k_1 < k < 1$.*

While the original purpose of the tariff is to help domestic firms, Proposition 1 says that if the foreign firm is tied up with a domestic firm, the other domestic firm could lose market share from the tariff, contrary to conventional wisdom. The intuition lies in the production shifting from x to y^d due to the control power v and the initial ownership share k .

To see this more clearly, let us derive the reactions functions, using the FOCs:

$$x = r^f(y^d, y^h) = \frac{(a - c^f - t)}{2} - \frac{\gamma(1+k)}{2}y^d - \frac{\gamma}{2}y^h, \quad (14)$$

$$y^d = r^d(x, y^h) = \frac{(b - c^d + s)}{2} - \frac{y^h}{2} - \frac{\gamma x}{2}(1 + \eta), \quad (15)$$

$$y^h = r^h(x, y^d) = \frac{(b - c^d + s) - \gamma x - y^d}{2}. \quad (16)$$

Figure 3 around here

Figure 3 depicts the reaction curves of firms f and d for given y^h . From (15) and Assumption 2, a larger k leads to a steeper reaction curve for firm d when $k < \bar{k}$; whereas it leads to a flatter reaction curve when $k > \bar{k}$.¹⁰ Thus depending on k , two reaction curves of firm d , $r^{d'}$ and r^d , are drawn in the figure.

Figure 3 also shows that the production sifting from x to y^d becomes larger as the reaction curve becomes steeper. Suppose that the tariff on good X increases, then the reaction curve r^f shifts downward. In turn x falls and y^d rises, because they are strategic substitutes. In Figure 3, since curve $r^{d'}$ is steeper than curve r^d , y^d increases more on the former curve than on the latter one for a given y^h .

Now, whether y^h increases or not depends on the scale of the production sifting from x to y^d . Proposition 1 implies that the increase in y^d dominates the decrease in x if k is between k_1 and 1. As a consequence, the increase in y^d squeezes the production of firm h , y^h , giving rise to Proposition 1.

Next, we investigate the effects of the tariff on prices.

$$\frac{dp_x}{dt} = \frac{(3 - 2\gamma^2) - v\{(1 - k)(3 - 2\gamma^2) + \gamma^2\}}{\Delta}, \quad (17)$$

$$\frac{dp_y}{dt} = \frac{\gamma\{1 - v(2 - k)\}}{\Delta}. \quad (18)$$

From (17), dp_x/dt is negative if and only if $v > (3 - 2\gamma^2)/\{(1 - k)(3 - 2\gamma^2) + \gamma^2\} (\equiv f(k))$. And (18) says that dp_y/dt becomes negative if only if $v > e(k)$. In Figure 2, $v(k)$ intersects with $f(k)$ at $k = k_2$ and $k = \gamma^2/(3 - 2\gamma^2)$.¹¹ Thus, we have

¹⁰From Lemma 1, the reaction curve under $k \geq k_1$ is always steeper than that under $k < k_1$.

¹¹In view of Figure 2, the parameters in which the price of good X falls exist if and only if $\bar{k} < \gamma^2/(3 - 2\gamma^2)$.

Proposition 2 *An increase in the tariff, (i) reduces the price of good Y if and only if $k_1 < k < 1$; and (ii) also reduces the price of good X if and only if $k_2 < k < \gamma^2/(3-2\gamma^2)$.*

Proposition 2 is again counter-intuitive. Normally when the tariff rises, imports decrease while import prices rise, and the prices of substitutes also rise. However, Proposition 2 says that both prices can fall following an increase in the import tariff. The intuition can be understood as follows. For (i), conditions (10) and (13) state that $dx/dt < 0$ and $dY/dt > 0$. But due to the production shifting of firm f , if k is within the satisfied range, the effect of dY/dt dominates dx/dt in affecting the price of good Y through equation (1b), lowering p_y . For (ii), since the two goods are substitutes, a large decrease in p_y also lowers p_x .

Finally, we turn to the profit of the domestic firm h . Substitution yields

$$\frac{d\pi^h}{dt} = 2y^h \frac{dy^h}{dt}.$$

Invoking Proposition 1, we can hence establish the following proposition whose intuition is straightforward from Proposition 1:

Proposition 3 *An increase in the import tariff reduces the profit of firm h if and only if $k_1 < k < 1$.*

By Lemma 2, the tariff increases firm d 's profit, but reduces the profit from selling good X as follows

$$\begin{aligned} \frac{d\pi^d}{dt} &= y^d \frac{dY}{dt} + \gamma x \eta \frac{dy^d}{dt} > 0, \\ \frac{d\pi^x}{dt} &= k\gamma y^d \frac{dx}{dt} - \gamma x \frac{dY}{dt} - x < 0. \end{aligned}$$

Although the change in firm f 's total profit is generally ambiguous, the tariff may benefit the foreign firm f because the output of the locally-owned firm h is reduced.

Proposition 4 *An increase in the tariff, (i) raises firm f's profit if $\bar{k} \leq k \leq k_4$, where k_4 is defined as $\gamma^2(k_4+1)(k_4+2) - 6k_4 = 0$; (ii) but reduces its profit if $k \leq k_1$ or $k = 1$.*

Proof From Lemma 2, the change of firm f 's profit is

$$\frac{d\pi^f}{dt} = -(\gamma x + ky^d) \frac{dy^h}{dt} - \left(\frac{\gamma x(1-v)}{\lambda} \right) \frac{dy^d}{dt} - x. \quad (19)$$

Because the sum of the last two terms are always negative, equation (19) becomes negative when $dy^h/dt \geq 0$, i.e., $k \leq k_1$ and $k = 1$ (see Proposition 1).

Now if $k \geq \bar{k}$, the second term in (19) disappears, i.e.,

$$\left. \frac{d\pi^f}{dt} \right|_{v=1} = -ky^d \frac{dy^h}{dt} - x \left(\gamma \frac{dy^h}{dt} + 1 \right). \quad (20)$$

Proposition 1 states that the first term in (20) is positive. Using (9) and (12), the second term becomes

$$-\Delta \left(\gamma \frac{dy^h}{dt} + 1 \right) \Big|_{v=1} = \gamma^2(k+1)(k+2) - 6k. \quad (21)$$

The right hand side of (21) is decreasing in k . Q.E.D.

3.2 Production Subsidy

Now, we turn to the impact of the production subsidy. First, we look at outputs and obtain

$$\frac{dx}{ds} = -\frac{\gamma(2+k)\lambda}{\Delta} < 0, \quad (22)$$

$$\frac{dy^d}{ds} = \frac{2\lambda + v\gamma^2}{\Delta} > 0, \quad (23)$$

$$\frac{dy^h}{ds} = \frac{2 - v\{2 + \gamma^2 - (2 - \gamma^2)k\}}{\Delta}, \quad (24)$$

$$\frac{dY}{ds} = \frac{4(1-v) + kv(4 - \gamma^2)}{\Delta} > 0. \quad (25)$$

Figure 4 around here

A counter-intuitive result is that dy^h/ds in (24) is negative if and only if $v > 2/\{2 + \gamma^2 - (2 - \gamma^2)k\}$ ($\equiv g(k)$). Figure 4 illustrates the relationship between $g(k)$ and $v(k)$. Curve $v(k)$ intersects with $g(k)$ at $k = k_3$ and $k = \gamma^2/(2 - \gamma^2)$. Assumption 2 assures that $v(k)$ intersects with $g(k)$ at most once in $[0, \bar{k}]$. This implies that there exist parameters (k, v) in which firm h decreases its output if and only if $\bar{k} < \gamma^2/(2 - \gamma^2)$. Therefore, the following proposition can be established.

Proposition 5 *An increase in the production subsidy to good Y reduces the output of firm h if and only if $k_3 < k < \gamma^2/(2 - \gamma^2)$.*

This counter-intuitive result again stems from the production shifting from x to y^d due to the control power v . As is shown in Figure 5, when the reaction curve r^d becomes steeper (from r^d to $r^{d'}$), the effect of a change in the production subsidy on y^d becomes larger.

In Figure 6, we compare the effects of the tariff and the subsidy. Because firm h 's reaction curve also shifts upward, the range of k in which firm h reduces its output becomes smaller than in the tariff case. This arises because the subsidy affects domestic production directly, while the tariff does it indirectly by first reducing imports.

Figure 5 around here

Figure 6 around here

As expected, the subsidy lowers the prices of both goods.

$$\frac{dp_x}{ds} = -\frac{\gamma\{kv(2-k-\gamma^2) + (1-v)(2-k)\}}{\Delta} < 0, \quad (26)$$

$$\frac{dp_y}{ds} = -\frac{kv\{4-\gamma^2(3+k)\} + (1-v)\{4-\gamma^2(2+k)\}}{\Delta} < 0. \quad (27)$$

As to the profit of firm h , substitutions yield,

$$\frac{d\pi^h}{ds} = 2y^h \frac{dy^h}{ds}.$$

That is, when the output of firm h decreases, its profit also falls. Thus, Proposition 5 leads straightforwardly to:

Proposition 6 *An increase in the production subsidy to good Y reduces the profit of firm h if and only if $k_3 < k < \gamma^2/(2-\gamma^2)$.*

From Lemma 1, the production subsidy increases the profit of firm d , but decreases the profit from selling good X as follows

$$\begin{aligned} \frac{d\pi^d}{ds} &= y^d \frac{dY}{ds} + \gamma x \eta \frac{dy^d}{ds} > 0, \\ \frac{d\pi^x}{ds} &= k\gamma y^d \frac{dx}{ds} - \gamma x \frac{dY}{ds} < 0. \end{aligned}$$

The change in firm f 's total profit is generally ambiguous. However, the production subsidy may benefit the foreign firm through two channels. One is firm f 's financial interest in firm d and the other is the reduction of firm h 's output. Specifically, we can state

Proposition 7 *An increase in the production subsidy to good Y, (i) increases firm f's profit if $\bar{k} \leq k \leq \gamma^2/(2 - \gamma^2)$; (ii) but decreases its profit if k is sufficiently small.*

Proof Using firm h's first order condition, $dp_y = dy^h - ds$, equation (8) in Lemma 1 can be rewritten as

$$\frac{d\pi^f}{ds} = -\gamma x \frac{dy^h}{ds} - ky^d \frac{dp_y}{ds} - \left(\frac{\gamma x(1-v)}{\lambda} \right) \frac{dy^d}{ds}.$$

The second term is always positive for $k > 0$. The last term is negative if $k < \bar{k}$ and zero if $\bar{k} \leq k$. Proposition 5 implies that the first term is positive if and only if $k_3 \leq k \leq \gamma^2/(2 - \gamma^2)$. Q.E.D.

4 Regulated foreign ownership

In many developing countries, there exist legal limits on foreign ownership (e.g., China, see footnote 3). Our model can be used to analyze such a policy. We focus on the effects on the outside agents, who are not directly involved in the partial ownership, i.e., the consumer prices and the profit of firm h.

Totally differentiating the first order conditions (5a), (5b) and (5c), we obtain¹²

$$\begin{pmatrix} 2 & \gamma(1+k) & \gamma \\ \frac{\gamma(1+kv)}{\lambda} & 2 & 1 \\ \gamma & 1 & 2 \end{pmatrix} \begin{pmatrix} dx \\ dy^d \\ dy^h \end{pmatrix} = \begin{pmatrix} -\gamma y^d \\ -\gamma x \theta \\ 0 \end{pmatrix} dk. \quad (28)$$

Recall from Assumption 2 and Lemma 1 that θ captures the change in firm d's weight on the profit from good X, that is, the change in firm d's incentives to reduce its own output for the sales of good X. There are two cases: (i) if $0 \leq k < \bar{k}$, because a higher ownership share leads to a greater control power, the reduction of firm d's output for the sales of good X increases as firm f's share rises; (ii) if $\bar{k} < k \leq 1$, firm f acquires full control of firm d, and an increase in its share raises the cost to reduce the output and profit of the latter firm (see Lemma 1). Thus, in the latter case, the higher share mitigates firm d's output reduction.

¹²Here both sides of (5b) are divided by λ .

4.1 The effects on the outside agents

First, we look into firm h . From the FOCs, foreign ownership changes firm h 's profit as follows

$$\frac{d\pi^h}{dk} = 2y^h \frac{dy^h}{dk},$$

which depends on the change of firm h 's output

$$\begin{aligned} \frac{dy^h}{dk} &= \frac{\gamma[\gamma y^d \{e(k) - v\}(2 - k) + \lambda x \theta (2 - \gamma^2 - k\gamma^2)]}{\Delta}, \\ \frac{dy^h}{dk} \Big|_{v=1} &= -\frac{\gamma\{(1 - k)\gamma y^d + kx(2 - \gamma^2 - k\gamma^2)\}}{\Delta} < 0. \end{aligned}$$

As can be seen in Figure 2, $e(k) > v$ if $k < k_1$ and the sign is ambiguous when $k_1 < k < \bar{k}$.¹³ Thus, we can state:

Proposition 8 *Suppose that firm f 's ownership share rises. Then the output and profit of firm h increase if $k < k_1$ but decrease if $k \geq \bar{k}$.*

Proposition 8 says that when firm f owns a small share of firm d , an increase in foreign ownership benefits the rival firm h , because firms f and d take into account the intra-marginal effects of their own output expansion on each other, leading them to reduce outputs. That is, the higher control power leads firms f and d to internalize their over-production by reducing their outputs. And when the control power is not high, the room for output reduction is large. However, if firm f owns a large enough share of firm d , then it has full control of firm d , and further increase in foreign ownership enables the two to become closer into one entity, thus hurting the rival firm h .

The policy implication of Proposition 8 is that if foreign ownership is sufficiently large, then regulating it helps the locally-owned firm in terms of market share and profits; on the other hand, if foreign ownership is small, then regulation will hurt the locally-owned firm.

Next we investigate the consumer prices. From the FOC for firm h , we derive

$$\frac{dp_y}{dk} = \frac{dy^h}{dk}.$$

Using Proposition 8, we establish:

¹³The changes of outputs x , y^d and y^h all depend on the ratio x/y^d as can be seen from (28). However, the ratio takes any positive value $[0, +\infty]$, because either x or y^d can be zero. See the Appendix for such corner solutions.

Lemma 3 *Suppose that firm f 's ownership share increases. Then the price of good Y rises if $k < k_1$, but falls if $k \geq \bar{k}$.*

The price of good X changes as follows:

$$\begin{aligned}\frac{dp_x}{dk} &= \frac{\gamma}{\Delta} \left[y^d \{f(k) - v\} \{(1-k)(3-2\gamma^2) + \gamma^2\} + \lambda \gamma x \theta \{1 - k(2 - \gamma^2)\} \right], \\ \frac{dp_x}{dk} \Big|_{v=1} &= -\frac{\gamma [y^d \{\gamma^2 - k(3-2\gamma^2)\} + \gamma k x \{1 - k(2 - \gamma^2)\}]}{\Delta}.\end{aligned}$$

It can be seen from Figure 2 that the sign is ambiguous if either $k_2 < k < \bar{k}$ or $\gamma^2/(3-2\gamma^2) < k < 1/(2-\gamma^2)$ holds, and that $v > f(k)$ if and only if $k_2 < k < \gamma^2/(3-2\gamma^2)$. Since $\gamma^2/(3-2\gamma^2) < 1/(2-\gamma^2)$, we have:

Lemma 4 *Suppose that firm f 's ownership share rises. Then the price of good X increases if either $k \leq k_2$ or $k \geq 1/(2-\gamma^2)$ holds, but decreases if $\bar{k} < k < \gamma^2/(3-2\gamma^2)$.*

Furthermore, in view of Lemmas 3 and 4, the following Proposition is straightforward:

Proposition 9 *Suppose that firm f 's ownership share increases. Then the prices of both goods X and Y rise if $k < k_1$, while they both fall if $\bar{k} < k < \gamma^2/(3-2\gamma^2)$.*

The intuition for Proposition 9 follows from Proposition 8. If k is small, an increase in foreign ownership reduces the joint outputs of firms f and d , and the reduction dominates the expansion of firm h 's output, leading to a lower industry output, which in turn results in a higher price. On the other hand, if k is large enough, firm f gains control of firm d , and further increase in foreign ownership strengthens the two firms as a single entity, enabling it to compete with firm h by expanding output, thus lowering the price.

5 Welfare

In this section, we look into the welfare effects of commercial policies under CBO. For computational simplicity, we assume the following on the ownership of the domestic firms.

Assumption 3 *The residual share $(1-k)$ of firm d 's stocks and all of firm h 's stocks are owned by domestic residents.*

We define the domestic welfare W as the sum of the consumer surplus, the domestic firms' profit and the government revenue:

$$W \equiv U(x, Y) - p_x x - p_y Y + \pi^h + (1-k)\pi^d + tx - sY,$$

where $\partial U/\partial x = p_x$ and $\partial U/\partial Y = p_y$. Totally differentiating W yields:

$$\begin{aligned} dW = & -\{x dp_x + ky^d dp_y\} + \{(p_y - c^h)dy^h + (1-k)(p_y - c^d)dy^d\} \\ & + \{tdx + xdt - k(sdy^d + y^d ds)\} + (\rho - \pi^d)dk. \end{aligned} \quad (29)$$

The first three brackets respectively express the terms of trade effect, the resource allocation effect, and the tariff revenue effect. The last term is the surplus from the sales of firm d 's stock to firm f .

5.1 Tariff and production subsidy

We are now in a position to state:

Proposition 10 *Suppose that $s = 0$ and $t = 0$ hold initially. Then, (i) a small tariff on good X raises domestic welfare if $(k - k_1)(c^h - c^d) \geq 0$; and (ii) a small production subsidy to good Y enhances domestic welfare if $(k - k_3)\{k - \gamma^2/(2 - \gamma^2)\}(c^h - c^d) \leq 0$.*

Proof Expression (29) can be rewritten as

$$dW = x(dt - dp_x) + (tdx - ksd y^d) + d\omega,$$

where $d\omega \equiv -ky^d(dp_y + ds) + (p_y - c^h)dy^h + (1-k)(p_y - c^d)dy^d$. Given $s = 0$ and $t = 0$ initially, the second term becomes $(tdx - ksd y^d) = 0$. It is thus sufficient to show that $(dt - dp_x)$ and $d\omega$ are both positive.

First, recall that $dp_x/ds < 0$ from (26). And from (17) we have

$$1 - \frac{dp_x}{dt} = \frac{(1-v)(3 - k\gamma^2) + kv(3 - k\gamma^2 - 2\gamma^2)}{\Delta} > 0.$$

Therefore, $(dt - dp_x) > 0$; that is, the producer price of good X always falls.

From the FOC for firm h , we derive $dp_y + ds - dy^h = 0$, and from that for firm d , we have $p_y - c^d = y^d + \eta\gamma x$, where $\eta \equiv v/(1 - v + kv)$. Now $d\omega$ can be simplified as

$$\begin{aligned} d\omega &= -ky^d dy^h + (p_y - c^d)(dY - kdy^d) + (c^d - c^h)dy^h \\ &= (1-k)y^d dY + \eta\gamma x(dY - kdy^d) + (c^d - c^h)dy^h. \end{aligned} \quad (30)$$

Because $dY/dt > 0$ in (13) and $dY/ds > 0$ in (25), the first term in (30) is positive. The second term is also positive because

$$\begin{aligned} \frac{dY}{ds} - k \frac{dy^d}{ds} &= \frac{2\gamma\{(1-v)(2-k) + kv(2-\gamma^2-k)\}}{\Delta} > 0, \\ \frac{dY}{dt} - k \frac{dy^d}{dt} &= \frac{\gamma(2-v-k+kv-k^2v)}{\Delta} > 0. \end{aligned}$$

Using Proposition 5, the last term in (30), $(c^d - c^h)(dy^h/ds) \geq 0$ if and only if $(k - k_3)\{k - \gamma^2/(2 - \gamma^2)\}(c^h - c^d) \leq 0$. Similarly, from Proposition 1, $(c^d - c^h)(dy^h/dt) \geq 0$ if and only if $(k - k_1)(c^h - c^d) \geq 0$. Q.E.D.

Thus, even though foreign ownership and control cause distortions to outputs, prices and profits, a small tariff or a small production subsidy can shift rents and benefit the domestic country. If $c^d = c^h$, both the tariff and the production subsidy increase domestic welfare, a la Brander and Spencer (1984). If $c^d \neq c^h$, on the other hand, it is not a simple rent-shifting argument. Lahiri and Ono (1988) showed in a closed economy that an increase in the output of the efficient firm and a decrease in the output of the inefficient firm enhance welfare, and vice versa. In our model, this effect also exists, in addition to the effect of rent-shifting. For example, the tariff raises firm d 's output and reduces firm h 's output when $k > k_1$. In this case, if firm d is more efficient than firm h (i.e., $c^h > c^d$), then the tariff improves welfare.

5.2 Foreign ownership regulation

We next examine the effect of the foreign ownership regulation on the host country's welfare. As seen in expression (29), the welfare change depends on the market structure in the stock market. Following Grossman and Hart (1980) and Flath (1991), we assume a competitive stock price, $\rho = \pi^d$, under which the domestic stockholders are indifferent to sell or buy the stock.

Propositions 8 and 9 suggest that the welfare change is generally ambiguous because the consumers and the locally-owned firm are affected in opposite ways from an increase in foreign ownership. When the prices of both goods fall, however, we find that the gain in the consumer surplus dominates the loss in the profit of the local firm, i.e.,

Proposition 11 *Suppose that $s = t = 0$ and $\rho = \pi^d$ hold. An increase in the foreign ownership improves the domestic welfare if $\bar{k} \leq k \leq \gamma^2/(3 - 2\gamma^2)$ and $c^h \geq c^d$.*

Proof The FOC of firm f , $dp_x = dx + \gamma k dy^d + \gamma y^d dk$, and the inverse demand, $dp_x = -dx - \gamma dY$, can be used to simplify the welfare decomposition (29) as

$$dW = -x(1 + 2\eta)dp_x + \gamma\eta x dk + (1 - k)y^d dY - (c^h - c^d)dy^h. \quad (31)$$

In view of Lemma 4, the price of good X decreases if $\bar{k} < k < \gamma^2/(3 - 2\gamma^2)$. Comparative statics yields $dY/dk = [-\lambda\theta\gamma x(2 + k\gamma^2) + \gamma^2 y^d(2 - v + 2kv)]/\Delta$, which is positive if

$k \geq \bar{k}$. Moreover, $dy^h/dk < 0$ if $k \geq \bar{k}$ (recall Proposition 8). Therefore, we obtain $dW/dk > 0$ if $\bar{k} \leq k \leq \gamma^2/(3 - 2\gamma^2)$. Q.E.D.

5.3 Foreign control regulation

When the foreign firm f holds a large control power, the acquired firm d ignores the interests of the minority shareholders. However, in many countries, antitrust law or corporate law obliges an acquiring firm to serve the interests of the minority shareholders. The domestic government may want to protect the interests of domestic shareholders by strengthening the enforcement of the laws (see O'brien and Salop 2000, for example). Our model can analyze such a practice by treating it as a reduction in the control power v for a given share k .

Under $dk = 0$, we have

$$\begin{pmatrix} 2 & \gamma(1+k) & \gamma \\ \frac{\gamma(1+kv)}{\lambda} & 2 & 1 \\ \gamma & 1 & 2 \end{pmatrix} \begin{pmatrix} dx \\ dy^d \\ dy^h \end{pmatrix} = \begin{pmatrix} 0 \\ -\frac{\gamma x \theta}{\lambda^2} \\ 0 \end{pmatrix} dv.$$

Comparative statics yields

$$\begin{aligned} \frac{dx}{dv} &= \frac{\gamma^2 x (2k+1)}{\lambda \Delta} > 0, \quad \frac{dy^d}{dv} = -\frac{\gamma x (4-\gamma^2)}{\lambda \Delta} < 0, \\ \frac{dy^h}{dv} &= \frac{dp_y}{dv} = \frac{\gamma x (2-k\gamma^2-\gamma^2)}{\lambda \Delta} > 0, \quad \frac{dY}{dv} = -\frac{\gamma x (2+k\gamma^2)}{\lambda \Delta} < 0. \end{aligned}$$

Moreover, we obtain

$$\frac{dp_x}{dv} = \frac{\gamma^2 x (k\gamma^2 - 2k + 1)}{\lambda \Delta} > 0 \text{ if and only if } k < \frac{1}{2 - \gamma^2}.$$

The reduction in foreign control leads firm d to expand its output, while the other firms to reduce their outputs because all products are substitutes. Since firm d 's output and hence π^d increase, the minority shareholders benefit from foreign control regulation. The total output of good Y increases and the prices of both goods fall as long as k is small. However, if firm f owns a large share, the price of good X rises because a large production-shifting from goods X to Y is generated.

Under $dk = 0$, the welfare change (31) is expressed as

$$dW = -x(1+2\eta)dp_x + (1-k)y^d dY - (c^h - c^d)dy^h.$$

The gain in the consumer surplus and the profit of firm d can dominate the loss of firm h as far as k is small. On the other hand, if k is large, a small domestic share in firm d 's stock cannot compensate for the loss of firm h and a rise in the price of good X . These are stated as

Proposition 12 *Suppose that $s = t = 0$ holds. A decrease in the foreign firm's control power improves domestic welfare, i.e. $dW/dv < 0$ for given k , if $k < 1/(2 - \gamma^2)$ and $c^d \leq c^h$ hold. However, it lowers domestic welfare if k is sufficiently large and $c^d \geq c^h$ holds.*

6 Concluding Remarks

In a model of cross-border partial ownership, we have investigated the effects of commercial policy such as import tariffs, production subsidies and regulation on foreign ownership. In particular, we have explicitly incorporated the aspect of foreign firm's control over the domestic firm through CBO. We have found that due to foreign ownership and control, commercial policies may not benefit the 100 percent locally-owned firm, because the foreign firm with corporate control can shift production across borders and thus evade the burden or even take advantage of commercial policy. We hope that these findings can shed light on host countries of FDI, especially developing countries.

We have assumed that goods X and Y are produced in the two countries separately. One could allow either country to produce both goods, but the mechanism of production shifting under foreign ownership and control remains the same, and most of our qualitative results should carry through.

CBO is sometimes accompanied by technology transfer. We have not dealt with this issue explicitly, because our focus is rather on the horizontal market-linkages through CBO. One might think, however, that technology transfer is already reflected implicitly in the marginal costs. That is, because of CBO, we have $c^d < c^h$. As has been shown, the difference becomes crucial when evaluating welfare.

We have assumed that the share of foreign ownership k and the degree of control v are exogenously given. It would be interesting to analyze how commercial policies affect them when they are endogenously determined, especially when many developing countries impose legal limits on foreign ownership.

Finally, the present paper focused only on horizontally related firms. In the tradition of Markusen (2002), Markusen et al. (1996), and Qiu and Spencer (2002), it is also

interesting to investigate vertically related firms. Our setup of cross-border ownership and control can be applied. These remain fruitful avenues for future research.

Appendix

In this appendix, we provide the necessary and sufficient conditions for x and y^d to have interior solutions. The FOCs and the demand functions yield the equilibrium outputs as

$$x = \frac{(1-v+kv)\{3(A-\gamma\delta) - \gamma(B-\delta)(2+k)\}}{\Delta}, \quad (\text{A1})$$

$$y^d = \frac{(B-\delta)(2-2v+2kv+v\gamma^2) - \gamma(1+v+kv)(A-\gamma\delta)}{\Delta}, \quad (\text{A2})$$

where $A \equiv a - c^f - t$, $B \equiv b - c^d + s$, and $\delta \equiv c^d - c^h$.

First, for a given k , (A1) and (A2) give rise to $x > 0$ and $y^d > 0$ if and only if $(A - \gamma\delta) \geq 0$ and

$$u(k) \equiv \frac{3}{(k+2)} > \frac{\gamma(B-\delta)}{(A-\gamma\delta)} > \frac{\gamma^2(1+v+kv)}{(2-2v+2kv+v\gamma^2)} \equiv l(k). \quad (\text{A3})$$

Because $u(k) - l(k) = \Delta / (2 - 2v + 2kv + v\gamma^2) (k + 2) > 0$, there exist parameters (A, B, δ) for an interior solution when k is given.¹⁴

Next, we examine the conditions for all $k \in [0, 1]$. $u(k)$ is obviously decreasing in k and, from Assumption 2, $l(k)$ is maximized at $k = \bar{k}$ because

$$l'(k) = \frac{\gamma^2(\gamma+2)(2-\gamma)}{(2-2v+2kv+v\gamma^2)^2} (v' - v^2) \begin{cases} \geq 0 & \text{if } k < \bar{k} \\ < 0 & \text{if } \bar{k} < k \end{cases}.$$

Thus, the parameters which make $x > 0$ and $y^d > 0$ for all $k \in [0, 1]$ exist if and only if

$$u(1) - l(\bar{k}) = \frac{(2-\gamma^2)\bar{k} - \gamma^2}{2\bar{k} + \gamma^2} > 0 \Leftrightarrow \bar{k} > \frac{\gamma^2}{2-\gamma^2}.$$

¹⁴A little manipulation brings $x = 0$ if $u(k) < \gamma(B-\delta)/(A-\gamma\delta)$ and $y^d = 0$ if $l(k) > \gamma(B-\delta)/(A-\gamma\delta)$. From the FOC for firm h , a non-negative δ assures $y^h > 0$ if $y^d > 0$.

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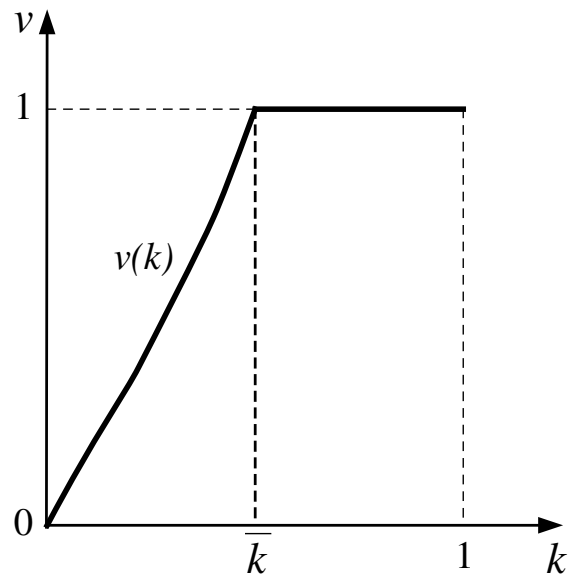


Figure 1: The schedule of ownership k and control v .

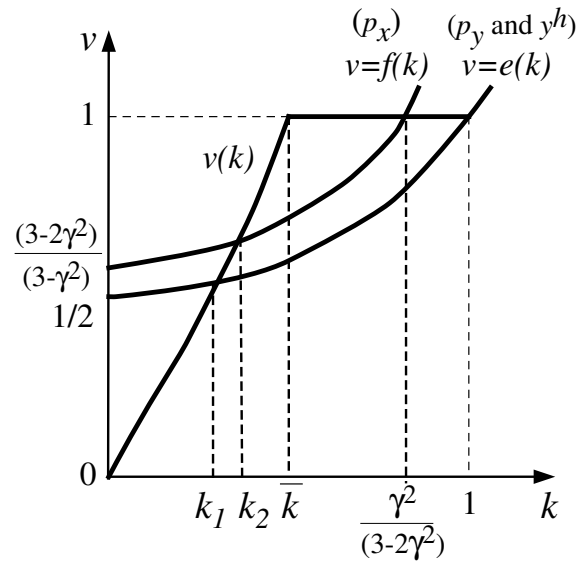


Figure 2: Tariff on good X.

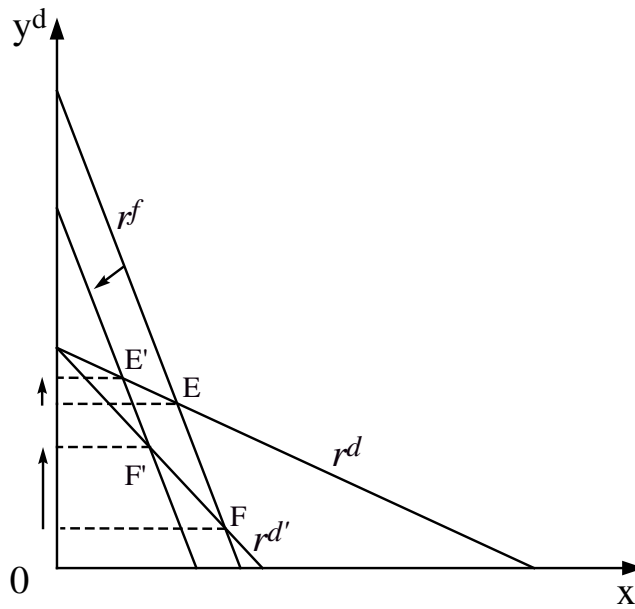


Figure 3: Production shifting from x to y^d (Tariff).

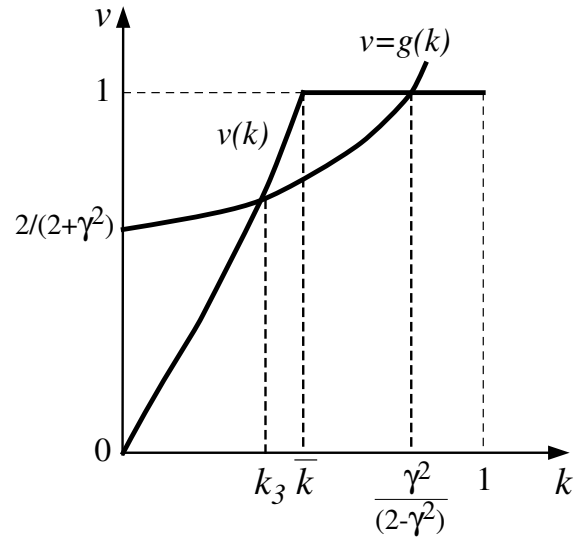


Figure 4: Production Subsidy for good Y .

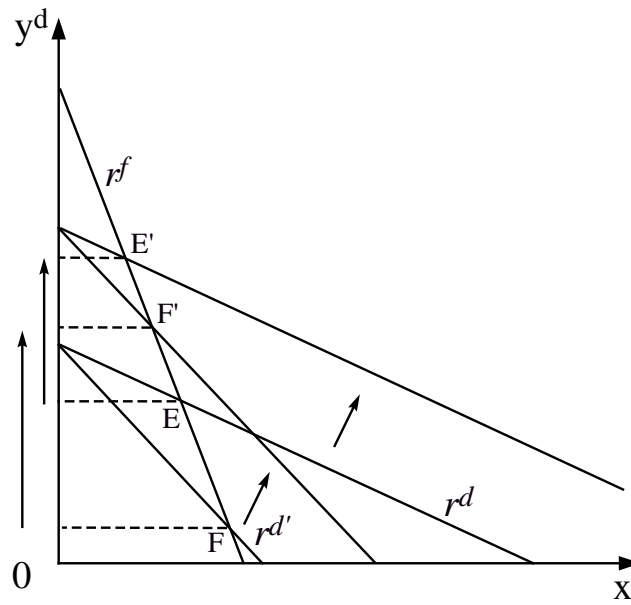


Figure 5: Production shifting from x to y^d (Production Subsidy).

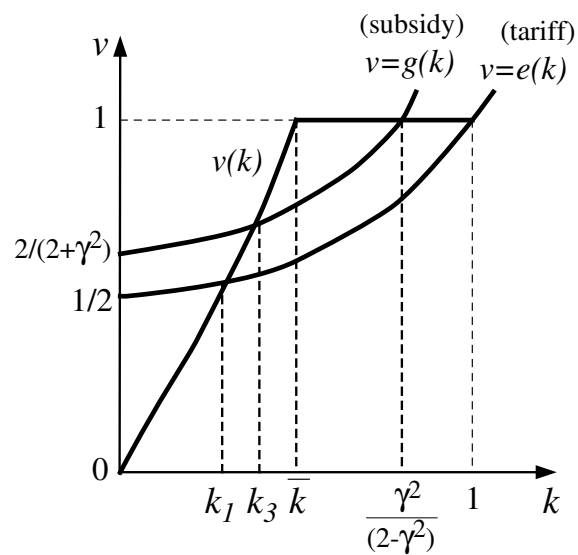


Figure 6: The range of the counter-intuitive case.