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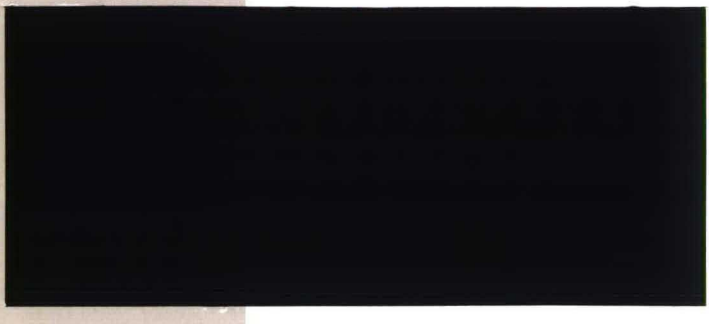

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STRATEGIC INDUSTRIAL POLICY FOR COURNOT AND BERTRAND OLIGOPOLY: MANAGEMENT-LABOR COOPERATION AS A POSSIBLE SOLUTION TO THE MARKET STRUCTURE DILEMMA

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STRATEGIC INDUSTRIAL POLICY FOR COURNOT AND BERTRAND OLIGOPOLY: MANAGEMENT-LABOR COOPERATION AS A POSSIBLE SOLUTION TO THE MARKET STRUCTURE DILEMMA

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Abstract

This paper reexamines the market structure problem in the strategic trade policy literature. It is shown that home management-labor cooperation in the form of rent-sharing raises total home industry rents regardless of whether the international duopoly is Cournot or Bertrand. Furthermore, home welfare also rises with firm-union rent-sharing if the international industry consists of more than two firms, if the industry is faced with entry, and if there is domestic consumption. This paper shows that management-labor cooperation can be a robust strategic industrial policy and can be interpreted as a solution to the market structure dilemma.

1. Introduction

The study of trade policies to enhance a country's competitiveness in an oligopolistic environment has attracted increasing attention in recent years (e.g., see Helpman and Krugman 1989). Brander and Spencer's (1984, 1985) pioneering work show that tariffs and export subsidies serve as policies that increase the home country's economic rents at the expense of the foreign country. Eaton and Grossman (1986) and Cheng (1987) highlight the fact that the nature of the optimal industrial policy will depend critically on the nature of the oligopolistic interaction. Bulow, Geanakoplos and Klemperer (1985) analyze the results in the oligopolistic trade policy literature by the concepts of strategic substitutes and complements. Dixit (1984) further shows that the Brander-Spencer result will depend on the number of firms in the market, while Venables (1985) and Horstman and Markusen (1986) emphasize the fact that entry conditions will modify considerably the basic profit-shifting arguments. All these important qualifications in the strategic trade policy literature seem to point to a professional consensus that the government, at least at this stage of our knowledge about various industry conditions, simply does not have enough information to carry out a successful industrial policy.

However, though the literature has understandably focused on the instruments of taxes and subsidies, there are other less discussed elements that are included in the industrial policy proposals. One often repeated idea is the concept of enhanced collaboration between management and labor. The origin of this notion is partly based on the observation that in Japan, the unions seem to be more willing to act and adapt to increase the company's profits, while in North America, the traditional labor-management relationship tends to be adversarial. One proposal that may serve to moderate the antagonistic relationship is to institute a rent-sharing plan between the workers and the owners of the firm. It has been pointed out that the Japanese bonus system has the essential properties of profit-sharing (Freeman and Weitzman 1987). On a macroeconomic level, rent-sharing has also been advocated as a beneficial labor market

institution that can lead to lower unemployment and lower inflation (Weitzman 1984, 1985). In this paper, we exclusively concentrate on the question of whether management-labor cooperation can serve as a strategic industrial policy, i.e., whether the *industry rents* can be increased.[1] In the next section, we set up the basic duopoly framework, where it is seen that sharing rents will increase the total industry rents (the sum of the rents of the union and the firm) regardless of whether the international duopolists are Cournot-Nash or Bertand-Nash. In section 3, our results are seen to apply also to the case of an international oligopoly with m foreign firms and n domestic firms. In section 4, it is shown that rent-sharing can still increase total industry profits when the international oligopoly is faced with endogenous entry. Thus the rent-enhancing property of this kind of management-labor cooperation is shown to be robust with respect to the type of oligopolistic interactions, the number of oligopolists, and entry and can be viewed as a possible "solution" to the market structure dilemma in the strategic industrial policy literature. In section 5, we examine the conditions under which sharing rents is still beneficial when domestic consumption constitutes part of the country's welfare. Finally, some concluding remarks will be provided in the last section.

2. Basic Duopoly Model

The basic product market model is standard in the literature. We consider two international firms, one domestic and one foreign. The domestic firm produces good x and the foreign firm produces good y, a substitute. As in Eaton and Grossman (1986), we assume initially that both firms export to a third market in order to focus on the rent-enhancing effects of an industrial policy. For the home country, we consider a situation where a rent sharing plan is set up so that a fraction θ of the firm's rents are distributed to the workers. We first examine the Cournot-Nash case. The firms will maximize their respective profit functions $\bar{\pi}$ and π^*:

$$\bar{\pi} = (1 - \theta)\pi = (1 - \theta)[xp(x, y) - c(x, w, r_1, \ldots, r_t)] \tag{1}$$

$$\pi^* = yp^*(x, y) - c^*(y, w^*, r_1^*, \ldots, r_t^*) \tag{2}$$

where p and p^* are the domestic and foreign inverse demands in the third market and c and c^* are the home and foreign cost functions. For x and y to be substitutes, we assume $p_x = \partial p/\partial x < 0, p_y = \partial p/\partial y < 0, p_x^* = \partial p^*/\partial x < 0$ and $p_y^* = \partial p^*/\partial y < 0$. w and w^* are the wages of labor in each country. r_i $(i = 1, \ldots, t)$ and r_i^* $(i = 1, \ldots, t)$ are the prices of the i-th nonlabor inputs that are necessary for the production of good x and good y, respectively. It is assumed that each firm produces its output with a different production function f and f^*, with $t + 1$ inputs. Both f and f^* are continuous from above, quasiconcave and are nondecreasing. The dual cost functions c and c^* are twice continuously differentiable with respect to the outputs and the input prices. All input prices except the home wage are competitively determined. For w, it is assumed to be set by a domestic labor union. This set up is essentially similar to that in Brander and Spencer (1986),[2] whose model also features international duopolists with a labor union. With a given domestic wage rate, the Cournot-Nash firms maximize their profits:

$$\bar{\pi}_x = (1 - \theta)[p + p_x - c_x] = 0 \tag{3}$$

$$\pi_y^* = p^* + yp_y^* - c_y^* = 0 \tag{4}$$

$$\bar{\pi}_{xx} < 0 \qquad \pi_{yy}^* < 0 \tag{5}$$

$$H \equiv \bar{\pi}_{xx}\pi_{yy}^* - \bar{\pi}_{xy}\pi_{yx}^* > 0 \tag{6}$$

where subscripts are partials. (3) and (4) are the first order necessary conditions, (5) represents the sufficient second order conditions and (6) is the usual stability condition for the Cournot firms. To facilitate the presentation and to relate our results to the literature, we shall sometimes invoke the following:

$$\bar{\pi}_{xy} < 0 \qquad \pi_{xy}^* < 0 \tag{7}$$

(7) assumes that the normal Cournot-Nash reaction functions are downward sloping in the

quantity space. This assumption, however, is *not* necessary for the results in this paper until section 5, where domestic consumption is taken into account.

Totally differentiate the first order conditions $\bar{\pi}_x(x, y, w)$ and $\pi_y^*(x, y)$ from (3) and (4) and using the implicit function theorem, we obtain

$$(dx/dw)^c = -\bar{\pi}_{xw}\pi_{yy}^*/H \tag{8}$$

$$(dy/dw)^c = \bar{\pi}_{xw}\pi_{yx}^*/H \tag{9}$$

where the subscript c is used to represent the Cournot case, $\bar{\pi}_{xw} = -(1-\theta)c_{xw} = -(1-\theta)c_{wx} = -(1-\theta)(\partial l/\partial x)$, by the Shepherd's lemma. Assuming that labor is a normal input, we have $\partial l/\partial x > 0$, $\bar{\pi}_{xw} < 0$, and thus $(dx/dw)^c < 0$. Furthermore if the foreign reaction function is "normal," we have $\pi_{yx}^* < 0$ and $(dy/dw)^c > 0$. The slope of the home derived demand for labor $l(x(w), w)$ is

$$(dl/dw)^c = (\partial l/\partial x)(dx/dw)^c + \partial l/\partial w \tag{10}$$

where $\partial l/\partial w < 0$ is the derivative property of the cost function and $(dx/dw)^c$ is from (8). We next turn to the labor union, which is assumed to have a well-defined objective function U:

$$U = (w - k)l + \theta\pi \tag{11}$$

k is the alternative wage that the workers can obtain elsewhere. (11) assumes that the union will act to maximize its economic rents. There are considerable disagreements as to what the union's objective functions are.[3] The reason we prefer this formulation here is that we can sum up the change to U and π to get a measure of the change to total industry rents due to an industrial policy. Furthermore, this objective function also allows us to interpret the union as any upstream input supplier so that our conclusions become more general. The term $\theta\pi$ in (11) reflects the portion of the union's rents due to rent-sharing. This type of labor-management practice is seen to be fairly widespread in Japan, where a worker is paid a fixed salary plus biannual bonuses which can amount to one-third of the worker's annual income (Allen 1981,

Aoki 1988).

Overall, our model can be interpreted as a two-stage game with subgame perfect property. In the first stage, the home union moves first to set the wage, taking the derived demand $(dl/dw)^c$ in (10) and the term $\theta\pi$ into account when calculating its optimal w. In the second stage, the firms take this input price as given and the international duopolists set simultaneously and independently their strategic variables (in this particular case, quantity). Maximization of U by the labor union yields the first and second order conditions

$$(U_w)^c \equiv (dU/dw)^c = l + (w - k)(dl/dw)^c + \theta(d\pi/dw)^c = 0 \tag{12}$$

$$(U_{ww})^c \equiv (d^2U/dw^2)^c < 0 \tag{13}$$

Totally differentiate (12) with respect to θ and w and solve:

$$(dw/d\theta)^c = -(U_{w\theta})^c/(U_{ww})^c = -(d\pi/dw)^c/(U_{ww})^c \tag{14}$$

Using (1) and the Shepherd's lemma, $(d\pi/dw)^c = xp_y(dy/dw)^c - l$. If the Cournot reaction function is normal, we have $(dy/dw)^c > 0$ by (9) and with $P_y < 0$, we have $(d\pi/dw)^c < 0$ and thus $(dw/d\theta)^c < 0$. Note that (14) holds for the particular value of $\theta = 0$ so that $(dw/d\theta)^c$ can be interpreted to mean that instituting rent-sharing for the normal Cournot case will reduce the wage quoted by the home union to the home firm. From the results of Eaton and Grossman (1986), we can infer that the result of $(dw/d\theta)^c < 0$ is only true for the "normal" Cournot-Nash firms and will not generally hold for the Bertrand-Nash firms, as will be confirmed later.

What is the impact of rent-sharing on total home export rents? Define $NW = \bar{\pi} + U$ as home national welfare. NW can be rewritten as $\pi + \bar{U}$ where $\bar{U} = (w-k)l$. Differentiate NW with respect to θ and using the union's first order condition, we obtain

$$(dNW/d\theta)^c = (1 - \theta)(d\pi/dw)^c(dw/d\theta)^c \tag{15}$$

Substitute (14) into (15)

$$(dNW/d\theta)^c = -(1-\theta)[(d\pi/dw)^c]^2/(U_{ww})^c \geq 0 \tag{16}$$

i.e., except for the case where $(d\pi/dw)^c$ is exactly zero, the sum of the home firm's rents and the home labor union's rents rises with the setting up of a plan of sharing rents.[4] To see clearly the international *rent shifting* nature of domestic management-labor cooperation, we can examine the impact of θ on foreign profits and obtain

$$(d\pi^*/d\theta)^c < 0$$

Thus, like any traditional strategic trade policy, domestic rent-sharing in the Cournot-Nash case will raise home welfare and reduce foreign profits.

From the expression of (16), it can be seen that $(d\pi/dw)^c$ can actually take either positive or negative sign and $(dNW/d\theta)^c > 0$ will still hold. This means that even if we have a nonstandard upward-sloping foreign Cournot-Nash reaction function with $\pi^*_{yx} > 0$ and $(dy/dw)^c < 0$ (see (9)) so that $(d\pi/dw)^c = xp_y(dy/dw)^c - l \gtrless 0$, we shall still have the result that $(dNW/d\theta)^c > 0$. When we treat the case of the "normal" Bertrand-Nash firms, we shall indeed encounter the situation where $d\pi/dw$ has an ambiguous sign. However, as we just argued above, this will not change the conclusion that sharing rents will raise national welfare.

So now we shall formally analyze the Bertrand-Nash case. The direct demands $x(p, p^*)$ and $y(p, p^*)$ can be obtained by inverting the inverse demands $p(x, y)$ and $p^*(x, y)$ postulated earlier. For x and y to be substitutes, we have $x_1 = \partial x/\partial p < 0$, $x_2 = \partial x/\partial p^* > 0$, $y_1 = \partial y/\partial p > 0$, and $y_2 = \partial y/\partial p^* < 0$. The relevant profit functions with a home rent-sharing plan are:

$$\bar{\pi} \equiv (1-\theta)\pi = (1-\theta)[px(p, p^*) - c(x(p, p^*), w, r_1, \ldots, r_t)] \tag{17}$$

$$\pi^* = p^* y(p, p^*) - c^*(y(p, p^*), w^*, r_1^*, \ldots, r_t^*) \tag{18}$$

Given wage rate w, the Bertrand-Nash firms will maximize their respective profits:

$$\bar{\pi}_p = (1-\theta)[x + px_1 - c_x x_1] = 0 \tag{19}$$

$$\pi^*_{p^*} = y + p^* y_2 - c^*_y y_2 = 0 \tag{20}$$

$$\bar{\pi}_{pp} < 0 \qquad \pi^*_{p^*p^*} < 0 \tag{21}$$

$$J = \bar{\pi}_{pp}\pi^*_{p^*p^*} - \bar{\pi}_{pp^*}\pi^*_{p^*p} > 0 \tag{22}$$

(19) and (20) are the necessary first order conditions, while (21) is the set of sufficient second order conditions. (22) is the standard stability condition for price-setting firms. As in the Cournot case, in order to relate some of our results to those in the literature we shall sometimes make references to the case of "normal" Bertrand reaction functions, i.e., assuming $\bar{\pi}_{pp^*} > 0$, $\pi^*_{p^*p} > 0$, even though these assumptions are *not* necessary for our conclusions. Totally differentiate $\bar{\pi}_p(p, p^*, w)$ and $\pi^*_{p^*}(p, p^*)$ from (19) and (20) with respect to p, p^* and w and solve

$$(dp/dw)^B = -\bar{\pi}_{pw}\pi^*_{p^*p}/J = (1-\theta)x_1(\partial l/\partial x)\pi^*_{p^*p^*}/J \tag{23}$$

$$(dp^*/dw)^B = \bar{\pi}_{pw}\pi^*_{p^*p}/J = -(1-\theta)x_1(\partial l/\partial x)\pi^*_{p^*p}/J \tag{24}$$

where the superscript B is used to denote the Bertrand case. Using (23) and (24), we have

$$(dx/dw)^B = x_1(dp/dw)^B + x_2(dp^*/dw)^B \tag{25}$$

$$(dy/dw)^B = y_1(dp/dw)^B + y_2(dp^*/dw)^B \tag{26}$$

The slope of the home derived demand for labor $l(x(w), w)$ is

$$(dl/dw)^B = (\partial l/\partial x)(dx/dw)^B + \partial l/\partial w \tag{27}$$

As for the union, the equations are formally the same as those in the Cournot case:

$$U = (w-k)l + \theta\pi$$

$$(U_w)^B = l + (w-k)(dl/dw)^B + \theta(d\pi/dw)^B = 0$$

$$(U_{ww})^B < 0$$

The only difference here is that now the union takes $(dl/dw)^B$ and $(d\pi/dw)^B$ rather than $(dl/dw)^C$ and $(d\pi/dw)^C$ into account when setting the optimizing wage. Differentiate the union's first order condition with respect the θ and w, we again obtain:

$$(dw/d\theta)^B = -(d\pi/dw)^B/(U_{ww})^B \tag{28}$$

Unlike the case of "normal" Cournot reaction functions where $d\pi/dw < 0$, the sign of $d\pi/dw$ with "normal" Bertrand reaction functions is ambiguous. From (17),

$$(d\pi/dw)^B = x_2(dp^*/dw)^B(p - c_x) - l \gtrless 0 \tag{29}$$

where $x_2 > 0$, $(p - c_x) > 0$ and $(dp^*/dw)^B > 0$ if the foreign firm's reaction function is upward sloping in the $p^* - p$ space. From (29), we can see that in the Bertrand case, a rise in the home wage has two effects on the home firm's profits. It raises the total costs of production, as represented by the term $(\partial c/\partial w) = l$. But a rise in w also makes the equilibrium more collusive, enhancing π (Dixit 1986). In the event that there are no direct factor cost changes so that the term l is absent, then only the collusive effect remains and $(d\pi/dw)^B > 0$, as in the case discussed by Eaton and Grossman (1986), who deduced that for Bertrand-Nash producers, a tax will raise home welfare.

Though we cannot sign $(d\pi/dw)^B$ and so the sign of $(dw/d\theta)^B$ is indeterminate, we can still analyze the effects of rent-sharing on total home economic profits, in light of the discussion associated with (16). Define again $NW = \bar{\pi} + U$, which can be written as $NW = \pi + \bar{U}$, where $\bar{U} = (w - k)l$. Differentiate NW with respect to θ and using the union's first order condition:

$$(dNW/d\theta)^B = -(1 - \theta)[(d\pi/dw)^B]^2/(U_{ww})^B \geq 0 \tag{30}$$

Except for the somewhat unlikely case where $(d\pi/dw)^B$ is exactly zero, rent-sharing will still raise national welfare with price-setting firms. If $(d\pi/dw)^B = 0$, we have $(dNW/d\theta)^B = 0$. In other words, at worst rent-sharing will leave national welfare unchanged. Assuming that $d\pi/dw \neq 0$, we can summarize our results:

Proposition 1: Rent-sharing between the home union and the home firm will increase total home economic rents regardless of whether the international duopolists are Cournot-Nash or Bertrand-Nash.

Formally, the expression of $dNW/d\theta$ is the same for both the quantity-setting firms and the price-setting firms (compare (16) to (30)), with both involving the square of the term $d\pi/dw$ and the union's second order condition U_{ww}. It is also worth repeating that our results do not depend on the signs of the slopes of the reaction functions. As a rent-enhancing policy, why is rent sharing not sensitive to the nature of the duopolistic interaction in its impact on national welfare, as is the case in Eaton and Grossman (1986)? Somewhat mechanically, the result can be seen to come about because when the union maximizes its objection function, it takes the derived labor demand and the sensitivity of profits to a change in wage into account. The derived demand and the profit sensitivity summarize the information of various product market conditions so that when the rent-sharing union maximizes its objective, it will implicitly maximize total industry rents for all types of oligopolistic interactions. Note that our results do not come about because we treat the labor union in an unusual manner. Our modeling of the union here is simply a straightforward extension of the standard textbook treatment.[5]

On a conceptual level, the shared parameter θ can be interpreted as a measure of the degree of cooperation between the union and the firm and sharing rents is thus analogous to creating a partial collusion between the workers and the capital owners. As is usual with the formation of a cartel, the result of the increase of the total "monopoly" rents will hold no matter whether we have a price-setting or quantity-setting industry. More concretely, note that generally the participants in a typical cartel will have an incentive to share any relevant information needed to maximize total joint profits. So in the event that the union does not have sufficient information about the product market conditions (whether the competition is price-setting or quantity setting), the firm will have an incentive to let the union know[6] so that the labor union can raise

or lower its optimal wage to tax or to subsidize the producer to increase the pool of company profits, which the workers will eventually share. The cartel property explains why the rent-enhancing effect of rent-sharing is not industry-specific.

Finally, if we interpret our model as a two-stage game, then our conclusions can be further understood by noting that the major problem of implementing the "correct" industrial policy under oligopoly is that the government is an exogenous first mover[7] and thus it does not have the knowledge of whether the international firms are quantity-setting or price-setting. This problem will be "solved" if the agent that is conducting the policy is endogenous to the market. A natural candidate to fulfill that role is an input supplier in the factor markets. In our particular case, the supplier is the labor union. Rent-sharing creates an incentive for the union to change its optimal wage to subsidize or to tax the firm correctly to increase total to-be-shared profits, and by the rational expectation property of the subgame perfect equilibrium, the union will incorporate all second-stage information that will affect its own payoff when maximizing its rents.

Overall, management-labor cooperation in the form of sharing rents shifts the responsibility of carrying out effective traditional industrial policies (subsidization or taxation) from the exogenous government to an endogenous market participant who is in a "joint venture" with the firm, sidestepping the difficulty of requiring the government to gather detailed knowledge about the industry. In this way, rent-sharing can be viewed as a "solution" to the market structure dilemma widely discussed in the strategic industrial policy literature.

3. n Domestic Firms and m Foreign Firms

In this section we shall extend our analysis to the case of an oligopolistic industry with n identical domestic firms and m identical foreign firms. As before, each domestic firm produces good x, while each foreign firm produces a substitute, good y. We first consider the Cournot-Nash case. The method of analysis is the same as in section 2: we first derive an expression for

the demand for labor, which the union will take into account when setting its wage. From the union's first order condition, we obtain the impact of rent-sharing on the wage rate and thus on industry rents. As can be seen from the previous section, it is not necessary to sign the terms dx/dw, dl/dw, $d\pi/dw$ derived in the intermediate steps in order to show that $dNW/d\theta$ is nonnegative. The relevant profit functions $\bar{\pi}^i$ and π^{*i} for firm i for each country can be written:

$$\bar{\pi}^i = (1-\theta)x_i p_i[(x_1, \ldots, x_i, \ldots, x_n, y_1, \ldots, y_m) - c(x_i, w, r_1, \ldots, r_t)] \tag{31}$$

$$\pi^{*i} = y_i p_i^*(x_1, \ldots, x_n, y_1, \ldots, y_i, \ldots, y_m) - c^*(y_i, w^*, r_1^*, \ldots, r_t^*) \tag{32}$$

where all symbols are as previously defined. Profit maximization implies:

$$d\bar{\pi}^i/dx_i = (1-\theta)[p_i + x_i \partial p_i/\partial x_i - c_{x_i}] = 0 \tag{33}$$

$$d\pi^{*i}/dy_i = p_i^* + y_i \partial p_i^*/\partial y_i - c_{yi}^* = 0 \tag{34}$$

Totally differentiate the first order conditions with respect to x_i, y_i and w, impose symmetry $x_i = x_j$, $y_i = y_j$, $dx_i = dx_j$, $dy_i = dy_j$ and solve[8]:

$$(\bar{\pi}^i_{x_i x_i} + (n-1)\bar{\pi}^i_{x_i x_j})dx_i + (m\bar{\pi}^i_{x_i y_i})dy_i = -\bar{\pi}^i_{x_i w}dw \tag{35}$$

$$(n\pi^{*i}_{y_i x_i})dx_i + (\pi^{*i}_{y_i y_i} + (m-1)\pi^{*i}_{y_i y_j})dy_i = 0 \tag{36}$$

$$(dx_i/dw)^c = -\bar{\pi}^i_{x_i w}(\pi^{*i}_{y_i y_i} + (m-1)\pi^{*i}_{y_i y_j})/\Delta \tag{37}$$

$$(dy_i/dw)^c = \bar{\pi}^i_{x_i w}(n\pi^{*i}_{y_i x_i})/\Delta \tag{38}$$

where the superscript c again refers to the Cournot case, $\bar{\pi}^i_{x_i w} = -(1-\theta)\partial l_i/\partial x_i$, and for stability, $\Delta = (\bar{\pi}^i_{x_i x_i} + (n-1)\bar{\pi}^i_{x_i x_j})(\pi^{*i}_{y_i y_i} + (m-1)\pi^{*i}_{y_i y_j}) - (m\bar{\pi}^i_{x_i y_i})(n\pi^{*i}_{y_i x_i}) \neq 0$. The slope of each home firm's derived demand for labor is:

$$(dl_i/dw)^c = (\partial l_i/\partial x_i)(dx_i/dw)^c + \partial l_i/\partial w \tag{39}$$

Next we can turn to the rent-maximizing union:

$$U = (w - k)nl_i + \theta n \pi^i \tag{40}$$

The objective function is similar to that previously used except now there are n home firms, with each firm sharing a portion of its profits with the union. Solving the union's maximizing problem,

$$(U_w)^c = nl_i + (w - k)n(dl_i/dw)^c + \theta n(d\pi^i/dw)^c = 0 \tag{41}$$

$$(U_{ww})^c < 0 \tag{42}$$

Totally differentiating (41) with respect to w and θ, we can again obtain the impact of rent-sharing on the wage:

$$(dw/d\theta)^c = -(U_{w\theta})^c/(U_{ww})^c = -n(d\pi^i/dw)^c/(U_{ww})^c \tag{43}$$

What is the impact of sharing rents on national welfare? Again define $NW = n\overline{\pi}^i + U = n\pi^i + \overline{U}$, where $\overline{U} = (w - k)nl_i$. Differentiate NW with respect to θ and use (41), we have

$$(dNW/d\theta)^c = -(1 - \theta)[(dn\pi^i)/dw)^c]^2/(U_{ww})^c \geq 0 \tag{44}$$

where $(d(n\pi^i)/dw)^c = n(d\pi^i/dw)^c = n\{x_i[(n-1)(\partial p_i/\partial x_i)(dx_i/dw)^c + m(\partial p_i/\partial y_i)(dy_i/dw)^c] - l_i\} \gtrless 0$ can be obtained from (31). since (44) involves the square of $(d(n\pi^i)/dw)^c$ and $(U_{ww})^c < 0$, we see again that except for the case where $(d\pi^i/dw)^c$ is exactly zero, we have $(dNW/d\theta)^c > 0$, i.e., sharing rents will increase national welfare in a n-home-form, m-foreign-firm international Cournot industry.

The method of analysis in the Bertrand case is similar to the Cournot case. We first derive the labor demand from the producers' optimization conditions. We next obtain the impact of rent-sharing on the wage rate and finally that on the export profits. To save space, we shall leave the derivations to the interested readers[9] and simply state our results:

$$(dw/d\theta)^B = -n(d\pi^i/dw)^B/(U_{ww})^B \tag{45}$$

$$(dNW/d\theta)^B = -(1 - \theta)[(d(n\pi^i)/dw)^B]^2/(U_{ww})^B \geq 0 \tag{46}$$

The expressions of $dNW/d\theta$ under the Cournot and Bertrand cases are formally the same (compare (44) to (46)) and in general $dNW/d\theta > 0$. As in the duopoly case, rent-sharing will raise national welfare with either the Cournot or Bertrand firms. The intuition for the multifirm oligopoly situation is identical to that for the duopoly. The industry union under an industry-wide rent-sharing scheme will have an incentive to raise the producer's profits (as well as its own original rents). To achieve that, the union will either raise the wage to tax the firms or lower the wage to subsidize the oligopolists, depending on the particular market condition. As before, the domestic firms are in essence in cooperation with the union and if necessary, will have an incentive to supply the relevant product market information to the labor union in order to achieve joint profit maximization. Thus, the Eaton-Grossman type market structure problem does not arise here.[10] Alternatively, the union, unlike the government, can be viewed as an endogenous first mover in a standard two-stage subgame perfect game, and will then take the relevant conditions for the second stage into account when maximizing its rent. Summarizing our results and assuming $d\pi^i/dw \neq 0$,

Proposition 2: For the n-home-firm, m-foreign-firm international oligopoly, rent-sharing between the home union and the home firms will increase total home economic rents regardless of whether the international firms are Cournot-Nash or Bertrand-Nash.

4. Endogenous Entry and Exit

In this section we shall analyze the impact of sharing rents when the domestic and foreign firms can each endogenously enter their respective home and foreign parts of the industry. We set the long run equilibrium conditions as $\bar{\pi}^i = M$ and $\pi^{*i} = M^*$, where M and M^* are nonnegative constants. If we wish to allow international capital mobility so that the domestic firms and the foreign firms earn the same amount of profits in the long run, we can set $\bar{\pi}^i = \pi^{*i} =$

M and the following analysis will be qualitatively similar. The existing literature (e.g., Venables 1985, Horstman and Markusen 1986) utilize the traditional long run equilibrium condition of $\bar{\pi}^i = \pi^{*i} = 0$, which is most appropriate in the case where the number of oligopolists in each country is large so a potential entrant accurately anticipates that its entry will only lower profits per firm by a negligible amount. This permits continuous entry with the zero profit outcome being a good approximation to the actual condition. But if the number of firms is relatively small, the long run equilibrium profits can remain positive due to strategic interactions between the incumbants and the entrants. A potential entrant may reasonably expect that its entry will significantly lower per firm profits and may then decide to stay out. The comments here parallel those made by Eaton and Grossman (1986, p. 398), who pointed out that the incumbent firms may earn positive profits even in a free entry equilibrium. In this paper, we shall consider *both* versions of the long run conditions, i.e., $M > 0, M^* > 0$ and $M = M^* = 0$.

We start with the case of a Cournot-Nash industry with entry. As in the short run case with no entry, we first aim to derive an expression for the labor demand. Differentiate the long run equilibrium conditions $\bar{\pi}^i(n, m, w) = M$ and $\pi^{*i}(n, m, w) = M^*$ and solve

$$(\partial n/\partial w)^c = [(-\bar{\pi}^i_w \pi^{*i}_m + \pi^{*i}_w \bar{\pi}^i_m)/(\bar{\pi}^i_n \pi^{*i}_m - \bar{\pi}^i_m \pi^{*i}_n)]^c \tag{47}$$

$$(\partial m/\partial w)^c = [(-\pi^{*i}_w \bar{\pi}^i_n + \bar{\pi}^i_w \pi^{*i}_n)/(\bar{\pi}^i_n \pi^{*i}_m - \bar{\pi}^i_m \pi^{*i}_n)]^c \tag{48}$$

where subscripts are partials, e.g., $\bar{\pi}^i_w \equiv (1 - \theta)\partial\pi/\partial w$ for the i-th firm, holding n and m constant, i.e., $\bar{\pi}^i_w = d\pi^i/dw$ discussed in the no entry case. All these terms can be further simplified by differentiating the profit functions, but as in the previous sections, it is not necessary to sign these terms to get the qualitative impact of rent-sharing on total economic rents. For stability, we require that $\bar{\pi}^i_n \pi^{*i}_m - \bar{\pi}^i_m \pi^{*i}_n > 0$.[11] (47) and (48) tell us how a change in the home wage will change the long run equilibrium number of firms in each country. Unlike the short run case where n and m are fixed, the per firm output and per firm labor demand now also is a function of the equilibrium number of firms, i.e., $x_i = x_i(n(w), m(w), w)$ and

$l_i = l_i(x_i, w)$. To obtain expressions for $(\partial x_i/\partial n)^c$ and $(\partial x_i/\partial m)^c$, we differentiate the firm's first order conditions and impose symmetry:

$$\left\{\bar{\pi}^i_{x_i x_i} + (n-1)\bar{\pi}^i_{x_i x_j}\right\} dx_i + m\,\bar{\pi}^i_{x_i y_i} dy_i + \bar{\pi}^i_{x_i n} dn + \bar{\pi}^i_{x_i m} dm = 0$$

$$n\,\pi^{*i}_{y_i x_i} dx_i + \left\{\pi^{*i}_{y_i y_i} + (m-1)\pi^{*i}_{y_i y_j}\right\} dy_i + \pi^{*i}_{y_i n} dn + \pi^{*i}_{y_i m} dm = 0$$

From the above, we can solve for $(\partial x_i/\partial n)^c$ and $(\partial x_i/\partial m)^c$ and using $(\partial x_i/\partial n)^c$ and $(\partial x_i/\partial m)^c$, we obtain

$$(\partial l_1/\partial n)^c = (\partial l_i/\partial x_i)(\partial x_i/\partial n)^c \tag{49}$$

$$(\partial l_i/\partial m)^c = (\partial l_i/\partial x_i)(\partial x_i/\partial m)^c \tag{50}$$

Thus the slope of the long run home labor demand is

$$(dl_i/dw)^c_l = (dl_i/dw)^c + (\partial l_i/\partial n)^c (dn/dw)^c + (\partial l_i/\partial m)^c (dm/dw)^c \tag{51}$$

where the subscript l refers to the long run case, $(dl_i/dw)^c$ is the slope of the labor demand with no entry as given by (39), $(\partial l_i/\partial n)^c$ and $(\partial l_i/\partial m)^c$ are given by (49) and (50) respectively, and $(dn/dw)^c$ and $(dm/dw)^c$ are given by (47) and (48) respectively. The union's maximization problem is similar to the no entry case, except now it will take the long run home labor demand and long run profit sensitivity to the wage change into account rather than their short run counterparts:

$$U = (w-k)nl_i + \theta n\pi^i$$

$$(U_w)^c_l = nl_i + (w-k)(d(nl_i)/dw)^c_l + \theta(d(n\pi^i)/dw)^c_l = 0$$

$$(U_{ww})^c < 0$$

Differentiating $(U_w)^c_l$ with respect to w and θ,

$$(dw/d\theta)^c_l = -(d(n\pi^i)/dw)^c_l/(U_{ww})^c_l \tag{52}$$

Using (52) we can compute $(dNW/d\theta)_i^c$:

$$(dNW/d\theta)_i^c = -(1-\theta)[(d(n\pi^i)/dw)_i^c]^2/(U_{ww})_i^c \geq 0 \tag{53}$$

As before, we do not need to sign $(d(n\pi^i)/dw)_i^c$ since it is squared. Note that one difference between (53) and its short run counterpart is that in the long run $[d(n\pi^i)/dw]^c \neq n(d\pi^i/dw)^c$, since n itself is endogenous. Note that (53) holds for *both* long run conditions of $M = M^* = 0$ or $M > 0$ and $M^* > 0$.

For the Bertrand case, the analysis is again analogous to the Cournot case. We shall again leave the detailed derivations to the interested readers and simply state our result:

$$(dNW/d\theta)_i^B = (1-\theta)[(d(n\pi^i)/dw)_i^B]^2/(U_{ww})_i^B \geq 0 \tag{54}$$

Thus as in previous sections, for both the Cournot and Bertrand cases, national welfare will not fall with management-labor cooperation. This holds true for both the zero profit and constant positive profit long run conditions. For the case of $\bar{\pi}^i = 0$, NW will be unaffected by rent-sharing. This can be seen by inserting $\bar{\pi}^i = 0$ in (53) and (54). Unlike the use of an exogenous industrial policy such as a subsidy (Venables 1985, Horstman and Markusen 1986), instituting rent-sharing will not lead to wasteful excessive entry. This can be verified by examining the term $(dn/d\theta)^\tau$, where τ is either c (Cournot) or B (Bertrand):

$$(dn/d\theta)^\tau = (dn/dw)^\tau(dw/d\theta)_i^\tau \tag{55}$$

With $(dw/d\theta)_i^\tau = -(d(n\pi^i)/dw)_i^\tau/(U_{ww})_i^\tau$ and $\bar{\pi}^i = M$, (55) becomes

$$(dn/d\theta)^\tau = -M[(dn/dw)_i^\tau]^2/(U_{ww})_i^\tau \geq 0 \tag{56}$$

If $M = 0$ we have $dn/d\theta = 0$, i.e., rent-sharing will not induce a change in the equilibrium number of firms. As contrast to a government-imposed policy, rent-sharing will *not* reduce national welfare by promoting excessive entry even if we assume that in the long run, equilibrium rents are completed dissipated.

For the case of $M > 0$, we have generally $dn/d\theta > 0$ and from (53) and (54), $dNW/d\theta > 0$. The intuition here is that with long run positive equilibrium profits, an industry-wide rent-sharing plan will provide the union an incentive to change the equilibrium number of firms since its share of profits is proportional to n. Thus $dn/d\theta > 0$ with $M > 0$. To achieve a rise in n, the union will change its optimizing wage to induce entry. Whether the wage should be raised or lowered to increase n will depend on the sign of $(dn/dw)^{\tau}$. In a standard two-stage game, the union will take $(dn/dw)^{\tau}$ into account when setting its optimal wage. As the equilibrium number of firms rises, so will long run total home industry rents.[12] For compactness, we summarize our results for the case of $M > 0$:

Proposition 3: For the multifirm international oligopoly with endogenous entry, rent-sharing between the home union and the home firms will increase total home economic rents regardless of whether the international firms are Cournot-Nash or Bertrand-Nash.

Finally, by comparing the expressions of $dNW/d\theta$ in all previous sections, we easily see that they are all formally identical (compare (16), (30), (44), (46), (53), and (54)). We can in fact write the *general formula* for the impact of management-labor cooperation on total industry rents as:

$$(dNW/d\theta)^{\tau}_{\lambda} = -(1-\theta)[d(n\pi^{i})/dw)^{\tau}_{\lambda}]^{2}/(U_{ww})^{\tau}_{\lambda} \qquad (57)$$

where τ represents either Cournot or Bertrand, λ represents either long run or short run. If the expression is evaluated for $n = m = 1$, we get back the basic duopoly case. Thus the previous sections tell us that unless $d(n\pi^{i})/dw = 0$, rent sharing as a means to enhance labor-management cooperation will generally raise total export rents no matter whether the international industry is Cournot or Bertrand, no matter whether the industry has two firms or more than two firms, and no matter whether the number of firms is fixed or endogenous. In other words, the effectiveness of rent-sharing as a rent-enhancing industrial policy is robust with respect to the Eaton-

Grossman market structure problem.

5. Domestic Consumption

So far we have assumed that the home firms only export to a third market in order to focus on the effects of a strategic industrial policy on economic rents. Here we shall relax this restriction and consider the case where domestic consumption constitutes part of the home welfare. To make our point as simple as possible, we shall concentrate on the duopoly case. In particular, we now consider the situation where the home firm produces x only for domestic consumption and the foreign firm exports y to the home country. We assume throughout this section that the duopolists all have "normal" reaction functions, i.e., $\pi_{xy} < 0$, $\pi^*_{xy} < 0$, $\pi_{pp'} > 0$ and $\pi^*_{p^*p} > 0$. Furthermore, we also invoke here conditions that guarantee the uniqueness of the respective Cournot and Bertrand equilibria, i.e., $\pi_{xx} + |\pi_{xy}| < 0$ and $\pi^*_{yy} + |\pi^*_{yx}| < 0$ for quantity-setting firms and $\pi_{pp} + |\pi_{pp'}| < 0$ and $\pi^*_{p^*p'} + |\pi^*_{p^*p}| < 0$ for price-setting firms (Friedman 1977). Intuitively, these conditions require that the change to marginal profit due to an increase of a firm's own strategic variable outweigh that due to an increase of the rival's strategic variable.

To obtain a measure of consumer's welfare, we assume that the home inverse demand $p(x, y)$ and $p^*(x, y)$ are generated by a representative consumer maximizing a utility function $Z(x, y, m) = V(x, y) + m$, where Z is linear and separable in m, the expenditure on a numeraire good. $V(x, y)$ is differentiable and strictly concave. $p(x, y)$ and $p^*(x, y)$ thus obtained are twice-continuously differentiable and are downward sloping, i.e., $p_x < 0$ and $p^*_y < 0$. For x and y to be substitutes, we have $p_y < 0$ and $p^*_x < 0$ and in particular if the demands are symmetric, we have $p_x = p^*_y$ and $p_y = p^*_x$. $p(x, y)$ and $p^*(x, y)$ can be inverted to yield the direct demands $x(p, p^*)$ and $y(p, p^*)$, which are twice-continuously differentiable with $x_1 < 0$, $y_2 < 0$, $x_2 > 0$ and $y_1 > 0$. If the demands are symmetric, we have $x_1 = y_2$ and $x_2 = y_1$. The use of Z implies

that the marginal utility of income is one and legitimizes the partial equilibrium framework. The measure of consumer surplus CS is given by $CS = V(x, y) - px - p^*y$. When evaluating national welfare, NW is now $CS + \bar{\pi} + U$, i.e., home welfare is the sum of home consumer surplus, domestic profits and home labor's rents. For both the Cournot-Nash and Bertrand-Nash cases, the sign of $dNW/d\theta$ with positive domestic consumption is generally ambiguous. To obtain some conditions for evaluating the impact of sharing rents, we proceed to differentiate CS with respect to θ:

$$(dCS/d\theta)^\tau = (dw/d\theta)^\tau[-xdp/dw - ydp^*/dw]^\tau \tag{58}$$

where τ again refers to either c (Cournot) or B (Bertrand). For Cournot-Nash firms, $(dw/d\theta)^c < 0$ by (14) and by the normal reaction function assumption. If we have homogenous goods with $p = p^*$, (58) is reduced to $(dCS/d\theta)^c = -(dw/d\theta)^c(x + y)(dp/dw)^c \cdot (dp/dw)^c = p(d(x + y)/dw)^c > 0$ by (8), (9) and the assumption of a unique equilibrium ($\pi^*_{yy} + |\pi^*_{yx}| < 0$). Therefore, for homogenous product, $(dCS/d\theta)^c > 0$ and since from Proposition 1, we have $[d(\bar{\pi} + U)/d\theta]^c \geq 0$, we obtain the result that national welfare rises with rent-sharing in a Cournot homogenous duopoly.

Alternatively, we can simply add the expression of $(dCS/d\theta)^c$ to $(d(\bar{\pi} + U)/d\theta)^c$ and obtain

$$(dNW/d\theta)^c = (dw/d\theta)^c[(-xp_x\pi^*_{yy} - yp_x^*\pi^*_{yy} + yp_y^*\pi^*_{yx})(\partial l/\partial x)/H + (w - k)dl/dw]^c \tag{59}$$

where $(dw/d\theta)^c < 0$ as before. Examining (59), since $-xp_x\pi^*_{yy} < 0$, $-yp_x^*\pi^*_{yy} < 0$, and $yp_y^*\pi^*_{yx} > 0$, the only term that can make $(dNW/d\theta)^c < 0$ is $yp_y^*\pi^*_{yx}$. So a sufficient condition for $(dNW/d\theta)^c > 0$ is for $yp_y^*\pi^*_{yx}$ to be overwhelmed by a term such as $-xp_x^*\pi^*_{yy}$. For symmetric demands ($p_x = p_y^*$) and given the uniqueness assumption ($\pi^*_{yy} + |\pi^*_{yx}| < 0$), $-xp_x\pi^*_{yy} + yp_y^*\pi^*_{yx} \leq 0$ is reduced to $x \geq y$, i.e., the sufficient condition is that home output is required to be larger than import volume. Furthermore, we can also look at an alternative sufficient condition, i.e., for

$yp_y^*\pi_{yx}^*$ to be outweighed by $-yp_x^*\pi_{yy}^*$. We can see that if the demand and cost functions are linear, $-yp_x^*\pi_{yy}^* + yp_y^*\pi_{yx}^* < 0$ and $(dNW/d\theta)^C > 0$. Thus we have established some plausible cases whereby rent-sharing will be welfare-enhancing with Cournot firms even with positive domestic consumption: (i) if the goods are homogenous, or (ii) if the demands are symmetric and $x \geq y$ or (iii) if the demand and cost functions are linear.

As for the Bertrand case, relatively little information can be gained about the sign of $(dNW/d\theta)^B$ with domestic consumption. From (58), we see that with price-setting firms $(dp/dw)^B > 0$ and $(dp^*/dw)^B > 0$ by (23), (24) and $\pi_{p^*p}^* > 0$. However, the difficulty arises with the ambiguous sign of $(dw/d\theta)^B$ by (28) and (29). If the cost change effect dominates the collusive equilibrium effect (see the discussion associated with (29)), then $(d\pi/dw)^B < 0$ and $(dw/d\theta)^B < 0$. (58) then gives us $(dCS/d\theta)^B > 0$, and with Proposition 1, $(dNW/d\theta)^B > 0$. If demands are linear and the cost functions are linear, e.g., if $x = a_1 - b_1p + dp^*$, $y = a_2 - b_2p^* + dp$ and $x = hl$, where a_i $(i = 1, 2) > 0$, b_i $(i = 1, 2) > 0$, $d > 0$, and $h > 0$, then $(d\pi/dw)^B = -x/h < 0$ which means $(dNW/d\theta)^B > 0$. In general, if however $(d\pi/dw)^B > 0$, then the consumer surplus is unambiguously reduced and no meaningful condition can be found for national welfare to rise with rent sharing.

To summarize, under a variety of conditions, rent-sharing may still raise national welfare with domestic consumption. The sufficient conditions for the case of Cournot firms include (a) homogeneous goods, or (b) symmetric demands with home output larger than import volume, and for Bertrand firms, the chief condition is for a rise in home wage to lower the home firm's profits (i.e., $d\pi/dw < 0$). *In addition to* the above conditions we can also state more concisely the following:

Proposition 4. With positive domestic consumption, sharing rents raises home national welfare regardless of whether the duopolists are Cournot-Nash or Bertrand-Nash if the demand

and cost functions are linear.

Conclusion

In recent debates of industrial policies, it has often been suggested that one way to improve international competitiveness is to reduce the adversarial relationship between labor and management. This paper examines rent-sharing as a means to achieve such cooperation. It is shown that sharing rents in general will increase overall rents, i.e., rent-sharing at home between labor and the firm will increase total rents accrued to the home union and the home firm. As a strategic industrial policy, the rent-enhancing effect of management-labor cooperation is robust with respect to the market structure problem encountered in papers by Eaton and Grossman (1986) and Cheng (1987). Rent-sharing will typically raise the sum of the labor rents and the firm's rents no matter whether the firms are Cournot-Nash or Bertrand-Nash, whether there are two firms or more than two firms, and whether the number of firms is fixed or endogenous. Furthermore, plausible conditions can also be found under which sharing rents can still raise national welfare if there is domestic consumption. For example, if the demand and cost functions are linear, then total national welfare with domestic consumption will rise with rent-sharing.

Rent-sharing can be seen as creating a partial cartel between the labor union and the firm. The creation of a cartel in any type of industry will generally raise the total monopoly rents. On a practical level, the domestic producer can be thought of as providing any necessary information about the product market structure to the domestic sharing union if the union does not already possess such knowledge. The union can then change its optimal wage to either subsidize or to tax the firms to maximize total joint profits. Such discussions of joint strategies and knowledge sharing can perhaps occur in a labor-management council. This type of joint consultation scheme between management and labor is in fact quite widespread in Japan.

Finally, we can note a general implication of this paper for the implementation of strategic industrial policies: the government can exogenously improve the competitiveness of the firms, but that action will tend to be industry-specific since the government is exogenous to the market environment. A better way is to design incentive schemes such that the market participants can endogenously and credibly carry out the "industrial" policies themselves. Since the implementation of the policies is up to the private economic agents who can adjust and adapt to the specific market instances, results of the industrial policies will then tend to be robust. Management-labor cooperation is an example of such an incentive scheme and it can be used as a successful strategic industrial policy to raise rents under a variety of market structures.

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Endnotes

1. For a study of the effects of rent-sharing on variables such as employment and price level in an oligopolistic environment, see Fung (1987a, 1987b).

2. Other works that stress the role of the factor market in the context of strategic industrial policy include Dixit and Grossman (1986) and Katz and Summers (1988).

3. For a discussion of the various union objectives, see Farber (1984).

4. Note that we have studied the effect of rent-sharing by employing the methodology of comparative statics with respect to the exogenous parameter θ. This in general is in accordance with the notion in the literature (e.g., Weitzman 1987) that due to the insider-outsider externalities (Lindbeck and Snower 1988), rent-sharing may not arise endogenously.

5. There is still much disagreement of whether firms are on their labor demand curves. But some justification of that can be given by noting that in general, unions may set or negotiate the wage, but employment is typically left to be decided by the firms. Also, there is some recent empirical evidence which shows that firms are on their labor demands (Oswald 1984). However, as pointed out independently by Professor Gene Grossman, Professor Lawrence Summers and Professor Masahiko Aoki, our results could be significantly altered if the firms are off their labor demand curves due to efficient bargains.

6. I am indebted to Professor Gene Grossman and Professor Dani Rodrik for raising the issue of how the union can in practice obtain the necessary information about the product market.

7. There are some disagreements as to whether the government should be modeled as a first mover, see Rodrik and Zeckhauser (1987).

8. The method of analysis here is similar to the multifirm case in Eaton and Grossman (1986).

9. The method of derivations is the same as the Cournot case: first, the labor demand is derived, then from the union's first order condition, we obtain $dw/d\theta$, using $dw/d\theta$, we have $dNW/d\theta$ for the Bertrand case.

10. As pointed out by Professor Gene Grossman, if we have a separate union for each firm, our results can be changed. However, at least for the case of the U.S., the industrial union assumption seems appropriate.

11. A similar stability condition is discussed in Brander and Krugman (1983).

12. Note that qualitatively similar results can be found in Dixit and Kyle (1985) and Venables (1985), who showed that policies that promote domestic entry will raise national welfare.

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