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Analysis of performance standards for direct foreign investments

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Abstract. Within the framework of a duopolistic model, we investigate the impact of foreign investment standards on welfare, output, and employment. Minimum local content and export requirements reduce world output, world welfare, and the source country's welfare. Under certain conditions, the decline in host country's consumer surplus resulting from diminished competition outweighs the shift of monopoly rent from the source country's firm to the host country's firm. Minimum content standards can increase host country's employment, but only to a point. Marginal increases in the content requirement can actually reduce employment as the magnitude of foreign investment declines.

Analyse des normes de performance pour les investissements directs en provenance de l'étranger. Les auteurs utilisent un modèle de duopole pour analyser l'impact de différentes normes de performance pour les investissements étrangers sur les niveaux de bien-être, de production, et d'emploi. Imposer un contenu local minimum ou des obligations d'exportation tend à réduire la production mondiale, le bien-être mondial, et le niveau de bien-être dans le pays exportateur de capital. Dans certains cas, la chute dans le surplus du consommateur pour le pays qui reçoit l'investissement (à cause de la concurrence moins grande) peut être plus grande que le gain de la rente de monopole par la firme du pays récipiendaire au détriment de la firme du pays exportateur de capital. Les normes imposant un contenu local minimum peuvent accroître le niveau d'emploi dans le pays récipiendaire de l'investissement étranger mais seulement jusqu'à un certain point. Des accroissements à la marge dans le contenu local requis peuvent en fait réduire l'emploi à proportion que l'investissement étranger décroît.

INTRODUCTION

It is well known that many countries are ambivalent towards foreign direct investments domiciled within their boundaries. They are cognizant of the

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benefits associated with foreign capital but are fearful of its real or imagined cost. That ambivalence is certainly reflected in the juxtaposition of incentives designed to attract foreign direct investments and a variety of restrictions placed on the activities of foreign firms.

In particular, performance standards imposed by host countries on direct foreign investments have become widespread. Two types of host country standards have been a bone of contention between source and host countries: minimum export requirements, under which a foreign owned firm must *export* a certain *minimum* proportion of its output; and local content laws for foreign owned firms, under which such firms must use *minimum amounts of domestic factors* or intermediate inputs in their production.[1] These requirements are limited to foreign controlled enterprises, thereby favouring local firms.

Even Canada has recently introduced such rules, administered by the Foreign Investment Review Agency (FIRA).[2] For obvious reasons, the Canadian requirements are of special significance to the United States, the source country of most Canadian foreign investment projects. Indeed, the Canadian requirements engendered a heated controversy between the two countries, including an appeal to GATT. A GATT panel sided with the United States in the case of the local content rule but refrained from expressing an opinion in the case of minimum export requirements.

Despite their increasing importance, the economic consequences of these requirements for the host and source countries (as well as for the world as a whole) have not been examined. This paper is designed to bridge that gap. It employs a model of the firm in a duopolistic market to analyse the welfare and employment implications of the two aforementioned performance standards. While the duopoly case captures the essence of the results, a generalized oligopolistic solution is also presented. The qualitative results are identical. Both the source and host countries are considered.[3]

Our analysis is in the spirit of recent work by Brander and Spencer (1981, 1985) and Spencer and Brander (1983), in that these standards are viewed as second best policies in a world distorted by imperfect competition. Our work is also related to a paper by Salop and Scheffman (1983) in which it is argued that firms may be able to induce exit (or restrict entry) of competitors by raising

1 For a description of institutional arrangements, see Brown (1982),

2 FIRA's name has recently been changed to Investment Canada, and its mandate has been substantially modified by the new Conservative government.

3 Grossman (1981) presents an analysis of the employment effects of local content legislation. Although there are superficial similarities between Grossman's paper and ours, they address essentially different problems. Grossman examined the effect of non-discriminatory content protection (namely, the domestic content regulation applied to domestic as well as foreign firms, so that the discriminatory component favouring domestic firms is absent) on resource allocation and on domestic value added and employment, in the country imposing the regulation, under monopoly and perfect competition. Minimum export requirements were not considered, nor was the effect of any of the policy measures on welfare. Where a comparison between our results is possible, they are qualitatively similar.

their rivals' costs. In our model, the host country government uses discriminatory performance requirements to raise the production costs of foreign-owned firms. This improves the competitive position of their own firms and increases domestic profits.

THE MODEL

Consider a two country world: the source country, where direct foreign investments originate (such as the United States) and the host country, where these investments are located (such as Canada). Each country has one firm producing commodity j, and both firms produce under constant returns to scale. The source country's firm is a monopolist in its own country but also sells goods in the host country, where it competes with the host country's firm. Production of the good that is sold by the source country's firm in the host country takes place in a subsidiary located in the host country. The subsidiary is subject to the performance requirements imposed by the government of the host country.

A possible sequence of events leading up to the imposition of investment performance standards is embodied in the following story. Assume that the initial equilibrium is characterized by exports of the source country's firm from its home plant to the host country. In an effort to expand its domestic industry, the host country imposes a tariff on imports of final products, while neglecting imports of intermediate inputs. If the tariff is larger than the difference between unit production cost in the source country and the price in the host country, the source country's firm will have incentive to establish a final assembly plant in the host country in order to circumvent the tariff. That subsidiary may account for only a small proportion of the value of the product (a packaging plant may suffice). The host country's government then imposes its performance standards on the subsidiary.[4]

We assume that unit production costs are lower in the source country. Labour and intermediate goods are available in both countries. The source country's subsidiary is burdened by higher unit production costs than those incurred by the parent. However, the subsidiary's costs are assumed to be lower than those of the indigenous host-country firm. Our assumption about the relative unit production costs provides an explanation of why the source country's firm would have no incentive to open a subsidiary in the host country in the absence of the tariff, and a reason that the source country's subsidiary

4 It may seem contradictory for the host country to impose first a prohibitive tariff, then performance standards. To the extent that employment effects enter the legislative objective function (see the fifth section below), there need not be a contradiction. A non-prohibitive tariff has the same qualitative effect on the host country's welfare as do performance standards, but performance standards tend to increase employment in the host country.

would not meet the performance requirements unless ordered to do so by the host country.

We employ the following notation:

Q_h = total output sold in the host country
Q_s = total output sold in the source country
$D_h(Q_h)$ = the inverse demand curve in the host country
$D_s(Q_s)$ = the inverse demand curve in the source country
q_h = output of the indigenous firm in the host country
q_h^s = output of the source country's firm in the host country
q_s^s = output of the source country's firm in the source country
C_s^s = unit cost of the source country's firm in the source country
$C_h^s(\alpha)$ = unit cost of the source country's firm in the host country
γ = the proportion of output of the foreign subsidiary that must be exported back to the source country; and
α = the proportion of total inputs of the foreign subsidiary that must be sourced locally. It is measured as the ratio of the value of inputs originating in the host country to the value of the output of the foreign subsidiary.

Our assumptions imply that $C_h^{s\prime}(\alpha) > 0$ for all $\alpha \in (0,1)$, $C_s^s \leqq C_h^s(0)$, and $C_h^s(1) \geqq C_h$.

We wish to determine the Cournot-Nash equilibrium outputs of the firms; and for the source country's firm, the division of its output between the two countries.[5] The objective functions for the source country's firm and the host country's firm are given by (1) and (2), respectively.[6]

$$\underset{q_s^s, q_h^s}{\text{maximize}}\ D_s(q_s^s + \gamma q_h^s)(q_s^s + \gamma q_h^s) + D_h((1-\gamma)q_h^s + q_h)(1-\gamma)q_h^s - C_h^s(\alpha)q_h^s - C_s^s q_s^s \qquad (1)$$

$$\underset{q_h}{\text{maximize}}\ D_h((1-\gamma)q_h^s + q_h)q_h - C_h q_h. \qquad (2)$$

5 Our results do not depend on the assumption that the firms compete in quantities. If we allowed the firms to compete in prices and produce differentiated products, all results would go through. The reason for this is that an increase in your competitor's cost benefits you and harms your rival in both price and quantity setting games. Since the primary effect of performance standards is to increase the cost of production for foreign firms, the problems discussed in Eaton and Grossman (1983) do not appear in our model.

6 We assume that the source country's firm perceives each country as a separate market in making its quantity decisions. The only link occurs when $\gamma > 0$, since in that case some of the goods they plan to sell domestically must be produced in the host country. This assumption has been referred to as the 'segmented markets perception' (Helpman, 1984). Because of our assumption of segmented markets, it is possible that the host country's firm might also export goods to the source country's market (provided the difference in production costs is not too large). If such intra-industry trade does take place, it will not affect our results, since investment standards do not affect marginal cost or marginal revenue of either firm in the source country's market (assuming q_s^s strictly positive). Thus equilibrium sales and profits in the source country's market will not change as a result of the imposition of investment standards.

The welfare of the host country consists of the sum of consumer surplus and profits of the host country's firm. This is presented in equation (3).

$$V_h = \left\{ \int_0^{Q_h} D_h(x)dx - D_h(Q_h)Q_h \right\} + \{D_h(Q_h) - C_h\}q_h. \tag{3}$$

PERFORMANCE REQUIREMENTS AND EQUILIBRIUM OUTPUT

We are now in a position to explore the effect of the two performance requirements on equilibrium output. We begin by differentiating (1) with respect to q_s^s and q_h^s. This yields the reaction function of the source country's firm. To obtain the reaction function of the host country's firm, we simply differentiate (2) by q_h. The intersection of the two reaction surfaces yields the equilibrium output levels for each firm.

Local content requirement

In order to confine ourselves at the outset to local content requirements, we abstract from minimum export standards by assuming that $\gamma = 0$. The first-order conditions for the source country's firm can be written as in (4) and (5), while the second-order conditions for a maximum are presented in (6) and (7).

$$D_s'(q_s^s)q_s^s + D_s(q_s^s) - C_s^s = 0 \tag{4}$$

$$D_h'(q_h^s + q_h)q_h^s + D_h(q_h^s + q_h) - C_h^s(\alpha) = 0 \tag{5}$$

$$D_s''(q_s^s)q_s^s + 2D_s'(q_s^s) < 0 \tag{6}$$

$$D_h''(q_h^s + q_h)q_h^s + 2D_h'(q_h^s + q_h) < 0. \tag{7}$$

Note that the first-order condition for q_s^s, equation (4), is independent of q_h^s and q_h. This is a result of our assumption that the source country's firm perceives the two countries as separate markets and produces under constant returns to scale. Thus, the optimal value of q_s^s is independent of the output produced in the host country.

Equation (5) is the reaction function of the source country's firm, which defines q_h^s for any given value of q_h.

In similar fashion, the first- and second-order conditions for the host country's firm are represented by (8) and (9), respectively.

$$D_h'(q_h^s + q_h)q_h + D_h(q_h^s + q_h) - C_h = 0 \tag{8}$$

$$D_h''(q_h^s + q_h)q_h + 2D_h'(q_h^s + q_h) < 0. \tag{9}$$

Equation (8) is the reaction function of the host country's firm. Solving equations (5) and (8) yields the equilibrium values of q_h^s and q_h.

To guarantee existence, uniqueness, and stability of equilibrium we require that the marginal revenue of each firm is a decreasing function of its opponent's output and that the reaction function of the host country's firm is

steeper than the reaction function of the source country's firm. Equivalently, we require that (10) and (11) hold.[7,8]

$$D''_h(Q_h)q_h^s + D'_h(Q_h) < 0;\ D''_h(Q_h)q_h + D'_h(Q_h) < 0 \tag{10}$$

$$\Delta_1 = -D'_h(Q_h)\{3D'_h(Q_h) + D''_h(Q_h)Q_h\} < 0. \tag{11}$$

Conditions (10) and (11) also guarantee that the reaction functions are downward sloping.

Totally differentiating equations (5) and (8) allows us to obtain the effect of introducing or altering local content requirements (α) on the output of the source country's firm in the host country, and on the output of the host country's firm. The respective effects are given by (12) and (13).

$$dq_h^s/d\alpha = -C_h^{s\prime}(\alpha)\{2D'_h(Q_h) + q_hD''_h(Q_h)\}/\Delta_1 < 0 \tag{12}$$

$$dq_h/d\alpha = C_h^{s\prime}(\alpha)\{D'_h(Q_h) + q_hD''_h(Q_h)\}/\Delta_1 > 0. \tag{13}$$

Local content laws, applied strictly to the foreign (source country's) firm, decrease the output of the source country's firm in the host country, and increase the output of the host country's firm. This result is unambiguous and follows from the fact that raising or introducing local content laws increases the cost of production for the source country's firm. This causes the source country's firm to reduce its output, and as it does so, the host country's firm moves down its reaction function and increases output. Furthermore, total output available for sale in the host country necessarily declines, as seen in (14).

$$dQ_h/d\alpha = d(q_h + q_h^s)/d\alpha = -C_h^{s\prime}(\alpha)D'_h(Q_h)/\Delta_1 < 0. \tag{14}$$

These results are illustrated graphically in figure 1. It depicts the reaction functions of the host country's firm ($q_h^*(q_h^s)$) and the source country's firm ($q_h^{s*}(q_h)$). Initial equilibrium, given by the intersection of the two reaction curves, is represented by point e. The local content requirements increase production costs of the source country's firm. In turn, this lowers $q_h^{s*}(q_h)$ in the direction of the arrows. The new equilibrium is at e'. Output of the host country's firm (q_h) rises and that of the source country's subsidiary (q_h^s) declines. Stability requires that the slope of $q_h^*(q_h^s)$ be less than one in the neighbourhood of equilibrium, while that of $q_h^{s*}(q_h)$ must be larger than one.[9] Hence the increase in q_h is smaller in magnitude than the decline in q_h^s. Total output in the host country necessarily declines.

7 The conditions (10), (11), (18), and (19) are not very restrictive. They will be violated only when demand is very convex. Also note that (11) follows trivially from (10) for all downward sloping demand curves.

8 To obtain (11), define $q_h^{s*}(q_h)$ as the reaction function of the source country's firm. Define $q_h^*(q_h^s)$ in an analogous manner. Using (5), (8), and the implicit function theorem, we find that the slope of the reaction function of the source country's firm is $-\{D''_h(Q_h)q_h^s + D'_h(Q_h)\}/\{D''_h(Q_h)q_h^s + 2D'_h(Q_h)\}$, while the slope of the reaction function for the host country's firm is $-\{D''_h(Q_h)q_h^s + 2D'_h(Q_h)\}/\{D''_h(Q_h)q_h + D'_h(Q_h)\}$.

9 In our model, this is equivalent to the source country's firm having the flatter reaction function.

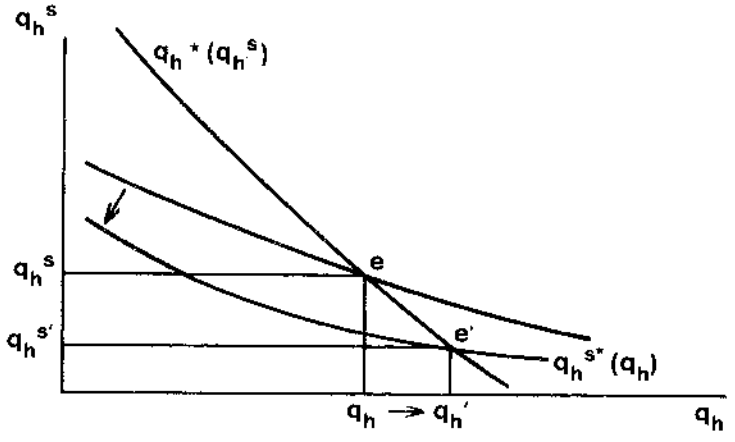

FIGURE 1 The reaction functions of the two firms

Minimum export standards

In order to focus exclusively on the minimum export requirements, it is now assumed that $\alpha = 0$ while γ can vary. In this case, the first-order profit maximizing conditions for the source country's firm reduce to (15) and (16), while the first-order condition for the host country's firm appears as in (17). The second-order conditions, deleted for the sake of brevity, are assumed to hold.

$$D_s'(q_s^s + \gamma q_h^s)(q_s^s + \gamma q_h^s) + D_s(q_s^s + \gamma q_h^s) - C_s^s = 0 \tag{15}$$

$$\gamma\{D_s'(q_s^s + \gamma q_h^s)(q_s^s + \gamma q_h^s) + D_s(q_s^s + \gamma q_h^s)\} + (1 - \gamma) \cdot \{D_h((1 - \gamma)q_h^s + q_h) + D_h'((1 - \gamma)q_h^s + q_h)(1 - \gamma)q_h^s\} - C_h^s(0) = 0 \tag{16}$$

$$D_h'((1 - \gamma)q_h^s + q_h)q_h + D_h((1 - \gamma)q_h^s + q_h) - C_h = 0. \tag{17}$$

Note that the first-order condition for q_s^s, equation (15), is no longer independent of q_h^s, since some of the output produced in the host country must be sold domestically according to the performance requirements. However, equation (15) implicitly defines q_s^s as a function of q_h^s. Solving (15) for q_s^s and substituting the solution into (16) leaves us with two equations in two unknowns. Solving this system of simultaneous equations yields the equilibrium values of q_h^s and q_h.

The satisfaction of expressions (18) and (19) assures that equilibrium will exist, be unique, and be stable.[10]

10 Equation (19) follows trivially from (18) for all downward sloping demand curves.

$$D''_s(Q_s)Q_s + 2D'_s(Q_s) < 0;\ D''_h(Q_h)(1-\gamma)q_h^s + D'_h(Q_h) < 0;$$
$$D''_h(Q_h)q_h + D'_h(Q_h) < 0 \qquad (18)$$

$$\Delta_2 = (1-\gamma)^2 D'_h(Q_h)\{D''_h(Q_h)Q_h + 3D'_h(Q_h)\} > 0. \qquad (19)$$

The effects on output of introducing or altering the minimum export requirements are derived by totally differentiating the system of equations (15)-(17). The results are presented as (20)-(24).

$$dq_h/d\gamma = -\{C_h^s(0) - C_s^s\}\{D''_h(Q_h)q_h + D'_h(Q_h)\}/\Delta_2 \gtreqless 0 \qquad (20)$$

$$dq_h^s/d\gamma = \{C_h^s(0) - C_s^s\}\{D''_h(Q_h)q_h + 2D'_h(Q_h)\}/\Delta_2(1-\gamma) + q_h^s/(1-\gamma) \lesseqgtr 0 \qquad (21)$$

$$dQ_h/d\gamma = d(q_h + (1-\gamma)q_h^s)/d\gamma = \{C_h^s(0) - C_s^s\}D'_h(Q_h)/\Delta_2 \lesseqgtr 0 \qquad (22)$$

$$dq_s^s/d\gamma = -\gamma\{C_h^s(0) - C_s^s\}\{D''_h(Q_h)q_h + 2D'_h(Q_h)\}/\Delta_2(1-\gamma) - q_h^s/(1-\gamma) \lesseqgtr 0 \qquad (23)$$

$$dQ_s/d\gamma = d(q_s^s + \gamma q_h^s)/d\gamma = 0. \qquad (24)$$

Equation (21) describes the effect on the *output* of the source country's firm in the host country. That output is subject to two conflicting influences. First, it expands in order to enable the firm to increase exports to a level that would satisfy the minimum percent-of-output requirement imposed by the government. This is represented by the term $q_h^s/(1-\gamma)$. Second, output contracts to offset the rise in production costs occasioned by the need to supply some of the source country's market out of the subsidiary's production (the marginal cost of producing a unit of output for sale in the host country becomes $C_h^s(0)/(1-\gamma)$), as mandated by the requirement. This is captured by the first term of equation (21). The net result is ambiguous. However, we can say that total sales in the host country by the subsidiary ($(1-\gamma)q_h^s$) unambiguously decline. This causes the host country's firm to slide down its reaction function and increase output (equation (20)). For stability, the increase in output by the host country's firm must be exceeded by the reduction in sales by the source country's subsidiary, so that total sales in the host country decline (equation (22)).

The marginal cost of production in the source country is not affected by the minimum export requirement and hence the optimal level of sales in the source country is not altered (equation (24)). Production in the source country may rise or fall since the level of output supplied by the subsidiary (γq_h^s) may go in either direction (equation (23)).

Foreign investment performance requirements

Because the local content and minimum export requirements influence output in the same direction, the overall result of foreign investment performance standards is unambiguous: output of the host country's firm rises on both

counts, and *sales* of the subsidiary of the source country's firm in the host country decline. The second effect always dominates, hence total sales in the host country fall. Total sales in the source country are unaffected.

PERFORMANCE REQUIREMENTS AND ECONOMIC WELFARE

Because worldwide sales decline, this analysis indicates a *reduction in world welfare.* The impact on the source country is also unambiguously negative. This follows from the fact that the source country's firm experiences lower profit (due to higher cost), and at the same time consumer surplus in the source country remains unchanged, because the price of output in that country is unaffected by the imposition of performance standards.

The analysis of the impact on the host country's welfare is less transparent, since the increased profit of the host country's firm is coupled with a decline in consumer surplus. The determination of the net welfare effect requires a more careful analysis, to which we now turn.

Local content

We again wish to begin by confining ourselves to investigating only the impact of the local content rule; therefore we set $\gamma = 0$. To find the impact of changing α on welfare, we first differentiate (3) and then use (5) and (8) to obtain (25).

$$dV_h/d\alpha = -D'_h(Q_h)\{q_h^s(dQ_h/d\alpha) + q_h(dq_h/d\alpha)\}. \tag{25}$$

Further substitution from (13) and (14) yields expression (26).

$$dV_h/d\alpha = -D'_h(Q_h)C_h^{s'}(\alpha)\{D'_h(Q_h)(q_h - q_h^s) + q_h{}^2D''_h(Q_h)\}/\Delta_1 \lesseqgtr 0. \tag{26}$$

The effect on the host country's welfare is indeterminate.

In order to clarify the indeterminancy of the outcome, consider the case of linear demand, where D'' is zero. In this case $dV_h/d\alpha \gtreqless 0$ as $q_h^s \lesseqgtr q_h$. This outcome is exhibited graphically in figure 2. D_h represents the host country's demand curve, while C_h represents (constant) unit cost of the indigenous firm. The intial total output is Q_h divided between the host country's firm ($0q_h$) and the source country's firm (q_hQ_h). Price is set at P_h. Initially, consumer surplus in the host country is $A + B + C + D$, while the profit of the host country's firm is shown by area E. The local content legislation reduces total output to Q'_h, and hence price rises to P'_h. At the same time, output of the host country's firm rises to q'_h. Consumer surplus is reduced to area A, while the indigenous firm's profit rises to $B + E + F$. The net effect on the host country's welfare is a gain of F and a loss of $C + D$. Area D is of second-order smallness and can be ignored. Area C is equal to $(P_h - C_h)dq_h/d\alpha$, and area F is equal to $(P_h - C_h)dq_h/d\alpha$. Differentiating the profit function of the host country's firm

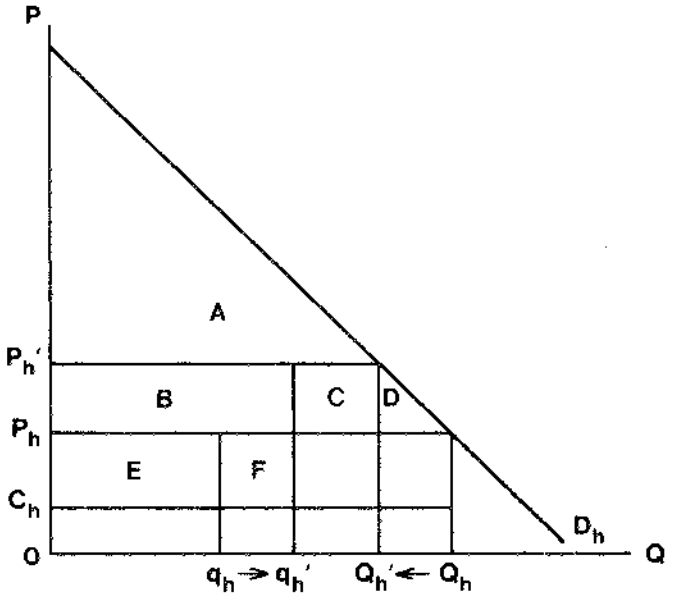

FIGURE 2 Welfare effects of content legislation on the host country

with respect to α (holding q_h^s fixed) and applying the envelope theorem, we find that $(P_h - C_h)dq_h/d\alpha = q_h dP_h/d\alpha$. Thus, area F is larger than area C, and welfare in the host country is directly related to α iff $q_h > q_h^s$.

Using the first-order conditions and the conditions assumed in equation (10), it is easy to show that $q_h > q_h^{s\prime}$ iff $C_h < C_h^s$. Thus, in our model (with $C_h > C_h^s$), the host country's welfare cannot rise. Relaxing our assumption that $C_h > C_h^s$ does not alter our results and thus, in a simple duopoly model the host country's welfare rises iff the indigenous firm has a cost advantage. In a more general model of oligopoly with linear demand, the condition is not quite as simple. Let N_s be the number of firms based in the source country and N_h the number based in the host country. Then, the welfare of the host country rises iff[11] $N_h q_h > N_s q_h^s$; to wit: if and only if total output by the indigenous firms exceeds total output of the foreign firms' subsidiaries. This result is identical to that obtained in the duopoly case, but it can no longer be translated into a simple inequality concerning the relative costs of the firms.

With non-linear demand and only two firms, there exists an additional term in equation (26): $q_h^2 D''_h(Q_h)$. If demand is concave to the origin, D'' is negative and welfare is more likely to rise as the content requirement is stiffened. The

11 In the oligopoly case, area C is equal to $N_s q_h^s dP_h/d\alpha$, and area F is equal to $N_h(P_h - C_h)dq_h/d\alpha$. Differentiating the profit function of one of the host country's firms with respect to α (holding the output of all other firms fixed) and applying the envelope theorem, we obtain $N_h(P_h - C_h)dq_h/d\alpha = N_h q_h dP_h/d\alpha$. Thus, area F is larger than area C if and only if $N_h q_h > N_s q_h^s$.

opposite holds for a convex demand curve. In the non-linear oligopoly case, we also pick up an extra term which is analogous to the one above and leads to the same qualitative results.[12]

Minimum export requirements

We now set $\alpha = 0$ and differentiate (3) with respect to γ to find the effect of minimum export requirements on the host country's welfare. Upon doing so, and substituting from (15)-(17), we obtain (27):

$$dV_h/d\gamma = -D'_h(Q_h)\{(1-\gamma)q_h^s(dQ_h/d\gamma) + q_h(dQ_h/d\gamma)\}. \tag{27}$$

Further substitution from (20) and (22) yields (28):

$$dV_h/d\gamma = \{C_h^s(0) - C_s^s\}\{D'_h(Q_h)[(1-\gamma)q_h^s - q_h] - q_h^2 D''_h(Q_h)\}/\Delta_2 \gtrless 0. \tag{28}$$

In the case of linear demand, the condition for improved welfare as the export requirement is strengthened is identical to that of the local content requirement, to wit: $q_h > (1-\gamma)q_h^s$. That is, sales by the host country's firm must be greater than sales by the source country's firm in the host country. Extension of the model to the oligopoly case leads to a similar generalization as in the case of local content requirement.

In the non-linear demand case, we again pick up the extra term with an outcome that is similar to that of local content requirement.

Foreign investments performance standards

Because the local content and minimum export requirements affect the host country's welfare in the same direction, they can be combined to yield the welfare effect of foreign investment performance standards. In the case of linear demand, performance requirements increase welfare if the output of the host country's firm exceeds the sales of the source country's firm in the host country. A similar result obtains in the generalized oligopoly case.

EMPLOYMENT EFFECTS

Local content

Two simplifying assumptions are needed to analyse the employment effect of minimum local content requirements. We assume that demand is linear and that labour is the only factor of production. Alternatively, we could consider a composite factor consisting of labour and intermediate inputs with zero substitution possibilities between them. Specifically, we assume that demand is represented by equation (29) and $q_h = L_h$, $q_h^s = L_h^s + L_s^s$. Here, L_h is the quantity of labour employed by the indigenous firm in the host country, L_h^s is

12 The explicit mathematical derivation of the non-linear oligopoly case is available from the first author upon request.

the quantity of host-country labour employed by the source country's firm, and L_s^s is the amount of source-country labour employed by the source country's firm to produce output for sale in the host country.

$$P_h = 1 - q_h^s - q_h. \tag{29}$$

Labour is normalized in such a way that one unit of it is required to produce one unit of the product in either the source or the host country. Thus, workers in the two countries are perfect substitutes. The cost differential between the two countries is reflected in differing wages. Defining W_h as the wage of one unit of normalized labour in the host country and W_s as the wage of one unit of normalized labour in the source country, we assume that $W_s = \beta W_h$. The wage differential, β, is assumed to be strictly less than one.

Conditioned upon the unit cost of the source country's firm in the host country, the Nash equilibrium price can be obtained by solving equations (5), (8), and (29). The solution is presented in (30).

$$P_h = 1/3\{1 + C_h^s(\alpha) + C_h\}. \tag{30}$$

Intuitively, we expect C_h^s to be directly related to the price of output. This is because an increase in price carries with it a mandatory increase in the use of local factors, which are more expensive. To determine C_h^s as a function of price, note that the assumption of $\beta < 1$ implies that equalities (31) and (32) hold. Substituting these into the definition of unit cost yields (33).

$$L_h^s = \alpha P_h q_h^s / W_h \tag{31}$$

$$L_s^s = q_h^s\{1 - \alpha P_h / W_h\} \tag{32}$$

$$C_h^s(\alpha) = \{W_h L_h^s + W_s L_s^s\}/q_h^s = \alpha P_h(1 - \beta) + \beta W_h. \tag{33}$$

We find the equilibrium price and unit production cost by solving (30) and (33). The results are presented as (34) and (35).

$$P_h = \{1 + W_h(1 + \beta)\}/\{3 - \alpha(1 - \beta)\} \tag{34}$$

$$C_h^s(\alpha) = \{3W_h\beta + \alpha(1 - \beta) + \alpha W_h(1 - \beta)\}/\{3 - \alpha(1 - \beta)\}. \tag{35}$$

Note that (35) is consistent with our earlier assumption that C_h^s is an increasing function of α.

Substituting equations (34) and (35) into (31), we obtain an expression for employment of host-country workers by the source country's firm. This is given in (36).

$$L_h^s = \{\alpha[1 + W_h(1 + \beta)][1 + W_h(1 - 2\beta) - \alpha(1 - \beta)(1 + W_h)]\}/W_h\{3 - \alpha(1 - \beta)\}^2. \tag{36}$$

Straightforward calculation yields (37) as the expression for employment by the host country's firm.

$$L_h = [1 - W_h(2 - \beta) + W_h\alpha(1 - \beta)]/[3 - \alpha(1 - \beta)] \tag{37}$$

Summing (36) and (37) and differentiating with respect to α allows us to capture the employment consequences of varying the size of α. The value of α that maximizes employment in the host country is given by (38), where $\min^+$ means that if the minimum is a negative number, we take α^* to be zero.

$$\min^+ \left\{ \frac{3[1 + W_h(3 - 2\beta) - W_h^2(10 - 13\beta + \beta^2)]}{(1 - \beta)[5 + W_h(11 - 6\beta) + W_h^2(18 - 7\beta - \beta^2)]}, \frac{3W_h}{1 + 2W_h} \right\} = \alpha^* \tag{38}$$

It is easily shown that when $\alpha = 3W_h/(1 + 2W_h)$, the source country's firm will hire only host-country workers.

The entries in table 1 are the values of α^* for alternative combinations of W_h and β. U.S. direct investments in developed countries, such as Canada, are most likely to be represented in the last two columns of the table, namely, by a wage differential of 0.8 or 0.9. In this case, a country wishing to maximize employment may impose local content requirements of up to 0.92. However, more likely employment-maximizing values for α (under certain circumstances pertaining to the W_h) are in the 0.6 to 0.8 range. U.S. investments in LDCs are most likely to be represented by the first three columns of the table, showing a much greater wage differential. For an LDC attempting to maximize employment, the maximum local content proportion to be considered is 0.5, with more likely values at the 0.2 to 0.4 range.

Minimum export requirements

In the model embodying our simplified technology assumptions, minimum export requirements have no effect on employment. This result follows from the fact that labour is the only input, and C_h^s evaluated at $\alpha = 0$ is equal to C_s^s.

Because of that result (which is unique to our set of assumptions), the combined effect of investment performance standards is fully reflected in the analysis of local content requirements.

ALTERNATIVE POLICY OBJECTIVES OF THE HOST COUNTRY

Previous sections dealt individually with possible objectives of the host country's government in imposing investment performance standards. Apart from the above objectives, the government may wish to maximize *local value added*, which is defined here as the sum of the profit of the host country's firm, employment of the host country's firm, and employment of host-country

TABLE I

Values of α (local content proportions) that maximize employment of host-country workers (a value of α, shown in cell, for each combination of β and W_h)

W_h \ β	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.1	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
0.2	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
0.3	0.36	0.44	0.54	0.56	0.56	0.56	0.56	0.56	0.56
0.4	0.20	0.28	0.37	0.50	0.67	0.67	0.67	0.67	0.67
0.5	0.05	0.12	0.21	0.33	0.51	0.75	0.75	0.75	0.75
0.6	For these values of W_h and β the indigenous firm will not produce; hence our duopolistic model no longer holds.		.06	0.17	0.34	0.61	0.82	0.82	0.82
0.7					0.19	0.45	0.89	0.89	0.89
0.8							0.75	0.92	0.92

NOTE: In the cases where α^* is insensitive to the values of β, the implication is that the source country firm is employing only host country workers to produce output sold in the host country.

workers by the source country's firm. While we do not develop a specific formula for local value added (it would have to include a production function that allows for substitution between labour and capital), we are able to sequence the order in which each objective is attained, *as α (or γ) is raised gradually* from zero to its maximum value. The host country's welfare is maximized first, followed in order by industry-wide employment of host-country workers, local value added, and profit of the host country's firm.

Why is this so? In the fourth section above, we showed that the welfare of the host country is maximized at a level of α (or γ) equal to zero. Therefore, it is (trivially) the first objective to be attained as α (or γ) rises.

Profit is monotonically increasing in both α and γ. On the other hand, employment may be maximized at a level of α between 0 and its maximum value (as shown in the preceding section). Hence, profits continue to rise beyond the point of maximum employment. The fact that value added contains both profit and employment establishes the validity of the above ranking.

SUMMARY

Within the framework of a duopolistic model, we have examined the impact of performance standards for foreign investments on welfare, output, and employment. We have shown that the establishment of performance standards reduces world economic welfare, the source country's welfare, and (under reasonable assumptions regarding relative production costs) the host country's welfare. World welfare declines because total world output is reduced. The

source country's welfare falls because monopoly rents are shifted from the source country's firm to the host country's firm. Finally, the decline in the welfare of the host country is due to a reduction in consumer surplus that outweighs the increase in monopoly rent.

Most of our results generalize to the case of oligopoly. The one exception is the effect of performance standards on the welfare of the host country. With more than two firms, the condition under which that welfare declines no longer simplifies to a comparison of relative production costs in the two countries. Rather, the host country's welfare declines if and only if total sales by the host country's firms are less than sales by the source country's subsidiaries.

Since legislators seldom evaluate commercial policy solely on the basis of economic welfare, we also show that there may be a positive impact of minimum content legislation on the employment of host-country workers. However, such legislation may go too far. As the cost of the source country's subsidiary rises, owing to the content requirement, its scale of operations contracts. Local employment will almost certainly be maximized when the local content requirement is less than 100 per cent.

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