Endogenous Market Structures and the Gains from Foreign Direct Investment[1]

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Abstract

This paper discusses the gains from liberalizing foreign direct investment (FDI) in a two-country setting with endogenous market structure. We investigate two different scenarios. In the first scenario, firms' headquarters are located in the domestic country only. If multinational and national firms coexist, market concentration occurs and FDI is welfare improving for the foreign country, but welfare reducing for the domestic country. In the second scenario, headquarters are located in both countries. Here, FDI leads to mutual welfare gains, irrespective of market structure effects.

JEL-Classification: F12, F15.

Keywords: Foreign direct investment, multinational enterprises, imperfect competition, welfare.

1 Introduction

This study examines the welfare effects of foreign direct investment (FDI) in a two-country model where the choice of FDI and market structure is endogenous. If headquarters are located in the domestic country only and FDI is profitable, we find that the foreign country gains, but the domestic country loses in terms of welfare if national and multinational firms coexist. In an equilibrium with only multinational firms, the impact on domestic welfare depends upon how many multinational firms are supported by the markets. If the headquarters are located in both countries, only multinational firms will be active in the market once FDI is allowed and profitable. Here, FDI leads to mutual welfare gains, and our study shows that, compared with intra-industry trade, FDI improves welfare just as intra-industry improves welfare in comparison with autarky.

The paper is motivated by the fact that the welfare effects of FDI are thus far relatively poorly understood in comparison with the welfare effects of trade. In recent years, however, economic integration has increasingly taken the form of FDI, rather than that of trade. FDI has been growing at a high rate, even though trade barriers have fallen extensively. In fact, the World Investment Report of the United Nations estimates sales of foreign affiliates at USD 16 trillions in the year 2000, whereas exports of goods and non-factor services amounted to USD 7 trillions in the same period.[1] In other words, the value of aggregate production of multinational firms in the host country nowadays outweighs aggregate exports.

This paper focuses on the case where FDI and exports are perfect substitutes.[2] The model we employ is similar to the setting employed in Horstmann

[1]See UNCTAD (2001), Table I.1, p. 10.

[2]Literature distinguishes between horizontal FDI (Markusen, 1984; Horstmann and Markusen, 1992; Brainard, 1993; Markusen and Venables 1998, 2000), which is undertaken to place production closer to foreign markets; and vertical FDI (Helpman, 1984; Helpman and Krugman, 1985), which is undertaken to exploit lower production costs in order to serve both the domestic and the foreign markets. This paper assumes horizontal FDI which seems to be dominant according to empirical evidence (Brainard, 1997; Blonigen, 2001;, Markusen, 1998, Markusen and Maskus, 2001) because most of the worldwide FDI occurs between countries that are similar in size, relative endowments and per capita incomes.

and Markusen (1992) but with free entry and exit. Market entry is considered by Markusen and Venables (1998, 2000) but – given the complexity of their models – solutions can be found only by numerical simulations. Due to the free entry/exit assumption, welfare analysis can be done by comparing the equilibrium prices of the two alternative regimes. Under the trade regime, FDI is banned, and the foreign market is served through exports. Then, FDI is liberalized, and firms may choose between exporting or locating production in the host country under the FDI regime. This regime switch has an impact on the market structure and welfare, the analysis of which is the purpose of this paper.

Following the eclectic paradigm of Dunning (1977), multinational firms are induced to invest abroad if, in addition to location advantages (i.e., lower production costs), they have ownership advantages and internalization advantages (i.e., no interest in selling licenses to foreign firms). Thus, we assume that firms need specific skills to be able to run their headquarters. We measure this requirement by the labor input. Since the labor input needed to set up the headquarters of an oligopolistic firm may differ substantially from country to country, we explore the economic implications of FDI by using two alternative scenarios as reference points. In the first scenario, the specific skills to run the headquarters are concentrated in the domestic country, so that the oligopolistic industry can exist only there. In the second scenario, the headquarters are located in both countries so that the oligopolistic industry is present in both countries. We then discuss the effects of lifting an FDI ban in both scenarios, given that the parameter values make FDI profitable. Thus, FDI is treated as a policy shift and the distribution of skills to run headquarters is considered exogenous; whereas the number of active firms, the location of plants and, hence, the type of active firms are determined endogenously in the context of these two models. Table 1 outlines the two scenarios under investigation.

The paper is structured as follows. Section 2 presents the framework of the model. Section 3 explores the effects of FDI liberalization on the market structure and welfare, when headquarters are located solely in the domestic country. Section 4 discusses the implications of FDI liberalization, when

Table 1: Overview of the model

	Headquarters are located ... in the domestic country only	in both countries
FDI banned	*Inter-sectoral trade*	*Intra-industry trade*
FDI allowed	*FDI vs inter-sectoral trade*	*FDI vs intra-industry trade*

headquarters are located in both countries. Section 5 concludes the paper.

2 The model

The model used in this paper builds on the model employed by Horstmann and Markusen (1992). There are two countries, a domestic country d and a foreign country f, and two goods, X and Y. Each country is endowed with a certain amount of a productive factor, such as labor L. In both countries, the homogeneous good Y is produced under perfect competition using only the labor input, so that $L^Y = Y$, where the superscript denotes the sector in which labor is used. The price of Y equals the return on L and Y is the numeraire of the model. Exporting Y is assumed to incur no trade costs. The industry producing X is characterized by imperfect competition and Cournot behavior. Firms produce one good, which is sold at home and exported or produced abroad. The technology is characterized by constant marginal cost c, and operating a plant in country i involves a fixed cost F_i. Shipping goods between countries costs t per unit. All costs are measured in units of labor required.

The consumer behavior in each country is determined by the linear quadratic utility function $U_i = U(X_i, Y_i) = \alpha X_i - 0.5\beta X_i^2 + Y_i$. Given the aggregate budget resource constraint $L_i + \sum \pi_i = p_i X_i + Y_i, i \in \{d, f\}$, where $\sum \pi_i$ denotes the aggregate profits of the oligopolistic industry and p_i the price of X_i in terms of the numeraire, maximization of U subject to the resource constraint yields the inverse income inelastic demand function

$$p_i = \alpha - \beta X_i, \quad i \in \{d, f\}, \quad \alpha - c - t > 0. \tag{1}$$

Markets are segmented so that each firm is able to regard each country as a separate market. Thus, each firm maximizes its profit with respect to both sales in the foreign market and production for the domestic market, and chooses the profit-maximizing quantity for each country separately.

The profits of a national firm operating in d are

$$\pi^n = (p_d - c)x_d^n + [p_f - (c+t)]x_f^n - F_d, \tag{2}$$

where x_d^n and x_f^n represent production for the domestic and the foreign market, respectively, and F_d is the fixed set-up cost for home production. These fixed costs comprise the investment costs for headquarters and one production plant in the domestic country.

The profits of a multinational firm are

$$\pi^m = (p_d - c)x_d^m + (p_f - c)x_f^m - F_d - F_f, \tag{3}$$

where x_d^m and x_f^m represent production for the domestic and the foreign market, respectively, and F_f is the fixed cost needed to start the production process abroad (i.e., the plant-specific fixed costs). In summary, multinational firms are able to produce for the foreign market without incurring trade costs t, but they have to bear the additional fixed cost of operating a plant abroad. We assume that $F_f < F_d$ and that a firm cannot set up a plant abroad without first setting up one at home.

The sequence of decisions is as follows: all active firms compete in the Cournot fashion in the second stage. In the first stage, firms decide on market entry as a national firm if FDI is banned. If FDI is allowed, they decide simultaneously on market entry and the type of firm they wish to be, national or multinational. As usual, the game is solved by backward induction, which requires that all active firms maximize profits and make zero profits in equilibrium.

3 FDI versus inter-sectoral trade

This section assumes that headquarters are located in the domestic country only. More formally, we assume that F_d is prohibitively high in the foreign country. Then, the trade regime is characterized by *inter-sectoral trade* as firms cannot be established in the foreign country. Due to this asymmetry in the labor input requirement to run headquarters and a production plant, the oligopolistic industry can exist only in the domestic country.

If FDI is banned, aggregate outputs are given by $X_d = Nx_d^n$ and $X_f = Nx_f^n$ for the domestic and the foreign country, respectively, where N denotes the total number of national firms. In equilibrium, each firm maximizes profits (2) given the equilibrium output of its rivals, and entry occurs until the excess profits of the marginal firm are driven to zero. Since firms are symmetric, all firms earn zero profits in equilibrium. This condition allows us to determine the equilibrium number of national firms,

$$N^* = \sqrt{\frac{(\alpha - c)^2 + (\alpha - c - t)^2}{\beta F_d}} - 1, \tag{4}$$

the equilibrium individual output levels

$$\begin{aligned} x_d^* &= \frac{\alpha - c}{\beta(N^* + 1)} = (\alpha - c)\sqrt{\frac{F_d}{\beta[(\alpha - c)^2 + (\alpha - c - t)^2]}}, \\ x_f^* &= \frac{\alpha - c - t}{\beta(N^* + 1)} = (\alpha - c - t)\sqrt{\frac{F_d}{\beta[(\alpha - c)^2 + (\alpha - c - t)^2]}}, \end{aligned} \tag{5}$$

and the equilibrium prices in both countries

$$\begin{aligned} p_d^* &= \frac{\alpha + cN^*}{N^* + 1} = c + (\alpha - c)\sqrt{\frac{\beta F_d}{(\alpha - c)^2 + (\alpha - c - t)^2}}, \\ p_f^* &= \frac{\alpha + (c + t)N^*}{N^* + 1} = c + t + (\alpha - c - t)\sqrt{\frac{\beta F_d}{(\alpha - c)^2 + (\alpha - c - t)^2}}. \end{aligned} \tag{6}$$

We will now investigate the impact on market structure and welfare, when the trade regime (*) represented by (4)-(6) is replaced by a regime where FDI is liberalized, under the hypothesis that the parameters of the model make FDI profitable and that

$$F_d < \frac{(\alpha - c)^2 + (\alpha - c - t)^2}{\beta}. \tag{7}$$

The condition (7) is required for a firm wanting to be active in the inter-sectoral trade case, as it implies $N^* > 0$.

The equilibrium number of national and multinational firms can be determined by solving the optimizing behavior of firms under the zero profit conditions. Let M be the number of multinational firms. In this case, aggregate output is determined by $X_d = Nx_d^n + Mx_d^m$ and $X_f = Nx_f^n + Mx_f^m$. The optimizing solution under the zero profit conditions (2) and (3) results in two non-linear equations in N and M,

$$f(N, M) = \frac{(\alpha - c)^2}{\beta(N + M + 1)^2} + \frac{[\alpha - c - (M + 1)t]^2}{\beta(N + M + 1)^2} - F_d = 0, \tag{8}$$

$$g(N, M) = \frac{(\alpha - c)^2}{\beta(N + M + 1)^2} + \frac{(\alpha - c + Nt)^2}{\beta(N + M + 1)^2} - (F_d + F_f) = 0, \tag{9}$$

where f denotes the zero profit condition for national firms, and g denotes the zero profit condition for multinational firms.

In order to examine the impact on the market structure, the definition of two critical values of F_f prove useful. Let $\overline{F_f}$ denote the minimum fixed costs which yield $M = 0$, and let $\underline{F_f}$ denote the maximum fixed costs which yield $N = 0$. $\overline{F_f}$ (and N) is determined by setting $f(N, 0) = g(N, 0) = 0$, whereas $\underline{F_f}$ (and M) is determined by setting $f(0, M) = g(0, M) = 0$:

$$\overline{F_f} = \frac{t}{\beta}\left(t + 2(\alpha - c - t)\sqrt{\frac{\beta F_d}{(\alpha - c)^2 + (\alpha - c - t)^2}}\right), \tag{10}$$

$$\underline{F_f} = \frac{t}{\beta}\sqrt{2\beta F_d - t^2}. \tag{11}$$

By using (10) and (11), we can demonstrate Proposition 1.

Proposition 1 *A unique equilibrium exists in the case of inter-sectoral trade and potential FDI. If* $F_f \in]\overline{F_f}, \infty[$*, only national firms are active. If* $F_f \in [0, \underline{F_f}[$*, only multinational firms are active. If* $F_f \in [\underline{F_f}, \overline{F_f}]$*, national and multinational firms coexist.*

Proof: See appendix.

Proposition 1 demonstrates that a mixed equilibrium in which national and multinational firms coexist is possible. Regarding the market structure in the mixed equilibrium, (8) and (9) can be solved explicitly for the equilibrium values of N and M:

$$N^e = \frac{\alpha - c}{t}\left(\frac{\beta F_f + t^2}{\sqrt{\eta}} - 1\right), \tag{12}$$

$$M^e = \frac{\alpha - c}{t}\left(1 - \frac{\beta F_f - t^2}{\sqrt{\eta}}\right) - 1 \tag{13}$$

where $\eta := 4\beta F_d t^2 - (\beta F_f - t^2)^2$ and the superscript e denotes the equilibrium values in the case of coexistence of national and multinational firms.[3] The four first order conditions and the two inverse demand functions (1) determine the equilibrium outputs and prices for both the domestic and the foreign market:

$$p_d^e = \frac{\alpha + c(N^e + M^e)}{N^e + M^e + 1} = c + \frac{\sqrt{\eta}}{2t},$$
$$p_f^e = \frac{\alpha + (c+t)N^e + cM^e}{N^e + M^e + 1} = c + \frac{\beta F_f + t^2}{2t}, \tag{14}$$

$$x_d^{ne} = x_d^{me} = \frac{\alpha - c}{\beta(N^e + M^e + 1)} = \frac{\sqrt{\eta}}{2\beta t},$$
$$x_f^{ne} = \frac{\alpha - c - t(M^e + 1)}{\beta(N^e + M^e + 1)} = \frac{\beta F_f - t^2}{2\beta t},$$
$$x_f^{me} = \frac{\alpha - c + tN^e}{\beta(N^e + M^e + 1)} = \frac{\beta F_f + t^2}{2\beta t}. \tag{15}$$

Note that the size of the multinational firm is larger than the size of the national firm ($x_f^{me} - x_f^{ne} = t/\beta$), because the former has to bear larger aggregate fixed costs.[4]

[3]Note that η is unambiguously positive in the case of a mixed equilibrium. Since F_f should be less than $\overline{F_f}$, η must be larger than $4\beta F_d t^2(\alpha - c)^2/[(\alpha - c)^2 + (\alpha - c - t)^2] > 0$.

[4]At first glance, one might argue that, if $\beta F_f < t^2$, the mixed equilibrium would be characterized by national firms serving the domestic market only. However, if exports vanish, it can easily be shown that national firms are no longer profitable and they would all exit from the market. In fact, this hypothetical equilibrium would violate the plausible assumption that $F_f < F_d$. Proof is available upon request.

Since the Jacobian determinant of (8) and (9) is unambiguously positive (see appendix), the slope of f is steeper than that of g at the equilibrium point. Hence, (12) and (13) intersect in the $M - N$ – space as is shown in Figure 1.[5]

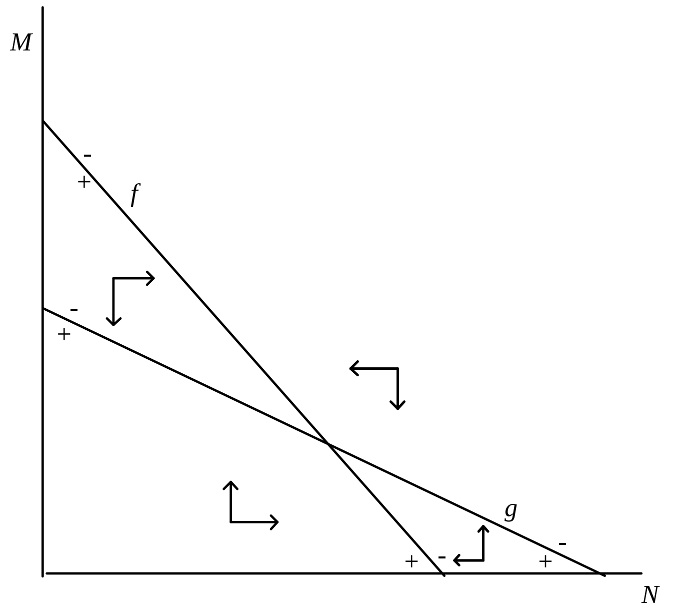

Figure 1: Mixed equilibrium

As Proposition 1 has shown, it might happen that only one type of firm, either national or multinational, is active in the market. In this case, f and g do not intersect. Figure 2 depicts the equilibrium with only multinational firms, since the g-curve lies to the right of the f-curve. In this case, F_f (t) is so low (high) that all national firms exit from the market, once FDI is liberalized. The equilibrium values for the number of firms, individual output levels and prices in a FDI regime with multinational firms only (**) are:

$$M^{**} = (\alpha - c)\sqrt{\frac{2}{\beta(F_d + F_f)}} - 1, \tag{16}$$

[5]Note that the slopes in all figures are linear only for ease of exposition. The positive Jacobian guarantees also that comparative statics yield reasonable results.

$$x_d^{**} = x_f^{**} = \frac{\alpha - c}{\beta(M^{**}+1)} = \sqrt{\frac{F_d + F_f}{2\beta}}, \tag{17}$$

$$p_d^{**} = p_f^{**} = \frac{\alpha + cM^{**}}{M^{**}+1} = c + \sqrt{\frac{\beta(F_d + F_f)}{2}}. \tag{18}$$

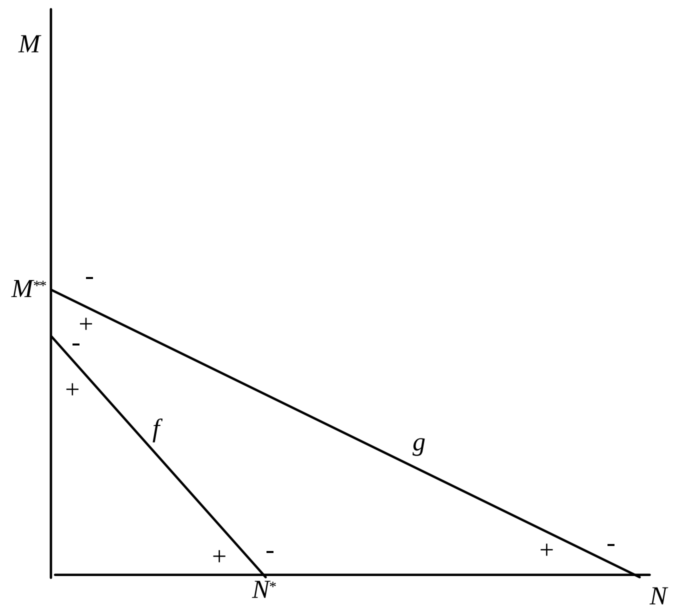

Figure 2: Equilibrium with multinational firms only

We can also determine the condition under which an equilibrium with only multinational firms emerges. Once this occurs, firms are forced to invest abroad to remain active in both the domestic and the foreign market. It is clear from Figure 2 that this condition can be determined by setting $f(0, M^{**}) \leq 0$. In this case, market entry is not profitable even for a single national firm. By using (8), we derive the following condition for an equilibrium with only multinational firms, which is consistent with Proposition 1:

$$f(0, M^{**}) \leq 0 \Leftrightarrow \beta F_f \leq t\sqrt{2\beta F_d - t^2}. \tag{19}$$

In summary, the lower the fixed costs to undertake FDI and/or the larger the trade costs, the more likely it is that only multinational firms are active in the market. It is also interesting to note that the larger F_d, the greater the likelihood that multinational firms alone will serve the markets. The intuition behind this result is that the larger the fixed costs to start the production process at home, the larger the size of the firms should be in order to avoid losses. Eq. (15) shows that the size of the multinational firms is larger than that of national firms because they have to bear higher fixed costs.

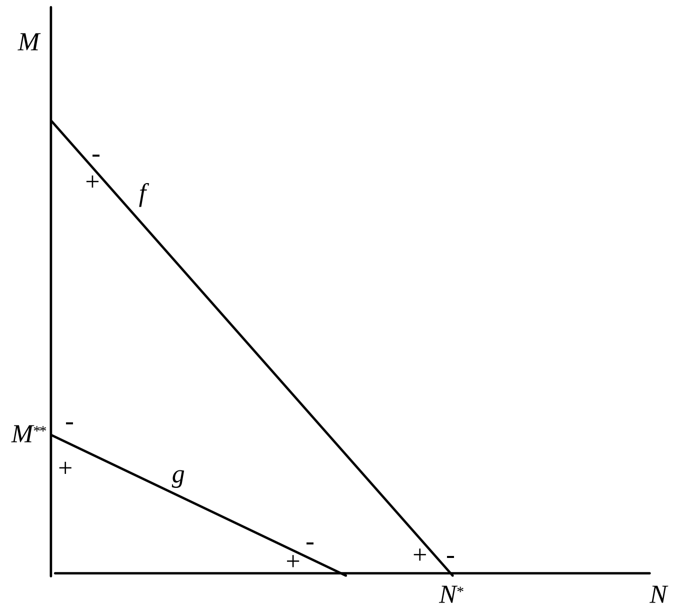

Figure 3: Equilibrium with national firms only

If F_f (t) is sufficiently high (low), then multinational firms are not profitable. Figure 3 depicts this case, which occurs if $g(N^*, 0) \leq 0$. By using (9), we derive the following condition for an equilibrium with only national firms, which is also consistent with Proposition 1:

$$g(N^*, 0) \leq 0 \Leftrightarrow \beta F_f \geq 2t(\alpha - c - t)\sqrt{\frac{\beta F_d}{(\alpha - c)^2 + (\alpha - c - t)^2}} + t^2. \quad (20)$$

Namely, the greater the fixed costs to undertake FDI and/or the lower the trade costs, the greater the likelihood that only national firms are active in the market.

Having identified the conditions under which firms are active in the domestic and foreign markets, investigating the impact of FDI liberalization on market structure is straightforward. If FDI is liberalized and multinational firms are profitable, the market structure changes. Lemma 1 and Lemma 2 summarize the results.

Lemma 1 *In the mixed equilibrium, the total number of active firms under the FDI regime is lower than that under the inter-sectoral trade case.*

Proof: The total number of active firms is given by $N^e + M^e$. The impact of FDI on market structure can be easily examined by using (4), (12), and (13). In fact, $M^e + N^e < N^*$ if, and only if,

$$[(\alpha - c)^2 + (\alpha - c - t)^2](\beta F_f - t^2)^2 < 4(\alpha - c - t)^2 t^2 \beta F_d. \tag{21}$$

This expression is fulfilled if, and only if, the condition for the equilibrium with only national firms (20) is violated. Since this is the case, it follows that allowing FDI leads to market concentration if national firms survive. □

The intuition of this result can be summarized as follows. We have shown that national and multinational firms sell the same amount in the domestic market (see (15)). Given the zero profit condition, the net profit from exporting has to equal the net profit of setting up a foreign subsidiary. If the total number of firms rose after liberalization, a national firm would automatically earn less from exporting, since the foreign market is more crowded, and multinational firms have a marginal cost advantage. This implies that national firms would have to earn more at home, which is inconsistent with entry. Hence, in any coexistence outcome, FDI leads to exit.

For Lemma 2, it is useful to define a critical value ζ:

$$\zeta := \frac{(\alpha - c)^2 + (\alpha - c - t)^2}{2(\alpha - c)^2} \tag{22}$$

Lemma 2 *In equilibrium with only multinational firms, the impact of a regime switch from inter-sectoral trade to FDI on the market structure depends on the fixed costs of a national firm compared with those of a multinational firm:*

$M^{**} < N^*$, if $\frac{F_d}{F_d+F_f} < \zeta$,
$M^{**} > N^*$, if $\frac{F_d}{F_d+F_f} > \zeta$.

Proof: The condition for $M^{**} \gtrless N^*$ follows from (4) and (16). The condition for the equilibrium with only multinational firms (19) can be re-arranged as follows:

$$\frac{F_d}{F_d + F_f} \geq \frac{(\alpha - c)^2 + (\alpha - c - t - tM^{**})^2}{2(\alpha - c)^2}. \tag{23}$$

Expression (23) can be consistent with both $M^{**} < N^*$ and $M^{**} > N^*$. □

Lemma 2 maintains that there is scope for market concentration even if only multinational firms are active in the market. In particular, the number of active firms under the FDI regime is lower, if national firms are not active at the margin. This happens if the fixed costs of a multinational firm are relatively high. However, we cannot rule out the possibility that $M^{**} > N^*$. If F_f is very small, the equilibrium number of multinational firms could be so large that the markets could support more multinational firms.

The impact of FDI on the market structure has an effect on the welfare of both the domestic and the foreign country, because the equilibrium prices and quantities depend upon the equilibrium number of firms and the costs of production. Based on Lemma 1 and Lemma 2, we prove the following Proposition 2.

Proposition 2 *In the mixed equilibrium, the welfare of the domestic country under the FDI regime is lower than that under the inter-sectoral trade case. In equilibrium with only multinational firms, the welfare of the domestic country can either increase or decrease. The welfare of the foreign country rises in both cases.*

Proof: Given the zero profit condition, the welfare analysis can be carried out by examining the impact of FDI on prices. If the foreign market is served via exports, prices are given by (6). If only multinational firms are active in the market, the domestic price and the foreign price coincide and are given by (18). If, instead, national and multinational firms coexist, prices are given by (14). By comparing (6), (14) and (18), it is evident that the domestic consumer is worse off if, and only if, the total number of active firms under the FDI regime is smaller than the number of national firms under the trade regime. If both national and multinational firms are active, the domestic consumer is worse off, because market concentration occurs (see Lemma 1). If only multinational firms are active, Lemma 2 claims that the impact on the market structure and, therefore, on domestic welfare depends on the fixed cost of a multinational firm as compared with the fixed costs of a national firm. Hence, the welfare effects for the domestic country stated by Proposition 2 are proven.

Conversely, the representative consumer in the foreign country is always better off, if FDI is liberalized. In this case, two effects have to be considered: first, due to higher total fixed costs, the exit of firms can occur, bringing about a rise in foreign prices, which decreases foreign welfare; second, the foreign consumer benefits unambiguously from lower production costs, as foreign prices can be set at a lower level. The proof of the foreign country's welfare improvement can be given by contradiction. Suppose that p_f given by (14) is larger than p_f given by (6). Then, an increase in the foreign price occurs if, and only if,

$$\beta F_f > 2t(\alpha - c - t)\sqrt{\frac{\beta F_d}{(\alpha - c)^2 + (\alpha - c - t)^2}} + t^2. \tag{24}$$

However, if this inequality were true, multinational firms would not be active and only national firms would serve the market (see condition (20)). Hence, if coexistence occurs, the foreign price under the FDI regime has to be lower than that under the inter-sectoral trade case. This finding also holds for the equilibrium with only multinational firms. In fact, condition (24) tells us that p_f is lower under coexistence, including the border case where $N^e = 0$ and $M^e = M^{**}$. If F_f is smaller, then the number of multinational firms increases. In addition, if the market is served only by multinational firms, then no trade costs have to be born by foreign consumers. Hence, the welfare of the foreign country is greater under an equilibrium with only multinational firms as compared with an equilibrium with only national firms. □

To clarify the last argument, consider the equilibrium with only national firms as depicted in Figure 3. A decrease in F_f implies a shift of the g-curve to the right. If F_f is sufficiently smaller, coexistence of national and multinational firms would occur. We have shown that this leads to welfare gains for the foreign country, including the border case for which $N^e = 0, M^e = M^{**}$. Given this corner solution, a further decrease in F_f strengthens the profitability of FDI and leads to larger welfare gains.

Note that the effect for domestic welfare is closely related to the foreign market. Since we have already proven that the domestic country is worse off in the case of coexistence, it is obvious that the domestic country can become better off if only multinational firms are active in the market. However, more firms with additional fixed costs alone cannot be expected to imply lower prices but an increase in average cost. To obtain a welfare gain, it is essential that the foreign market becomes much more profitable after FDI liberalization. If the increase in the profitability of the foreign market is substantial enough so that more multinationals are active than national firms have been active before, domestic welfare will improve. As the profitability of the foreign market depends crucially upon the size of fixed costs, we will now explore how small F_f should be to ensure that the domestic country is not worse off. The critical amount of the plant-specific fixed costs can be computed by setting expression (16) larger than or equal to expression (4). The domestic country is therefore not worse off if, and only if,

$$F_f \leq \psi F_d, \psi = \frac{(\alpha - c)^2 - (\alpha - c - t)^2}{(\alpha - c)^2 + (\alpha - c - t)^2}. \tag{25}$$

Only if F_f is small enough, does the domestic country gain from FDI, because the equilibrium number of multinational firms would be larger than the equilibrium number of national firms under the trade regime. However, it seems that F_f should be really small for a welfare enhancing effect to occur with FDI liberalization. In fact, consider a possible case where marginal costs are 10 % (30 %) of the reservation price and trade costs are 30 % of the marginal costs. In this case, the critical parameter ψ would be equal to 0.034 (0.137). In other words, for the domestic consumer to be better off, the fixed costs of setting up a plant abroad should be lower than 3.4 % (13.7 %) of the fixed costs of starting the production process at home.

4 FDI versus intra-industry trade

The previous section has shown the effects of FDI liberalization on the market structure and welfare as compared with inter-sectoral trade, under the assumption that the headquarters of the oligopolistic industry were located only in the domestic country. This section assumes that headquarters are located in both countries. If FDI is banned, the trade regime is characterized by *intra-industry trade*, and the model coincides with the reciprocal dumping model of Brander (1981) and Brander and Krugman (1983). They show that, with respect to autarky, trade is mutually welfare improving if market structures are endogenous, as firms move down their average cost curves. By symmetry we need to consider only the domestic country. If FDI is banned, aggregate output in each market is $X_d = X_f = 0.5N(x_d + x_f)$, where N denotes the total number of national firms active in both countries. The equilibrium values ($\tilde{}$) for the number of firms, individual output levels and prices are:

$$\tilde{N} = \frac{(\alpha - c) + (\alpha - c - t)}{\sqrt{2\beta F_d - t^2}} - 1, \tag{26}$$

$$\tilde{x}_d = \frac{\alpha - c + 0.5\tilde{N}t}{\beta(\tilde{N}+1)} = \frac{\sqrt{2\beta F_d - t^2} + t}{2\beta},$$
$$\tilde{x}_f = \frac{\alpha - c - (0.5\tilde{N}+1)t}{\beta(\tilde{N}+1)} = \frac{\sqrt{2\beta F_d - t^2} - t}{2\beta}, \tag{27}$$

$$\tilde{p} = \frac{\alpha + \tilde{N}c + 0.5\tilde{N}t}{\tilde{N}+1} = c + \frac{t + \sqrt{2\beta F_d - t^2}}{2}, \tag{28}$$

respectively. Note that intra-industry trade occurs (i.e., $\tilde{x}_f > 0$) if, and only if, $t^2 < \beta F_d$. This condition is needed to ensure that there are not too many local firms making exports not worthwhile. In addition, the market exists (i.e., $\tilde{N} > 0$) if, and only if, F_d is lower than $[(\alpha - c)^2 + (\alpha - c - t)^2]/\beta$. We will now discuss the impact on the market structure and welfare when the trade regime represented by (26)-(28) is replaced by the FDI regime, under the hypothesis that the parameters of the model make FDI profitable and

$$\frac{t^2}{\beta} < F_d < \frac{(\alpha - c)^2 + (\alpha - c - t)^2}{\beta}. \quad (29)$$

If FDI is liberalized, aggregate output is determined by $X_d = nx_d^n + mx_d^m + \tilde{n}x_f^{\tilde{n}} + \tilde{m}x_f^{\tilde{m}}$ and $X_f = nx_d^f + mx_f^m + \tilde{n}x_d^{\tilde{n}} + \tilde{m}x_d^{\tilde{m}}$, where $n(\tilde{n})$ and $m(\tilde{m})$ denote the number of national firms and the number of multinational firms having the headquarters in the domestic (foreign) country, respectively. Since countries are symmetric, we need to consider only one market, and since all types of firms are possibly present in the market, we define $N = 2n$ and $M = 2m$. The solution of the standard profit maximization problems faced by the firms yields the equilibrium price

$$p = \frac{\alpha + cN + 0.5tN + cM}{N + M + 1}, \quad (30)$$

and the individual output levels

$$x_d^n = x_d^m = x_f^m = \frac{\alpha - c + 0.5tN}{\beta(N + M + 1)}, x_f^n = \frac{\alpha - c - t - 0.5tN - tM}{\beta(N + M + 1)}. \quad (31)$$

Given the profit maximizing output and prices, profits (2) and (3) can be re-arranged as follows:

$$\phi(N, M) = \frac{(\alpha - c + 0.5tN)^2}{\beta(N + M + 1)^2} + \frac{(\alpha - c - t - 0.5tN - tM)^2}{\beta(N + M + 1)^2} - F_d = 0, \quad (32)$$

$$\gamma(N, M) = \frac{2(\alpha - c + 0.5tN)^2}{\beta(N + M + 1)^2} - F_d - F_f = 0, \quad (33)$$

where ϕ denotes the zero profit condition for national firms, and γ denotes the zero profit condition for multinational firms. ϕ and γ would allow us to determine the equilibrium number of both national and multinational firms. However, the Jacobian determinant of (32) and (33) with respect to N and M is zero, which implies that (32) and (33) are linearly dependent and no equilibrium solution with positive N and M exists.[6] Consequently, the equilibrium in a symmetric Cournot oligopoly with entry can only be a

[6]See appendix for proof.

corner solution, which leads to the conclusion that either only multinational firms or only national firms are in the market.

Proposition 3 *If the oligopolistic industry is located in both countries, firms are either all national or all multinational.*

Proof: See appendix.

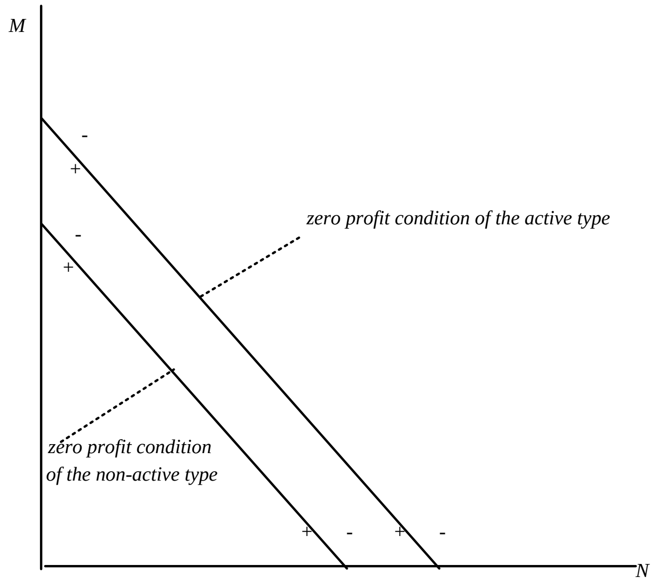

Figure 4: Equilibrium with one firm type only

In order to examine which type of firm is active in the market, it is useful to compare the implicit functions in the $M - N$ – space. The zero Jacobian implies that (32) and (33) could only intersect with identical slopes, which contradicts the assumption of intersection (see Figure 4).[7] Since $\partial\phi/\partial N, \partial\phi/\partial M, \partial\gamma/\partial N, \partial\gamma/\partial M < 0$, the points under (above) the $\phi-$ $(\gamma-)$ curve represent positive (negative) profits for national (multinational) firms. Then, the zero profit condition of the active type will lie above the zero profit condition of the non-active type.

[7]Needless to say that it may happen that both curves coincide. In this (unlikely) case, only $N + M$ can be determined.

Since the pre-liberalization equilibrium point is represented by (26) with national firms making zero profits, FDI is profitable if, and only if, $\gamma(\tilde{N},0) \geq 0$. $\gamma(\tilde{N},0) \geq 0$ implies that multinationals may enter without making losses and would – as Proposition 3 has shown – dominate the market. Once FDI is liberalized, the condition for the equilibrium with multinational firms only is given by:

$$\gamma(\tilde{N},0) = \frac{2(\alpha - c + 0.5t\tilde{N})^2}{\beta(\tilde{N}+1)^2} - F_d - F_f \geq 0, \tag{34}$$

which leads to (19). Hence, if $\beta F_f \leq t\sqrt{2\beta F_d - t^2}$, national firms do not survive and the equilibrium number of multinational firms is given by (16), regardless of the initial location of the headquarters.[8]

With regard to the impact on the market structure, by inserting (16) into (34), and rearranging, we obtain

$$M^{**} \geq \frac{\alpha - c - 0.5t}{\alpha - c + 0.5t\tilde{N}}\tilde{N}. \tag{35}$$

Since $(\alpha - c - 0.5t)/(\alpha - c + 0.5t\tilde{N}) < 1$, industry concentration may also occur in the case of intra-industrial FDI. However, the fixed costs to set up a plant abroad could also be so small that the equilibrium number of firms rises.

However, and most importantly, (35) is very useful for the welfare analysis. In fact, (35) is consistent with the price equation (30) under the two alternative regimes if, and only if, $p(0,M^{**}) \leq p(\tilde{N},0)$. This implies that the negative dumping effect, which occurs if homogeneous goods are traded internationally, plays a key role in the welfare analysis, regardless of the impact of a regime switch on market structure. Thus, we can conclude our analysis with the following proposition.

Proposition 4 *Although the impact on the market structure of the intra-industry FDI regime in comparison with the intra-industry trade case depends upon parameter values, intra-industrial FDI generates mutual welfare gains.*

[8] Conversely, if $\phi(0,M^{**}) \geq 0$, the market would be served by national firms only.

This is a remarkable result because it stresses the role of trade costs. Consider a firm switching from a national to a multinational firm because FDI has been liberalized. Then, a decline in the domestic price implies a decrease in the individual domestic output. Furthermore, the multinational firm has to bear the additional plant-specific fixed costs. From these profit-reducing effects, we would expect that prices rise. However, the foreign market has become so profitable that the increase in individual production for the foreign market is able to overcompensate these effects. Proposition 4 demonstrates that the profit-reducing effects are offset by vanishing trade costs.

5 Concluding remarks

This paper has examined the impact of FDI on market structure and welfare. We have distinguished between two different scenarios concerning the location of headquarters: (i) headquarters are located in the domestic country only, so that trade and FDI are inter-sectoral, and (ii) headquarters are located in both countries, so that FDI and trade are of the intra-industry type. Given these two different benchmarks, we studied the impact of liberalizing FDI on the market structure and welfare by comparing the two FDI regimes with the two trade regimes.

We have shown that, if the headquarters are located in the domestic country only, the FDI regime as compared with the inter-sectoral trade case leads to welfare losses for the domestic country, but to welfare gains for the foreign country when national and multinational firms are both active. However, if only multinational firms emerge, the welfare of the foreign country improves, whereas the impact on the welfare of the domestic country depends upon the size of fixed costs to set up a plant. FDI liberalization has also an impact on market structure: if both firms coexist, the number of active firms decreases, if only multinational firms are active, their number may be smaller or larger than the number of national firms in the case of no FDI. In this latter case, we have shown that domestic welfare improves only if FDI increases the number of active firms. It must be noted, however, that an increase in the number of firms and – due to entry of multinational firms – an increase in aggregate fixed costs alone cannot be expected to improve welfare, but would imply an increase in prices. In order to improve domestic welfare, it is essential that multinational firms save large trade costs. In other words, the increase in the profitability of the foreign market must be sufficiently large so that the number of active firms increases. We have nevertheless also demonstrated that an improvement in domestic welfare is very unlikely to occur.

The results are different if the headquarters are located in both countries. We have shown that a coexistence of both types of firms is not possible so that either only national or only multinational firms are active. The FDI regime then implies that national firms are completely replaced by multinational firms. We have shown that the FDI regime leads to mutual welfare gains in comparison with the intra-industry trade case, although the equilibrium number of multinational firms can be lower than that of national firms. The reason is that consumers have to bear trade costs in the intra-industry trade case which are saved by multinational firms. Furthermore, multinational firms dominate national firms if and only if the additional fixed costs are sufficiently low and trade costs are sufficiently substantial so that average costs do not increase. This case demonstrates that FDI, as compared with trade, leads to mutual welfare gains just as trade, as compared with autarky, leads to mutual welfare gains if market structures are endogenous and firms' headquarters may locate in either of the countries involved.

Appendix

Proof of Proposition 1

National firms will emerge if $F_f > \overline{F_f}$, because $\overline{F_f}$ is determined from (8) and (9) by setting M equal to zero. Any higher F_f would only deepen the cost disadvantage of multinational firms. By contrast, multinational firms will emerge if $F_f < \underline{F_f}$, because $\underline{F_f}$ is determined from (8) and (9) by setting N equal to zero. Any lower F_f would only raise the profitability of multinational firms. If, however, $\overline{F_f} > \underline{F_f}$, a range of F_f exists in which a mixed equilibrium occurs. For the mixed equilibrium proof, define $\Delta := (\beta/t)(\overline{F_f} - \underline{F_f})$. If $\Delta > 0$, a mixed equilibrium may exist. First, let us explore the behavior of the Δ-function in the relevant range. We observe that $\Delta = 0$ if $F_d = [(\alpha - c)^2 + (\alpha - c - t)^2]/\beta$. However, this level of fixed costs implies that the market does not exist, because even a single firm is not able to recoup its fixed costs (see condition (7)). Hence, the relevant fixed costs must be below this level. If Δ decreases with F_d in the relevant range, we have shown that Δ is positive, since it reaches zero at the border where the market does not exist under the intersectoral trade case. Differentiation yields

$$\frac{\partial \Delta}{\partial F_d} = \beta \left(\frac{\alpha - c - t}{\sqrt{\beta F_d[(\alpha - c)^2 + (\alpha - c - t)^2]}} - \frac{1}{\sqrt{2\beta F_d - t^2}} \right). \tag{A.1}$$

This term is negative if, and only if, $t > -\beta F_d[2(\alpha - c) - t]/[\alpha - c - t]^2$, which is always fulfilled. Hence, a mixed equilibrium may exist.

Uniqueness is proven if the Jacobian determinant has an unambiguous sign for the equilibrium values of N and M. Differentiation of the zero profit conditions yields

$$\frac{\partial f}{\partial N} = -\frac{2((\alpha - c)^2 + (\alpha - c - (M+1)t)^2)}{\beta(N + M + 1)^3} < 0, \tag{A.2}$$

$$\frac{\partial f}{\partial M} = \frac{\partial g}{\partial N} = -\frac{2[(\alpha - c)^2 + (\alpha - c + Nt)(\alpha - c - (M+1)t)]}{\beta(N + M + 1)^3} < 0, \tag{A.3}$$

$$\frac{\partial g}{\partial M} = -\frac{2((\alpha - c)^2 + (\alpha - c + Nt)^2)}{\beta(N + M + 1)^3} < 0. \tag{A.4}$$

For the negative signs of all derivatives see also (15). The Jacobian is then

$$|J| = \frac{\partial f}{\partial N}\frac{\partial g}{\partial M} - \frac{\partial f}{\partial M}\frac{\partial g}{\partial N} = \frac{4(\alpha - c)^2 t^2}{\beta^2 (N + M + 1)^4} = \frac{\eta^2}{[2\beta(\alpha - c)t]^2} > 0 \tag{A.5}$$

where $\eta := 4\beta F_d t^2 - (\beta F_f - t^2)^2 > 0$ because $F_f < \overline{F_f}$ (see footnote 3).

Expression (A.5) shows that the sign of the Jacobian is unambiguously positive. Note that this property holds also for the corner solutions characterized by $f(0, M) = g(0, M) = 0$ or $f(N, 0) = g(N, 0) = 0$, and hence proves that the equilibrium is unique. The proof can be given by contradiction. Suppose that multiple mixed equilibria exist. In this case both the f- and the g-function should intersect at least twice. However, both the f- and the g-function are twice continuously differentiable and have a negative slope. If they intersect twice, the second intersection should imply a Jacobian with an opposite sign. However, the Jacobian is always positive. Hence, any mixed equilibrium must be unique. □

Proof of Proposition 3

Proposition 3 claims that the Jacobian of (32) and (33) is zero. Differentiation of (32) and (33) yields

$$\frac{\partial \phi}{\partial N} = -\frac{[(\alpha - c) + (\alpha - c - t) - tM]^2}{\beta(N + M + 1)^3} < 0, \tag{A.6}$$

$$\frac{\partial \phi}{\partial M} = \frac{\partial \gamma}{\partial N} = -\frac{2(\alpha - c + 0.5tN)[(\alpha - c) + (\alpha - c - t) - tM]}{\beta(N + M + 1)^3} < 0, \tag{A.7}$$

$$\frac{\partial \gamma}{\partial M} = -\frac{4(\alpha - c + 0.5tN)^2}{\beta(N + M + 1)^3} < 0. \tag{A.8}$$

By using (A.6), (A.7) and (A.8), we find that

$$|J| = \frac{\partial \phi}{\partial N}\frac{\partial \gamma}{\partial M} - \frac{\partial \phi}{\partial M}\frac{\partial \gamma}{\partial N} = 0. \quad \square \tag{A.9}$$

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Proof: $x_f^{ne} = 0$ and $x_f^{me} > 0$ imply $F_f > F_d$ (not for publication)

If national firms serve only the domestic market, output levels per firm are

$$\begin{aligned} x_d^{ne} = x_d^{me} &= \frac{\alpha - c}{\beta(N^e + M^e + 1)}, \\ x_f^{ne} &= 0, \\ x_f^{me} &= \frac{\alpha - c}{\beta(M^e + 1)}, \end{aligned} \tag{B.1}$$

leading to the following zero profit conditions:

$$\Pi^{ne} = \frac{(\alpha - c)^2}{\beta(N^e + M^e + 1)^2} - F_d = 0, \tag{B.2}$$

and

$$\Pi^{me} = \frac{(\alpha - c)^2}{\beta(N^e + M^e + 1)^2} + \frac{(\alpha - c)^2}{\beta(M^e + 1)^2} - F_d - F_f = 0. \tag{B.3}$$

(B.2) and (B.3) imply that

$$M^e = \frac{\alpha - c}{\sqrt{\beta F_f}} - 1 \tag{B.4}$$

and

$$N^e = \frac{\alpha - c}{\sqrt{\beta}} \left(\frac{1}{\sqrt{F_d}} - \frac{1}{\sqrt{F_f}} \right). \tag{B.5}$$

Clearly, $N^e > 0$ if, and only if, $F_f > F_d$, which contradicts one of our assumptions. □