Foreign Entry and Domestic Welfare, with an Application to Portuguese Life-Insurance

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1 Introduction

Foreign investment has been one of the most important factors of growth in the Portuguese economy during the past decade. It has also been a topic of contention among a number of interested parties. The debate surrounding the virtues of foreign investment typically contrasts the benefits from technology transfer with the costs of increased dependence from foreign capital. Some say foreign investment is a condition *sine qua non* for the modernization of the Portuguese economy; others will argue that the country is being "sold to foreign powers".

In this paper, we depart from the "classical" controversy and instead examine the impact of foreign investment from the perspective of (partial equilibrium) industrial organization. Specifically, we consider foreign investment as entry into some imperfectly competitive domestic market. Our goal is to evaluate the impact of entry on market competitiveness, in particular on the level of domestic social surplus. Evidently, this is a somewhat limited analysis, since it does not consider important factors such as technology transfer, direct and indirect creation of employment, political dependence, and the like. However, we believe it to be a worthwhile exercise, especially because it looks at one aspect which is often neglected in the debate surrounding the effects of foreign investment.

Our analysis is related to the literature on free entry and welfare. Ever since the seminal paper by von Weizsacker (1980), economists have agreed that there may be situations in which the equilibrium market structure with free entry is non-optimal from a social welfare point of view. In fact, Mankiw and Whinston (1986) have recently shown that for quite general conditions the free entry equilibrium number of firms in any given industry is greater than the socially optimum number, and thus a barrier to entry might be welfare improving. Our paper considers the case of an industry which is subject to entry by foreign firms. The impact of (foreign) entry on (domestic) we fare is different from the case considered by Mankiw and Whinston (1986), since the regulator is only concerned about consumer's surplus and *domestic* firms' profits. As we shall see, this difference may be quite substantial, and in fact the case for barriers to entry may be reversed.

In sections 2 and 3 of the paper, we present tests for the marginal and the global effects of foreign entry on domestic welfare. We show that marginal entry is welfare improving if and only if foreign firms' market share is above some threshold value. As a result, the optimum number of foreign firms is either zero or infinity. The global impact of foreign entry is positive if and only if the increase in total quantity (the consumer's surplus effect) is sufficiently greater than the decrease in the domestic firms' Herfindahl index (the profit transfer effect). Section 4 extends the results to the case of entry by acquisition (as opposed to *de novo* entry).

An important feature of the tests presented in sections 2 and 3 is that they depend only on current market share data, which is usually easy to obtain. In section 5, the tests are applied to the Portuguese life-insurance market. We find the global effect of foreign entry by 1989 to be negative. However, based on the available data, we find it plausible that the effect of marginal entry (both *de novo* entry and entry by acquisition) be positive. Therefore, although foreign entry has decreased domestic welfare, *additional* foreign entry would increase domestic welfare.

We conclude with some final remarks concerning limitations of the analysis and possible extensions.

2   Marginal Welfare Effect of Foreign Entry

Consider a homogeneous product N-firm Cournot oligopoly, with $N = D + F$, where D is the number of domestic firms and F the number of foreign firms competing in the domestic market. Demand is given by $P(Q)$, where P is price, q_i firm i's output, and $Q \equiv \sum q_i$ total output.

Firm i's profits are given by

$$\pi_i = P(Q)q_i - C_i(q_i), \quad i = 1, \ldots, N \qquad (1)$$

where $C_i(q_i)$ is firm i's cost function. We assume P is a concave function of q_i. The first-order (sufficient) conditions for profit maximization are given by:

$$P(Q) + q_i \frac{\partial P}{\partial Q} - \frac{\partial C_i(q_i)}{\partial q_i} = 0, \quad i = 1, \ldots, N \qquad (2)$$

and can be re-written as

$$q_i = \frac{P(Q) - c_i}{-\partial P / \partial Q}, \quad i = 1, \ldots, N$$

where c_i, stands for marginal cost.

For simplicity, though at the risk of some abuse of notation, we will use D both for the *number* of domestic firms and the *set* of domestic firms. Therefore, total quantity produced by domestic firms, Q_D, is the sum of q_i for all i in D, $Q_D \equiv \sum_{i \in D} q_i$. A similar definition holds for Q_F.

Domestic welfare is defined as the sum of consumer's surplus and domestic firms' producer's surplus:

$$W = \int_0^Q P(x)dx - PQ + PQ_D - \sum_{i \in D} C_i(q_i) . \qquad (4)$$

One can easily identify two different effects on domestic welfare following from entry by foreign firms. On the one hand, total output in the industry expands, which implies a lower price and a greater consumer's surplus. On the other hand, domestic firms' profits decrease, both because of a lower price and of a lower market share held by domestic firms. Figure 1 depicts these two effects in a simple case of linear demand and zero marginal cost. The equilibrium under autarky is given by E_0, whereas E_1 is the equilibrium with foreign entry. The effects of foreign entry on domestic welfare are given by areas A (the "consumer's surplus" effect) and B (the "profit transfer" effect). Conceptually, the problem we want to solve in this paper is very simple: which is greater, A or B? Difficulties arise, however, because we have no reliable estimates of what the demand and cost functions are, not to speak of where the (hypothetical) autarky equilibrium E_0 would lie.

In the results that follow, we will consider changes in domestic welfare resulting from entry by foreign firms *assuming that the number of domestic firms remains fixed*. The typical sequence of events we have in mind is the following. In a first stage, the domestic country is in autarky and entry proceeds to the point where no domestic potential entrant can gain positive profits. In a second stage, entry by foreign firms is allowed. Due to absolute cost advantages, both in terms of fixed costs and of marginal costs, foreign entry does indeed occur. It is easy to see that if domestic entry was not
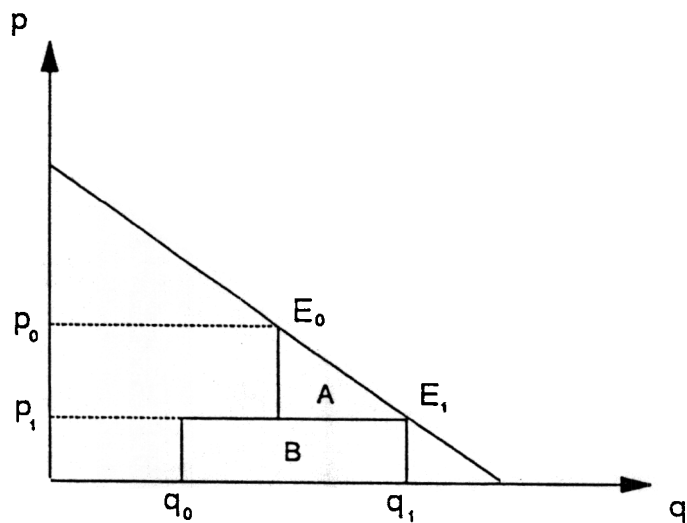
Figure 1: Effects of foreign entry on domestic welfare.

optimal at the end of stage one, than it will not be optimal during the second stage either.

Our first result is about the marginal effect on domestic welfare of entry by a foreign firm.

Proposition 1 *At the margin, foreign entry increases domestic welfare if and only if*

$$s_F > \sum_{i \in D} \eta_i s_i \qquad (5)$$

where $s_F \equiv \frac{Q_F}{Q'}, s_i \equiv \frac{q_i}{Q}$ and (see Farrel and Shapiro (1990))

$$\eta_i \equiv \frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2} .$$

Proof: The change in domestic welfare resulting from entry by a "marginal" foreign firm is given by

$$\frac{dW}{dF} = \sum_{i \in D}(P - c_i)\frac{\partial q_i}{\partial F} - Q_F \frac{\partial P}{\partial Q}\frac{\partial Q}{\partial F} . \qquad (6)$$

From the first-order condition (2) we have (by the implicit function theorem)

$$\frac{\partial q_i}{\partial Q} = -\frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2} = -\eta_i \ . \tag{7}$$

Substituting (7) for $\partial q_i/\partial F$ in (6), we have

$$\frac{dW}{dF} = \left(-\sum_{i \in D}(P - c_i)\left(\frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2}\right) - Q_F \frac{\partial P}{\partial Q}\right)\frac{\partial Q}{\partial F}$$

$$= \left(\sum_{i \in D} q_i \left(\frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2}\right) - Q_F\right)\frac{\partial P}{\partial Q}\frac{\partial Q}{\partial F} \tag{8}$$

where the latter equality follows from (3). Since $\partial Q/\partial F > 0$, a necessary and sufficient condition for $dW/dF > 0$ is that

$$\sum_{i \in D} q_i \left(\frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2}\right) - Q_F < 0 \tag{9}$$

which, dividing through by Q, gives (5). ■

Proposition 1 indicates the critical value of foreign firms' market share above which additional foreign entry is desirable. This implies that, starting from an autarky equilibrium, entry by foreign firms to a small extent necessarily decreases domestic welfare (the profit transfer effect dominates). On the other hand, if foreign entry has proceeded to a point where foreign firms hold a market share close to one, then *additional* entry by foreign firms necessarily increases domestic welfare (consumer's surplus effect dominates).

This dichotomy of effects has strong implications in terms of the optimum number of foreign firms from the point of view of domestic welfare:

Corollary 1 *The optimum number of foreign firms is either zero or infinity.*

Proof: From Proposition 1, we have conclude that $dW/dF > 0$ if $s_F > k$, where k is given by (9b). Since s_F is itself increasing in F, we conclude that W is a quasi-convex function of F, and the result follows. ■

To see how both extreme cases of Corollary 1 could possibly occur, consider the following example. Demand is linear ($P = 2 - Q$) and there is one domestic firm with zero fixed and marginal cost. Now first suppose there is an infinite number of potential foreign entrants with zero fixed and marginal costs. Clearly, infinite entry would be preferable, since total

domestic surplus would increase from 3/2 to 2. Now suppose instead that foreign firms' marginal costs is 1/2, and that fixed costs are zero. Under this second set of assumptions, infinite entry by foreign firms would decrease domestic welfare from 3/2 to $3/2 - 1/4$.

Unfortunately, the values of η_i in (5) are not easy to estimate. However, based on (5) and some knowledge of the demand and cost functions, we can provide necessary and sufficient conditions corresponding to proposition 1.

Corollary 2 *Assume that marginal cost $c_i(q_i)$ is nondecreasing and consider a marginal increase in the number of foreign firms.*

a) *If the demand function is convex or not too concave, then $s_F > s_D$ is a sufficient condition for an improvement in domestic welfare;*

b) *If the demand function is sufficiently concave, then $s_F > s_D$ is a necessary condition for an improvement in domestic welfare.*

Proof: From the definition of η_i, we get

$$\eta_i = \frac{\partial P/\partial Q + q_i \partial^2 P/\partial Q^2}{\partial P/\partial Q - \partial^2 C_i/\partial q_i^2}$$

Therefore, $\eta_i < 1$ if $\partial^2 P/\partial Q^2 > -(\partial^2 C_i/\partial q_i^2)/q_i$ and $\eta_i > 1$ if $\partial^2 P/\partial Q^2$ is sufficiently negative. If $\eta_i < 1$, then $s_F > s_D$ is a sufficient condition; if $\eta_i > 1$, then it is necessary. ∎

Finally, for the special case when demand and costs are linear, $s_F > s_D$ (or $s_F > .5$) is a necessary and sufficient condition for marginal foreign entry to improve domestic welfare.

3   Global Welfare Effect of Foreign Entry

In the previous section, we have analyzed the marginal effect of entry by foreign firms. We have seen that only when the market share of foreign firms exceeds some critical value it is desirable to have an additional foreign firm enter the domestic market. However, this "marginal" result does not tell much about the total gain from having foreign firms in the domestic market as compared to the autarky equilibrium. In this section, we focus on the global (as opposed to marginal) effect of foreign entry on domestic welfare. In order to keep the model tractable, we consider the simplest case of constant marginal costs, c_i, and a linear demand curve, $P = a - bQ$.

Firm i's profit before entry by foreign firms is given by

$$\pi_i = \left(a - b\sum_{i \in D} q_i - c_i\right) q_i, \quad i + 1, \ldots, D . \tag{10}$$

In the absence of foreign entry, firm i's equilibrium quantity is given by

$$q_i = \frac{1}{b}\frac{a + \sum_{j \in D} c_j - (D+1)c_i}{D+1}, \quad i = 1, \ldots, D . \tag{11}$$

Industry profits are $\sum_{i \in D} \pi_i = bQ^2 H$ (Cowling and Waterson, 1976), where H is the domestic firms' Herfindahl index before entry by foreign firms and Q is total quantity produced by domestic firms before entry by foreign firms.

Once again, we define domestic welfare as the sum of consumer's surplus and total domestic profits. Before entry by foreign firms, this is given by

$$W = \frac{1}{2}bQ^2 + bQ^2 H = bQ^2\left(\frac{1}{2} + H\right) \tag{12}$$

The equilibrium after entry by foreign firms implies a new value for domestic welfare,

$$W = \frac{1}{2}bQ'^2 + bQ'^2 H' = bQ'^2\left(\frac{1}{2} + H'\right) \tag{13}$$

where Q' is total quantity and H' is the domestic firms' Herfindahl index after entry by foreign firms.[1]

Proposition 2 *Domestic welfare improves with foreign entry (that is, $W' > W$) if and only if*

$$\left(\frac{Q'}{Q}\right)^2 > \frac{1 + 2H}{1 + 2H'} \tag{14}$$

Proof: Straightforward comparison of (12) and (13). ∎

Proposition 2 reflects the trade-off, in terms of domestic welfare, referred to above. The left-hand side can be interpreted as the consumer's surplus effect. Foreign entry implies a decrease in price (an increase in quantity), and thus an increase in consumer's surplus. The right-hand side, in turn, can be interpreted as the profit transfer effect. Foreign entry implies a decrease in domestic firms' profits, which is reflected in a lower domestic firms' Herfindahl index.

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[1] In general, a prime will denote equilibrium values after entry by foreign firms.
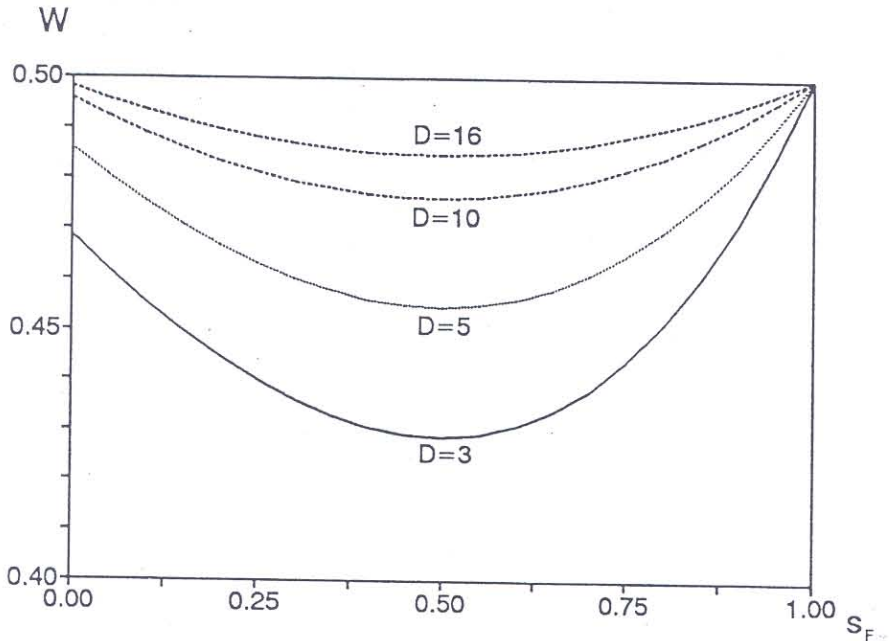
Figure 2: Domestic welfare as a function of the market share of foreign firms, for given values of the number of domestic firms.

Propositions 1 and 2 are illustrated in Figures 2 and 3. Figure 2 shows the level of domestic welfare as a function of the market share of foreign firms, for given values of the number of domestic firms. We assume demand and costs are linear, and that domestic and foreign firms' marginal costs are equal and that $(a - c)^2 = b$. It can be seen that domestic welfare is decreasing up to the point where the market share of foreign firms is 0.5, and increasing for higher values of s_F (Proposition 1). The market share held by foreign firms must be quite large for additional foreign entry to be beneficial from a domestic welfare point of view. This can be seen from Figure 3, which depicts the critical value s_F for $W = W'$, as a function of the number of domestic firms. We conclude that the critical market share increases rapidly as D goes from one to ten, and less so for higher values of D.

Both Figures 2 and 3 are based on the strong assumption that domestic and foreign firms' marginal costs are equal. In general, we would expect foreign firms to be at a cost advantage relative to domestic firms. Nevertheless, if we assume that foreign firms' marginal cost is a fraction γ of domestic firms' marginal cost, then we can show that the critical value of s_F for $W = W'$, as a function of D, is independent of γ (however, the critical value of F depends on γ). This result is not totally surprising, considering
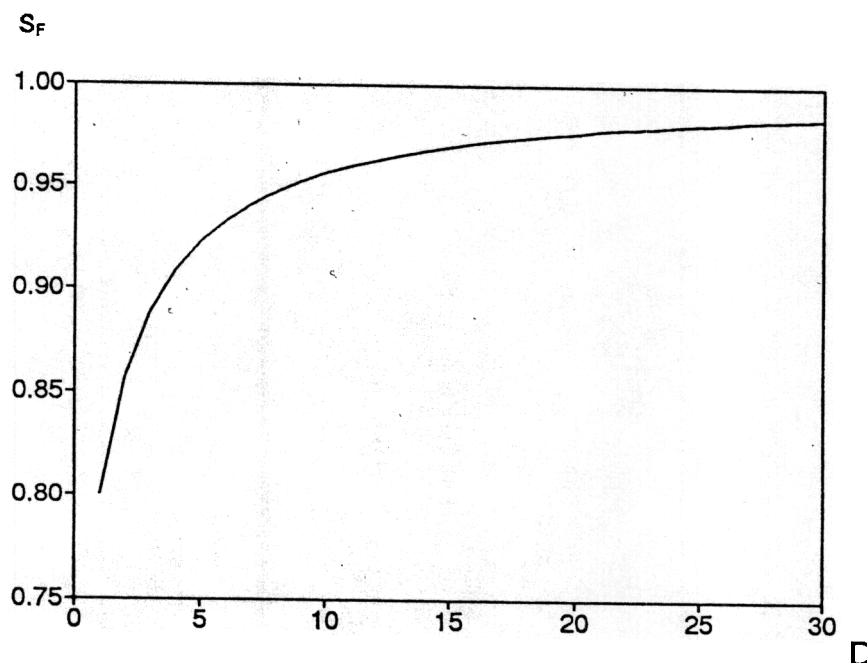
Figure 3: Critical value of foreign firms' market share such that domestic welfare is equal before and after foreign entry, for given values of the number of domestic firms.

the assumptions of linear demand and cost functions.

We should note that, from a practical point of view, equation (14) is of little use, since it depends on values (Q, H) of a hypothetical autarky equilibrium. Just like in the case of the marginal welfare effect, we would like to find a test which is based only on current market data. This is the object of our last result.

Lemma 1 *The following equations allow (14) to be written as a function of current market data:*

(i) $(\frac{Q'}{Q})^2 = (s_F \frac{D}{D+1} + s_D)^{-2}$;

(ii) $s_i = (s_F \frac{D}{D+1} + s_D)^{-1}(s_F \frac{D}{D+1} + s_i')$.

Proof: See Appendix. ∎

4   Entry by Acquisition

So far, we have only considered foreign investment in the form of *de novo* entry into the domestic market. In this section, we examine the conse-

quences of an alternative form of entry, namely entry by acquisition. In order to appreciate the difference between the two kinds of entry, consider the case of a domestic firm which is totally acquired by foreigners. This situation can be interpreted as the process of entry by an additional foreign firm *and* simultaneous exit of an existing domestic firm. By contrast, in the case of *de novo* entry, the latter does not occur.

The first-order effects of acquisition of a domestic firm are that a fraction of domestic profits are transferred to foreigners, and, at the same time, a compensating payment is made to the previous owners of the firm. The second-order effects are that the cost function of the acquired firm is (possibly) shifted, due to changes in management, technology transfer, of some other effect. As a result, the equilibrium solution in the domestic market is (possibly) changed as well. To be more specific, suppose that a fraction α_k of the k-th domestic firm is acquired by foreigners. Putting aside the possibility of information asymmetries, an agreement between buyer and seller signals that ownership is at least as valuable to the buyer as it is to the seller. We interpret this to imply that firm k's total cost is non-increasing in the value of α_k, that is, $\partial C_i / \partial \alpha_i \leq 0$.[2] Furthermore, we make the assumption that firm k's marginal cost is also non-increasing in α_k, that is, $\partial^2 c_i / (\partial q_i \partial \alpha_i) \leq 0$.

First, let us consider the simple case when marginal costs remain unchanged upon entry by acquisition.

Proposition 3 *If $\partial^2 c_i / (\partial q_i \partial \alpha_i) = 0$, then domestic welfare (weakly) improves with foreign entry by acquisition.*

Proof: Since marginal cost remains unchanged, the market equilibrium maintains regardless of the measure of acquisition. Therefore, the only effects to consider are the transfer of profits from the acquired firm and the corresponding price paid to domestic owners. Since information asymmetries are ruled out and agents are assumed to be rational, the price received by domestic owners must be at least as large as the foregone profits. ■

An immediate consequence of proposition 4 is that entry by acquisition may or may not be preferable to *de novo* entry. Suppose that $\partial c_i / \partial \alpha_i = 0$ in addition to $\partial^2 c_i / (\partial q_i \partial \alpha_i) = 0$.

Then, domestic welfare remains constant with entry by acquisition regardless of the value of s_F. However, we have seen that domestic welfare may increase or may decrease with de novo entry, depending on the value of s_F. Even though there is no one-to-one relationship between the welfare

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[2] An alternative possibility, which we will ignore, is that ownership has a strategic value for the buyer which it doesn't for the seller.

effects of *de novo* entry and of entry by acquisition, there is a one-way implication in terms of the marginal welfare effects.

Proposition 4 *If domestic welfare improves with marginal* de novo *entry, then it also improves with marginal entry by acquisition.*

Proof: Since there is now no clear distinction between domestic and foreign firms, we will treat all firms symmetrically and let $\alpha_i (i = 1, \ldots, N)$ represent the fraction of firm i which is owned by foreigners. Entry by acquisition consists of a change in the value of some α_k, with the value of N remaining fixed.

Domestic welfare is given by

$$W = \int_0^Q P(x)dx - PQ + \sum (1 - \alpha_i)(Pq_i - C_i(q_i)) \tag{15}$$

where the summation ranges over all i.

Consider now the impact of a marginal increase in the value of α_k,

$$\frac{dW}{d\alpha_k} = P\frac{\partial Q}{\partial \alpha_k} - \frac{\partial p}{\partial Q}Q\frac{\partial Q}{\partial \alpha_k} - P\frac{\partial Q}{\partial \alpha_k}$$
$$+ \sum (1 - \alpha_i)\left(\frac{\partial P}{\partial Q}q_i\frac{\partial Q}{\partial \alpha_k} + P\frac{\partial q_i}{\partial \alpha_k} - \frac{\partial C_i(q_i)}{\partial q_i}\frac{\partial q_i}{\partial \alpha_k}\right) \quad \frac{\partial C_k(q_k)}{\partial \alpha_k}$$

Notice that the direct derivative with respect to α_k cancels out with the value of the payment to domestic owners for the increase in the share of firm k. By analogy with the proof of proposition 1, this can be shown to be equivalent to

$$\left(\sum (1 - \alpha_i)q_i\eta_i - \sum \alpha_i q_i\right)\frac{\partial p}{\partial Q}\frac{\partial Q}{\partial \alpha k} + \frac{\partial C_k(q_k)}{\partial \alpha_k} < 0 , \tag{16}$$

which is implied by (9), the condition for an improvement from marginal *de novo* entry. ∎

Finally, we consider the global effect of foreign entry when this includes entry by acquisition. Since we do not know the relation between foreign ownership and the firm's cost function (that is, the derivative $\partial C_k(q_k)/\partial \alpha_k$), all we can hope for is to find necessary or sufficient conditions for an increase in welfare. In what follows, we consider the global impact of foreign *de novo* entry as the difference in welfare between the autarky equilibrium and the situation of *de novo* entry only. The global impact of foreign entry refers to the difference between autarky and the situation when all foreign entry (both *de novo* and by acquisition) has occurred.

Proposition 5 *If the global effect of* de novo *entry is positive, then the global effect of foreign entry (including both types of entry) is also positive.*

Proof: Recall that domestic welfare is a quasi-convex function of the degree of *de novo* entry by foreign firms. (See the proof of Corollary 1). Therefore, if the global effect of foreign entry is positive, it must be that the marginal effect is positive as well. By Proposition 5, if the effect of marginal *de novo* foreign entry is positive, so is the effect of marginal entry by acquisition. But since this is valid for any measure of entry by acquisition, it follows that the global impact is positive. ■

5 Application to the Portuguese Life-Insurance Market

The Portuguese insurance industry has experienced profound changes in the recent past. The first major change was a consequence of the April 74 Revolution: in 1975, all domestic insurance firms were nationalized. Firms with participation of foreign capital did not fall into the State's domain; only the capital share belonging to national citizens was nationalized. Moreover, the industry was legally declared closed to private enterprise.

The second major adjustment in market structure occurred in 1980. The engine of change was, once again, the State: it declared the merger of a number of State-owned firms, thus creating six "giant" firms. In the life-insurance market, the number of public firms fell from 18 in 1979 to 7 in 1980.

The third structural change consisted of the industry's liberalization process. It began in 1984 with its opening to private enterprise. In 1986, Portugal became a member of EEC, which also implied adjustments toward freer market conditions. The process of privatization of public firms, which has recently been started, provided an additional means of entry into the market. As a result of these changes, many firms, both domestic and foreign, have entered the market. This is particularly true for the life-insurance market, which has experienced a high rate of growth in recent years.

The presence and importance of foreign capital in the Portuguese life-insurance market has been a subject of debate between domestic firms, the political power and other groups. In fact, the market share of foreign firms has significantly increased in recent years, especially after 1986, as can be seen from Figure 4.

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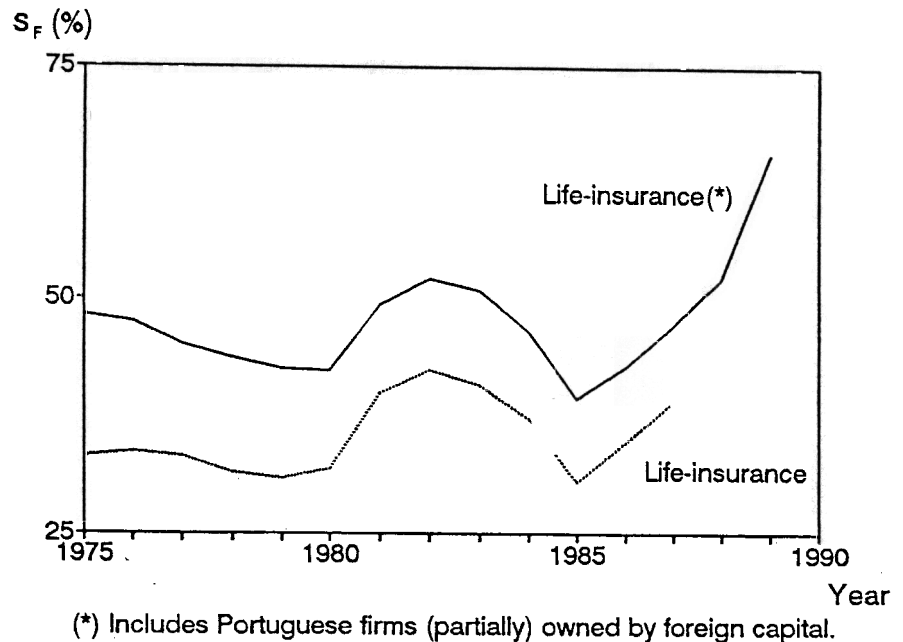(*) Includes Portuguese firms (partially) owned by foreign capital.

Figure 4: Foreign firms' market share (1975–89) of the Portuguese life-insurance market.

Since it is not possible to obtain the exact share of capital owned by foreigners, Figure 4 indicates a lower and an upper-bound for this value. The lower bound corresponds to the share of subsidiaries of foreign firms, whereas the upper bound also includes the share of Portuguese firms which are partially or totally owned by foreigners.[3]

The Portuguese life-insurance market seems to be a good example for application of the results developed in the previous sections. Evaluating the formulae in Propositions 1 and 2 (also using Lemma 1), we can calculate the values required for both the marginal and the total welfare tests. We will assume that demand and cost functions are linear. Since we have no exact and complete information about the shares of foreigners in Portuguese firms, we will consider the alternative concepts "subsidiaries of foreign firms" (i.e., *de novo* entry) and "subsidiaries plus Portuguese firms owned by foreign capital", which together give a lower and an upper bound

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[3] A few comments are in order. First, there is a significant increase in s_F during the early eighties, which can be explained by the wave of mergers between domestic firms. The sharp decline in 1985 is accounted for by the fact that a domestic firm (*Tranquilidade*) has capitalized a large fraction of future premiums in that year. Finally, the widening of the gap between the lower and the upper bound reflects an increased participation of foreigners in the capital of domestic firms.

Q, Q': Market quantity before and after foreign entry.
H, H': Herfindahl index of domestic firms before and after foreign entry.

of the desired value.

The results are presented in Table 1.[4] Comparison of the third and the forth values suggests that there was a global loss due to *de novo* entry by foreign firms. Not much can be said with regard to the global effect of foreign entry, since the sufficient condition of Proposition 5 is not satisfied. As to the effect of marginal entry, the relevant value is somewhere between 38.62% and 65.68%. It is thus possible that it is greater than 50%, which would imply a positive effect of marginal entry (either *de novo* or by acquisition).

To summarize, it is plausible that, as of 1989, the global welfare effect of foreign entry is negative, but the effect of marginal entry, either *de novo* entry or entry by acquisition, is positive.

6   Conclusion

We have developed tests for evaluating the marginal and the global effect of foreign entry on domestic welfare. For the particular case of the Portuguese life-insurance market, the results seem quite negative about the impact of foreign entry. However, one should interpret these results with caution, since they are based on somewhat arbitrary assumptions. First, at a theoretical level, we have assumed Cournot equilibrium as the relevant equilibrium concept. A model with conjectural variations, which may even be different before and after entry, would be more general and would, possibly, yield different results (cf. Spiller and Favaro (1984)). Second, the results for the Portuguese life-insurance market were based on assumptions of linear cost and demand. Third, we should note that we have considered the sum of consumer's and producer's surplus as our definition of domestic welfare. If we believe that consumer's surplus should be given a higher

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[4] The numbers are for 1989, and can be found in "Estatísticas da Actividade Seguradora – Elementos Estatísticos I".

Appendix

Proof of Lemma 1: Solving the first-order conditions for a Cournot equilibrium, we get

$$Q = \frac{1}{b(D+1)}\left(Da - \sum_{j\in D} c_j\right)$$

$$Q_D = \frac{1}{b(N+1)}\left(Da + D\sum_{j\in F} c_j - (F+1)\sum_{j\in D} c_j\right)$$

and

$$Q_F = \frac{1}{b(N+1)}\left(Fa + F\sum_{j\in D} c_j - (D+1)\sum_{j\in F} c_j\right)$$

Using (17), (18), and (19) can be rewritten as

$$Q_D = \frac{D+1}{N+1}Q + \frac{1}{b(N+1)}\left(D\sum_{j\in F} c_j - F\sum_{j\in D} c_j\right)$$

$$Q_F = \frac{F}{D}\frac{D+1}{N+1}Q + \frac{D+1}{b(N+1)}\left(D\sum_{j\in F} c_j - F\sum_{j\in D} c_j\right)$$

This is a system of two equations with two unknowns, Q and $F\sum_{j\in D} c_j$). Solving for Q, we get

$$Q = Q_F\frac{D}{D+1} + Q_D$$

or simply

$$\frac{Q}{Q'} = s_F\frac{D}{D+1} + s_D$$

which gives the first expression in the lemma

for firm i's quantity before and after entry by foreign firms, respectively
Solving these for c_i, we obtain

$$c_i \quad \frac{a + \sum_{j \in D} c_j \quad b(D+1)q_i}{D+1} \quad \frac{a + \sum_{j \in N} c_j \quad b(N+1)q_i'}{N+1}$$

Upon appropriate manipulations, we get

$$Q_F = (D+1)(q_i - q_i') . \tag{(}$$

Solving for q_i and using (23) gives the second expression in the lemma.

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