Country Asymmetries, Endogenous Product Choice and the Speed of Trade Liberalization *

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Abstract

We analyze the effects of trade liberalization on firms' decisions and profits in a vertical product differentiation model with countries which have different characteristics. Firms decide product specifications at the beginning of the game, in which autarky is followed by trade liberalization (whose date is anticipated). Our analysis suggests that a firm located in a large (or rich) country is the likely market leader at the trade equilibrium. This outcome might be reversed if small country firms have a strong cost advantage, transport costs are negligible, or if the large country opens its market before the small one.

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1 Introduction

This paper analyzes oligopolistic competition between firms located in two countries having different sizes. It aims at uncovering the effects of trade liberalization on product choice and profits obtained by the firms, and total welfare of the countries involved.

We assume that firms correctly anticipate the pace of trade liberalization and take it into account when deciding their product specifications at the beginning of the game. For a certain number of periods each country is in autarky. Then trade liberalization occurs, and firms compete in the international market for the rest of the time the game is played. The intertemporal profits of the firms are therefore a function of the speed at which trade liberalization occurs. The longer the delay with which countries decide to open their borders, the larger the impact of the autarky conditions and therefore the more relevant the characteristic of the domestic market. In such a setting, autarky and international trade are special cases of a more general situation. This is a noteworthy feature of our model, since most models of trade do not deal with intermediate situations where firms operate under autarky in some periods and under trade in others. The crucial parameter here is the speed of trade liberalization. Although we treat this parameter as exogenous and analyze the effects of changes in it, our framework might be extended to analyze the case where the speed of trade reform can be an endogenous variable.

To study endogenous product choices, we use a simple version of a well-known partial equilibrium model of vertical product differentiation where the burden of quality improvements falls upon fixed costs (such as R&D or advertising expenditures). In the basic version of the game, where countries differ only in market size (i.e., population or per-capita income), we show that a firm from a large (or rich) country is likely to be the industry leader after trade liberalization. Indeed, the equilibrium where the market leader is a firm from a small (or poor) country either does not exist (when asymmetries are strong), or if it exists it is risk-dominated by the equilibrium where the market leader

comes from the large (or rich) country.[1] In a version of the model with production cost asymmetries, the small country will become the market leader if it has a strong production cost advantage.

To understand the overall effect on the firms' profits, notice that the opening of trade has two effects on the firms. On the one side, there is a competition effect, since firms face new foreign competitors. On the other side, there is a market expansion effect, since with trade liberalization firms can sell in an additional market. In general the market leader, which is more likely to be the firm from the large country, tends to gain more from free trade. However, firms from the small country might still benefit from trade even though they will not be the market leaders, because they can sell in a larger market than the domestic one. This happens when the asymmetry in size between the countries is very pronounced. The opposite might happen to large country's firms, which will lose from trade even though they are market leaders at the trade equilibrium, when size asymmetries are large .

We think that our analysis helps understand better the literature on gains from trade and their distribution between unequal countries. Markusen (1981) shows that trade does not necessarily increase income in both countries, if they differ in size. In his model firms (one in each country) produce homogeneous goods and compete à la Cournot when trade opens. Under constant returns to scale the large country would be an importer of the good and might lose relative to autarky. The small country is therefore the most likely to benefit from trade liberalization. The situation can change under increasing returns to scale, since the large country would have a cost advantage which might result in it being the exporter and the beneficiary of trade. With monopolistic competition, Krugman (1980) shows that workers are better off in the larger country, thanks to the role played by economies of scale. However, trade has a positive impact on both countries' welfare, since consumers benefit from larger number of product varieties.

[1]Cabrales, García-Fontes and Motta (1997) reports the results of an experiment on a game which is similar to the game we use in this paper. We find that the equilibrium where the leader comes from the large country is selected much more often by the experimental subjects than the alternative equilibrium.

In our model, similarly to Krugman (1980), welfare is highest in both countries when trade liberalization occurs immediately. Possible losses by firms are outweighed by consumers' gains, which come under the form of lower prices and higher average qualities. In a sense, however, we find again Markusen's concern that trade brings about unequal gains. Despite the overall increase in welfare for both the large and the small country, our analysis underlines the possible detrimental impact that trade can have on the profitability of the *firms* located in one of the countries. This is an issue which has received less attention in the trade literature, even though we believe it is crucial to understand under which conditions firms have an incentive to support trade processes. [2]

A paper by Anderson, Donsimoni and Gabszewicz (1989) addresses this question in the context of an oligopolistic industry with homogeneous goods. It is found there that at least in one of the two countries firms make higher profits under autarky than under free trade. Unlike Anderson, Donsimoni and Gabszewicz (1989) it is not always the large country firms which lose from trade.[3] In our model, fixed costs of quality improvements imply that the expected size of the market faced by the firms along their lifetime determines the incentive to invest in quality. Unless trade is allowed from the beginning of the game and transport costs are absent, the firm located in the bigger market has an advantage (comparable to the cost advantage enjoyed in a model with increasing returns to scale) which makes it the likely high quality producer when markets open. A firm in the small country can then be relegated to low quality products and lose from trade. [4]

Finally, our results are consistent with earlier work which underscores the role played by domestic demand in determining the success of the firms in the international markets. In the economic literature, this has been first noted by Linder (1961) and then formalized by Krugman (1980) and Dinopoulos (1988). Evidence that size (and sophistication) of the

[2]This scarce attention might depend on the popularity among trade economists of monopolistic competition models. Since in these models profits are usually equal to zero, both under autarky and trade equilibria, the impact of trade on firms' profitability cannot be analyzed.

[3]See also Cordella (1993) and Nguyen and Wigle(1992) for two works where large countries might lose from trade.

[4]This is an aspect which was also showed in a different context by Motta (1992), where firms from the small country might have to exit the market because of the competition by higher quality producers.

home market demand is a possible explanatory factor of competitive advantages is also reported in the business literature (see for instance Porter (1990)). Indeed, our analysis suggests that the firms which produce the higher qualities in the international markets are those which come from the larger countries. [5] A similar result was also found in Motta, Thisse and Cabrales (1995) where, however, firms did not anticipate the occurrence of trade and could only adjust their quality choices after an unforeseen trade liberalization had been announced.

Across all the model specifications studied here an immediate move towards free trade allows both countries to improve their welfare with respect to the autarky situation. However, our analysis also suggests that trade liberalization reforms might receive strong opposition from industrial groups, whenever firms' profitability is lower under trade than under autarky.

The paper is presented in the following way. In the next section, we present the general features of the game. This basic model is then studied within a simple vertical product differentiation framework in section 3. Some extensions are considered in section 4. Section 5 concludes the paper.

2 The basic model

The world economy is composed of two countries. Country A, which we call the large country, has a share $\mu \geq \frac{1}{2}$ of the total population size S of the world. Country B share of the world population is $1 - \mu$. Apart from this size asymmetry, and unless otherwise specified, these two countries are perfectly identical.

For the sake of simplicity, we make the assumption that at the beginning of the game only two firms are considering entry into the industry we want to analyze. One firm is located in country A, and the other in country B. The firms are new in the industry and

[5] Note that this does not imply that these firms benefit from trade liberalization.

they have to decide the specification of the product they want to supply at the beginning of their business life. They then incur the cost of their investment in product specification and cannot change it any longer. Product choice is therefore endogenous and irreversible[6].

Firms are rational agents who are able to anticipate future events correctly. In particular, they know that the two countries have negotiated a trade liberalization agreement. For a number K of years, from time 0 to time $K-1$, the two markets will continue to operate under a regime of autarky. Starting from period K, however, the two markets will be completely integrated and they will remain in a such a situation until the end of the game,[7] which occurs at time T.[8]

Firms have a common discount factor, d (we may think that capital markets are open and therefore interest rates equalize), and the total present value of profits of firm i is:

$$V_i = \sum_{t=0}^{K-1} d^t \Pi_i^M(x_i) + \sum_{t=K}^{T} d^t \Pi_i^D(x_i, x_j) - G_i(x_i) \tag{1}$$

where Π_i^M represents the monopoly profit of firm i (i.e. the per-period profit when trade is not open) and Π_i^D the duopoly profit.[9] The variable which denotes the investment in product specification is x_i. Note that in monopoly the profits of firm i are independent of the product chosen by firm j. G is a function which attributes a cost to the investment made into the variety of the good. We assume that firms share the same technology $G_i = G_j$ and that no other fixed costs are necessary to provide a market.

The expression above can be written as:[10]

[6] In section 5.1 we discuss the case where firms are already established when the game starts.

[7] Introducing a period of progressive adjustment to complete liberalization of trade would complicate the analysis without adding any particular element of interest.

[8] T can be either finite or infinite. By assuming the latter, though, we would have a supergame which gives rise to many possible equilibria. Under finite horizon, we avoid this problem.

[9] Although the notation of equation (1) does not make it explicit, profits depend also on prices and quantities. The choice of notation here emphasizes that the profits at the monopoly stage do not depend on the other country's investment, while in the duopoly stage profits depend on both countries' investments.

[10] This can be done because in equilibrium during all periods of the duopoly stage the profits are constant and the profits are also constant in the autarky stage.

$$V_i = \frac{(1-d^K)}{(1-d)}\Pi_i^M + \frac{(d^K-d^T)}{(1-d)}\Pi_i^D - G \tag{2}$$

or, equivalently:

$$\frac{(1-d)}{(1-d^T)}V_i = \frac{(1-d^K)}{(1-d^T)}\Pi_i^M + \frac{(d^K-d^T)}{(1-d^T)}\Pi_i^D - \frac{(1-d)}{(1-d^T)}G \tag{3}$$

With an appropriate transformation of variables $\phi = \frac{(1-d^K)}{(1-d^T)}$ we obtain:

$$\pi_i = \phi\Pi_i^M + (1-\phi)\Pi_i^D - F, \tag{4}$$

where $F = \frac{(1-d)}{(1-d^T)}G$. Note that ϕ tends to zero as K tends to zero. In this case, trade liberalization is immediate and autarky profits Π_i^M do not play any role in the firm's present value of profits. Product decisions are taken with reference to a trade liberalization scenario only. At the other extreme, when ϕ is equal to one, K tends to T. Firms are in a situation of domestic monopoly throughout their life.

The reader may be worried about the assumption that the firms anticipate perfectly and correctly the timing of the trade liberalization process. This is a rather strong assumption for which we can offer two justifications. The first one is that one may interpret the parameters $(1-\phi)$ and ϕ in the equation above as the subjective probabilities the firms attach to the events that international trade and autarky respectively will be the prevailing ones for the lifetime of the product. Clearly, we would then have to assume that firms have the same information about the likelihood of these events and therefore the probability assigned by each firm to the events is independent of the firms.

Another justification is that the assumption about perfect knowledge of the timing of liberalization can be seen as a polar case. The other benchmark case is the one where firms are surprised by trade liberalization and do not take it into account at the moment when decisions on product choices are made. This case has already been analyzed in

Motta, Thisse and Cabrales(1995) and will be briefly recalled in section 5.1 below.

To have a full characterization of how the speed of liberalization affects the product choices of the firms, we turn now to the specification of the model.

3 Endogenous quality choices: the model.

We use a vertical product differentiation model [11] to analyze more in depth the game whose general features we have briefly outlined above. In this section we assume that there exist no transport costs and that technology, costs and incomes (or tastes) are identical in the two countries. (We relax each of these assumptions in the next section.) Countries differ only by population sizes. We show that this game might have two equilibria in pure strategies. In the first equilibrium, it is the firm located in the bigger country which produces the top quality and is the leader [12]. In the second, it is the firm located in the small country. The former equilibrium always exists, the latter exists provided that the small country does not delay trade liberalization too long. Nevertheless, the equilibrium (if it exists) where the market leader comes from the small country is never selected if the concept of risk dominance (Harsanyi and Selten (1988)) is used.

First, we present the model. Then, we analyze the equilibrium where the market leader comes from the big country. Finally, we turn to the equilibrium where the leader comes from the small country, and we identify the conditions under which it exists. The criterion of risk dominance is then used to select between these two equilibria.

In the two countries consumers have utility function $U = \theta u - p$ if they buy one unit

[11] See Mussa and Rosen (1978), Gabszewicz and Thisse (1979), Shaked and Sutton (1982), and Motta (1993).

[12] In vertical differentiation models with fixed costs of quality, the firm with higher quality has the higher share of the market and enjoys larger profits: this justifies referring to it as the market leader, as we shall do in the remainder. In models where quality costs fall upon variable costs, firms with different qualities earn similar profits. That model would give similar results to one where products were horizontally differentiated. In a model with variable costs of quality it would be less important to study which firm is going to be the market leader, since firms with different quality levels would earn similar profits. See the working paper version of this work for an analysis of trade within such a model.

of the differentiated good and $U = 0$ if they do not buy. The symbols u and p denote quality and price of the good, while θ represents a taste parameter. The distribution of θ in the two countries is the same. We assume it is uniform and that $\theta \in [0, \bar{\theta}]$. The mass of consumers is given by $\bar{\theta} S_i$ in each country i ($i = A, B$), with $S_A \geq S_B$. This amounts to saying that country A has a higher population size than country B.

Firms decide on the quality they want to produce at the initial period $t = 0$. To do so, they incur a fixed cost $F_i = k u_i^2/2$. This function is widely used in this type of models. [13] We then assume that firms play in each period t the Bertrand game, for a $(T+1)$ number of times.[14] We can now specify the expressions of the profits Π_i^M and Π_i^D appearing in equation (4), just by solving the last stage of the game. In the case of monopoly, a firm faces demand $q_i = S_i\bar{\theta} - p_i/u_i$. It is then straightforward that the optimal price choice for the monopolist is $p_i = u_i\bar{\theta}/2$. Correspondingly, the monopolist profit is $\Pi_i^M = u_i S_i \bar{\theta}^2/4$. Note that the higher the population size the higher the marginal profitability of the monopolist, which would then have a larger incentive to invest in quality. In the case of duopoly, that is when firms compete in the international market, demand faced by the top and bottom quality firm respectively would be:

$$q_1 = \bar{\theta} - \frac{p_1 - p_2}{u_1 - u_2}, \qquad q_2 = \frac{p_1 - p_2}{u_1 - u_2} - \frac{p_2}{u_2},$$

where $u_1 > u_2$. At the price equilibrium, profits for the top and bottom quality are:

$$\Pi_1^D = \frac{4u_1^2(u_1 - u_2)S\bar{\theta}^2}{(4u_1 - u_2)^2}, \qquad \Pi_2^D = \frac{u_1 u_2 (u_1 - u_2) S\bar{\theta}^2}{(4u_1 - u_2)^2}.$$

One can check that the prices chosen at the last stage of the game by the firms are completely independent of the hypothesis of integrated vs. segmented markets. [15] Indeed, prices charged in a market depend on the parameter $\bar{\theta}$ which is the same in both countries,

[13] See for instance Motta (1993). One may interpret the parameter k as incorporating the scalar term $\frac{(1-d)}{1-d^T}$ in equation (3).

[14] In the working paper version we show that the qualitative results are unaffected by the assumption of quantity instead of price competition.

[15] Markets are integrated when there can be no price discrimination between them. Markets are segmented when there can be price discrimination.

while they do not depend on the market size parameter. Hence, firms would choose the same price even if they could price discriminate. Contrary to other models where the assumption of integrated rather than segmented market can change the results (see eg. Markusen and Venables (1988)), our model is not sensitive to this assumption.

We are now able to write the intertemporal profit functions of the firms:

$$\pi_{1j} = \frac{\phi S_j u_1 \bar{\theta}^2}{4} + \frac{4(1-\phi)u_1^2(u_1-u_2)S\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_1^2}{2} \tag{5}$$

$$\pi_{2i} = \frac{\phi S_i u_2 \bar{\theta}^2}{4} + \frac{(1-\phi)u_1 u_2(u_1-u_2)S\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_2^2}{2} \tag{6}$$
$$i,j = A,B; i \neq j$$

Recall that in the equation above $S_A = \mu S$ and that $S_B = (1-\mu)S$. Next, it should be noted that we have deliberately not specified whether the high quality firm is located in country A or in country B, and vice versa for the low quality firm. Indeed, there might exist two equilibria in pure strategies. In the first one, it is the firm located in the bigger country which produces the top quality. In the second, the market leader is instead the firm located in the small country.

3.1 The market leader is located in the big country

When we analyze the case where the top quality firm comes from the big country A, the first-order conditions of the problem are:

$$S\bar{\theta}^2 \frac{64u_1^3(1-\phi+\mu\phi) - 48u_1^2u_2(1-\phi+\mu\phi) + u_1u_2^2(32-32\phi+12\mu\phi) - \mu\phi u_2^3}{4(4u_1-u_2)^3} = ku_1 \tag{7}$$

$$S\bar{\theta}^2 \frac{16u_1^3(1+3\phi-4\mu\phi) - u_1^2u_2(28+20\phi-48\mu\phi) + 12\phi u_1u_2^2(1-\mu) - \phi u_2^3(1-\mu)}{4(4u_1-u_2)^3} = ku_2 \tag{8}$$

By dividing the two equations above, rearranging and writing $u_1 = ru_2$ with $r > 1$ we obtain:

$$S\bar{\theta}^2 u_2 \frac{16r^4(4\mu\phi - 3\phi - 1) + r^3(16\mu\phi - 44\phi + 92) - r^2(36\mu\phi - 36\phi + 48) + r(11\mu\phi - 31\phi + 32) + \mu\phi}{4(4r-1)^3} = 0 \qquad (9)$$

We have found the analytical solutions of this equation by using the program *Mathematica*. There is only one real root $r^* = r(\mu, \phi)$ which satisfies the constraint $r > 1$. By substituting r^* into expression (8) and using $u_1 = ru_2$ we find the two qualities (u_1^*, u_2^*). Note that the parameters $S, \bar{\theta}^2, \frac{1}{k}$ enter the expressions in a multiplicative way and therefore do not affect the solutions.

The solutions have been obtained under the hypothesis that country A firm produces the top quality, and country B firm the bottom quality. To make sure that the pair (u_1^*, u_2^*) we have found is really an equilibrium, we also have to check that country B firm does not find it profitable to 'leapfrog' the rival and provide a quality higher than u_1^*. In other words, it must be checked that there exists no quality u_1' such that $\pi_1(u_1', u_2 = u_1^*) \geq \pi_2^*(u_1^*, u_2^*)$. Likewise, it must be checked that the firm from country A does not have an incentive to deviate by supplying a quality which is lower than u_2^*. Indeed, it is possible to prove that these deviations are not profitable, and therefore conclude that the pair (u_1^*, u_2^*) is always an equilibrium.[16]

By replacing the equilibrium qualities one can obtain the expressions for equilibrium profits, consumer surplus, domestic welfare and aggregate welfare.[17] In particular, the expressions for consumer surplus can be obtained by substituting the equilibrium qualities into the following:

$$CS_A = \mu S\bar{\theta}^2 u_1 \frac{16u_1^2 + 20u_1u_2 - 28\phi u_1u_2 + \phi u_2^2}{8(4u_1 - u_2)^2} \qquad (10)$$

[16]Details are available from the authors upon request.

[17]See below for their graphical representation. We omit the analytical solutions because they are extremely long and little can be gained from their inspection.

$$CS_B = (1-\mu)S\bar{\theta}^2 \frac{16u_1^3 - 16\phi u_1^3 + 20u_1^2u_2 - 4\phi u_1^2 u_2 - 8\phi u_1 u_2^2 + \phi u_2^3}{8(4u_1 - u_2)^2} \tag{11}$$

Note that consumer surpluses differ across countries for two reasons. Firstly, because countries have different population sizes (we are computing the aggregate, and not the per-capita surplus). Secondly, because in autarky country A citizens consume the top quality whereas country B citizens have to content themselves with the lower quality. For $\mu = .5$ and $\phi = 0$, the two expressions collapse to the same.

Finally, by using $W_A = \pi_1 + CS_A$, $W_B = \pi_2 + CS_B$, and $W = W_A + W_B$, country and total welfares can be found. Again, total population size, maximum taste and cost parameters play only a multiplicative role in the equilibrium solutions. Therefore, from now on we normalize these values to $S = 1$, $\bar{\theta} = 10$, and $k = 1$. This is without loss of generality, as the same property holds for the equilibrium with the firm from the small country being the leader.

Figure 1 shows equilibrium qualities, profits and welfares as functions of the delay in trade liberalization, represented by the parameter ϕ, which ranges from 0 (free trade from the first period) to 1 (autarky forever). Each curve is drawn for a given value of the parameter μ, which denotes the relative size of the large market. If a change of ϕ is represented by a movement along a given curve, a change in μ shifts the curve. The top panels illustrate the evolution of equilibrium qualities. As for u_1, the results are unambiguous. For any given relative market size, an increase in the speed of liberalization increases the value of the top quality. Indeed, a lower value of ϕ has two effects which have the same sign. Firstly, trade increases the size of the market (market size effect) and thus the marginal profitability of quality investment. Secondly, it also increases the period in which the firm is exposed to competition (competition effect). In turn, this pushes the firm to increase its product quality to differentiate it from the other firm. Both effects raise the incentives to provide a higher quality. For a given trade liberalization profile, an increase in the relative size of country A (a rise in parameter μ) increases the marginal

profitability of quality, and thus the incentive to invest in quality improvement.

The behavior of the bottom quality, apparently less clear cut, can be understood by taking into account that (for given size of the market) the need to differentiate in order to relax price competition pushes the low quality firm to decrease its quality level. The competition effect takes in this case an opposite sign as the market size effect. The opening of trade tends to decrease the quality produced by the former firm. When country B is not too small (eg. when $\mu = .5$ or $\mu = .7$), the market size effect - which in principle would tend to increase qualities by both firms - is less important. Hence, liberalization decreases the quality level of the firm located in the small country. However, when country B is very small (eg. when it is only a tenth of the total population size, $\mu = .9$), the positive effect due to the expansion of the market which follows trade liberalization is stronger than the competition effect, thus increasing u_2 as ϕ decreases.

The interpretation of the equilibrium profit schedules for a given size but different speed in liberalization goes along the same lines. The top quality firm is the one which reaps the benefit from liberalization to a greater extent. However, when country A is very large, the expansion of the market given by trade tends to play a smaller role than the effect of competition. (In the limit, when the size of the small country tends to zero, the firm would have to compete with a rival on a market of the same size as in autarky.) For any given speed of liberalization, an increase in the value of μ increases market demand and therefore the profitability of country A firm, whose profit function shifts upwards. Obviously, profit shifts downwards for the bottom quality firm, since an increase in μ implies a decrease in domestic demand.

Consumers from both countries benefit from an increase in the speed of liberalization (which corresponds to a lower value of ϕ) through an increased competition which tends to increase the availability of varieties, to reduce prices for given qualities and to increase the level of the top quality on the market. The positive effect on consumer utility tends to outweigh the possible negative effect on firm profits. Immediate trade liberalization brings about a higher welfare level than under autarky, and for both countries. However,

partial trade liberalization (that is, trade liberalization after many periods of autarky) might worsen a country's welfare with respect to the situation arising in a completely closed economy. This occurs when two countries are very similar and trade is open for few periods only. In this case the firm which is going to produce the lower quality at equilibrium has lower profits than under monopoly, and trade is not open long enough for consumers' gains to offset the firm's losses (in Figure 1, the welfare schedule W_B for $\mu = .5$ takes a U-shape). One important thing to note is that even though total welfare is maximized by liberalizing trade at the earliest possible date, there is always at least one firm that loses by liberalizing trade early, so we should expect in this context that some firm would oppose liberalization, if no compensating mechanism is implemented.

3.2 The market leader is located in the small country

In the case where the top quality firm is located in country B, the first-order conditions of the problem become:

$$S\bar{\theta}^2 \frac{64u_1^3(1-\mu\phi) - 48u_1^2u_2(1-\mu\phi) + u_1u_2^2(32-20\phi-12\mu\phi) - u_2^3(\phi-\mu\phi)}{4(4u_1-u_2)^3} = ku_1 \tag{12}$$

$$S\bar{\theta}^2 \frac{16u_1^3(1-\phi+4\mu\phi) - u_1^2u_2(28-28\phi+48\mu\phi) + 12\mu\phi u_1u_2^2 - \mu\phi u_2^3}{4(4u_1-u_2)^3} = ku_2 \tag{13}$$

We can then write $u_1 = zu_2$ (with $z \geq 1$) and use the same procedure followed to derive the equilibrium solutions in the previous section. We then find the value $z^* = z(\mu, \phi)$ which satisfies the first-order conditions, and by substitution the candidate solution (u_1^{**}, u_2^{**}). However, it turns out that this is not an equilibrium for all the values of the parameters. Indeed, the firm located in the large country might find it profitable to produce a quality u_1' higher than the quality u_1^{**} the rival would produce at the candidate solution. In other words, $\pi_1'(u_1', u_2 = u_1^{**})$ can be higher than $\pi_2^{**}(u_1^{**}, u_2^{**})$. We have studied the optimal deviation u_1' that country A firm can make, and compared π_1' with π_2^{**}. Unless the two countries have exactly the same size, it is always possible to find

a value of the parameter ϕ large enough for the candidate equilibrium to break down.[18] Indeed, the smaller the size of country B and the more difficult will be for its firm to be the market leader (the lower the value of ϕ which is necessary to sustain this equilibrium). In the case where $\phi = 0$ each firm is selling on the single market from the very beginning, and thus the reduced size of the domestic market does not limit the scope for the investment. However, as the delay in implementing the trade integration process increases (as ϕ rises), each firm produces for longer periods for the domestic market. If the size of the latter is small, the domestic firm cannot support the burden of a very high cost in quality, even if it anticipates that it can be the leader once trade is liberalized. In turn, this makes it easier for the firm located in the large country to 'leapfrog' the rival and produce a quality which is higher.

If the argument is still not clear, consider the following extreme example. Let country B be infinitesimally small ($\mu \to 1$), so that its firm produces under monopoly a quality $u_B^M = \epsilon$. If firms expect trade liberalization to occur only in a very remote period of their business lifes (alternatively, their common discount factor is extremely low), that is $\phi \to 1$, the quality that country B firm might wish to produce cannot be much higher than ϵ, whereas the quality chosen by country A firm would be close to $\frac{S\bar{\theta}^2}{4}$. Obviously, an equilibrium with the firm coming from the small country being the leader cannot be sustained. At the other extreme, when trade is expected to be free at the outset ($\phi \to 0$), the weight of the domestic market is irrelevant, and firms will have the same opportunity to be the market leader. Figure 2 shows the equilibrium outcomes in the plane (ϕ, μ). Note that the equilibrium where the leader comes from the large country (denoted by $E1$) always exists, whereas the equilibrium where the leader comes from the small country (denoted by $E2$) exists only if trade is liberalized soon enough or if the two countries are not too differing in sizes, for the reasons we have given above.

For the values of the parameters such that the equilibrium $E2$ exists, one can then use the values of quality, u_1 and u_2, which solve equations (12) and (13) to derive all the

[18] See the working paper version of this paper for more details.

other equilibrium values.[19] Figure 3 illustrates the equilibrium solutions (the dotted line indicates parameter values for which the equilibrium with the small country firm being the leader does not exist). As in the previous case, the results can be understood by thinking in terms of the competition and the market size effects. A complete discussion is probably superfluous. It may be worth emphasizing that when the firm from the large country is to be the bottom quality firm, then its profits are certainly going to shrink as the speed of liberalization increases. Since it comes from the large country and it produces the low quality at the open markets equilibrium, the competition effect is always dominant (the additional market when trade opens is relatively unimportant with respect to the effect played by the opening of competition). The opposite is true for the small country firm, which benefits both from the expansion of the market and from being the leader.

Even in this case, welfare attains its maximum level in both countries when trade liberalization occurs from the outset ($\phi = 0$). However, similarly to the previous equilibrium case, there might be a welfare loss in the case of partial liberalization. In particular, this occurs for a large country whose firm is relegated to the production of a low quality (see the schedule W_A when $\mu = .5$), and when trade is liberalized only at a late period (ϕ is close to 1). Here again, consumers do not enjoy free trade of goods for a long enough period to outweigh the firm's losses with respect to autarky.

By comparing the values under the two different equilibrium configurations (Figures 1 and 3), it can be checked that the domestic welfare in each country is higher when the national firm is the market leader, which suggests that a government would have an incentive to commit to help the domestic firm to gain such a position. Further, it can be noticed that total welfare is higher when the market leader is located in the large country. This is quite intuitive a result, since it is more efficient to have an equilibrium where the top quality firm spreads its investment costs over a larger domestic market.

[19]Recall that some changes are needed. For instance, $W_A = \pi_2 + CS_A$ and $W_B = \pi_1 + CS_B$ in the case the leader is country B firm.

3.3 Risk Dominance

It has been shown in Figure 2 that the game has two strict Nash equilibria, for a region of the parameters ϕ and μ. Standard refinements like perfectness, properness, or strategic stability do not select among strict Nash equilibria. Also, in this game there are no symmetric equilibria and no equilibrium Pareto dominates the other (taking in to account only the welfare of the players, the firms; and not the consumers). There is a solution concept that selects between equilibria in our game, though. This is the criterion of risk-dominance introduced by Harsanyi and Selten (1988). Since the concept of risk dominance is defined only for games with finitely many pure strategies we have to discretize the strategy space. We will show the results obtained when the discretization is very coarse, keeping only the equilibrium strategies for the two players. The advantage of discretizing this way is that the intuition for the concept of risk dominance is stronger for the two strategy case, and its relevance is better supported theoretically and empirically (research for the case with many strategies is not as well established). It is also much simpler and faster to compute the risk dominant equilibrium in the two strategy case. The restriction does not condition the results, anyway. We have done numerical analysis (available upon request), using the "tracing procedure" of Harsanyi and Selten (1988), that shows that the risk dominant equilibrium is the same even for a much finer discretization.

Risk dominance selects equilibria by comparing the "riskiness" of equilibrium points. This criterion compares the product of equilibrium misforecasts and the equilibrium with the largest product is the one that risk dominates. Let a 2×2 game with the following payoff matrix.

	B_1	B_2
A_1	a_{11}, b_{11}	a_{12}, b_{12}
A_2	a_{21}, b_{21}	a_{22}, b_{22}

where the payoffs are such that $E_1 = (A_1, B_1)$ and $E_2 = (A_2, B_2)$ are strict Nash equilibria, and let $LA_1 = a_{11} - a_{21}$. LA_1 is the gain made by player A by predicting rightly that

the other player will play E_1 (and best responding to the prediction) instead of predicting wrongly that the other player will play E_2 (and best responding to the prediction). Similarly, let $LB_1 = b_{11} - b_{12}.LA_2 = a_{22} - a_{12}.LB_2 = b_{22} - b_{21}$. We say that equilibrium E_1 risk dominates equilibrium E_2 when $LA_1LB_1 > LA_2LB_2$.

Besides the intuition and the axiomatization provided by Harsanyi and Selten , there are more reasons why risk dominance could be considered a good equilibrium selection criterion (see Kandori, Mailath and Rob(1993) and Carlsson and Van Damme(1993)). Perhaps the most appealing argument for risk dominance is that in the experiments perfomed by Cabrales, García-Fontes and Motta (1997), Guyer and Rapoport (1972) and Van Huyck, Battalio and Beil(1990) the risk dominant equilibrium is the one selected by actual players.

Let E_1 be the equilibrium where the big country firm is the leader and E_2 be the equilibrium where the small country firm is the leader. Recall that A is the big country and B is the small country.

In our case $a_{11} = \pi_{1A}(u_1^*, u_2^*)$, $a_{21} = \pi_{1A}(u_1^{**}, u_2^*)$, $a_{12} = \pi_{1A}(u_1^*, u_2^{**})$, $a_{22} = \pi_{2A}(u_2^{**}, u_1^{**})$, $b_{11} = \pi_{2B}(u_1^*, u_2^*)$, $b_{21} = \pi_{2B}(u_1^{**}, u_2^*)$, $b_{12} = \pi_{2B}(u_1^*, u_2^{**})$ and $b_{22} = \pi_{1B}(u_2^{**}, u_1^{**})$.

In our case, LA_1 is what player A gains by forecasting rightly that the other player will play the equilibrium where A itself is the leader, instead of forecasting wrongly that the other equilibrium holds. LA_2 represents the gains for player A of forecasting rightly that the other player will play the equilibrium where B is the leader. The interpretation of LB_1 and LB_2 is analogous.

Figure 4 shows that we have $LA_1LB_1 \geq LA_2LB_2$, and the equality only holds when $\phi = 0$, that is, when liberalization occurs at the earliest possible date. Thus, for the game we are studying the risk dominance criterion selects the equilibrium where the leader is the large country firm, except in the limiting case where the two countries liberalize the markets immediately (when $\phi = 0$).

Equilibrium selection can be interpreted in strong way and in a weaker way. The strong interpretation is that we will never (or rarely) observe players choosing the strategies that lead to an equilibrium that is not selected. The weaker interpretation is that the likelihood of observing players using the strategies that lead to each equilibrium is related to the difference $LA_1LB_1 - LA_2LB_2$. The larger this difference, the likelier it is that we will observe players using the E_1 strategies. We feel that the weaker hypothesis is more reasonable, not only because it is more difficult to reject, but also because most of the reasons in favor of risk dominance involve uncertainty or bounded rationality (see Harsanyi and Selten (1988) p.89), and in these circumstances it would be hard to expect the strong hypothesis to be satisfied. In our game, this interpretation would amount to saying that the more asymmetric the two country sizes, the less likely to observe the E_2 equilibrium, namely the equilibrium with the leader coming from the small country.

3.4 Conclusions

In this section we have analyzed how market size and the speed of trade liberalization affect the equilibrium outcome of a game where firms take product quality decisions by correctly anticipating the occurrence of trade. The analysis suggests that the firm coming from the large country would be the likely market leader. Indeed, when country sizes differ substantially, it would be impossible for the small country firm to be the leader. Further, we have seen that the equilibrium with the large country firm being the leader is always selected by the risk dominance criterion. Although the risk dominance concept as an equilibrium selection criterion is open to discussion (especially because the selection power of this criterion is probably higher when asymmetries are not too weak), this result does support the idea that the leader under trade would tend to be the large country firm.

4 Transport costs, and other extensions

In this section, we relax some of the assumptions we have made so far. Armed with the analysis carried out for the benchmark model, it will be easy to deal with some extensions. First, we analyze the case of positive transport costs. Second, we study what happens when countries differ in their citizens' propensity to pay (that is, in their tastes) for quality, instead of population sizes. Third, we relax the assumption that firms have identical production costs and identical technologies for the improvement of product qualities.

4.1 Transport costs

We have so far assumed zero exporting costs. This is clearly a useful assumption, albeit a strong one when dealing with international trade. We now introduce positive transport costs, modeled as "iceberg costs". This formalization implies a proportional reduction of the quantity that can be sold abroad with respect to the quantity produced. For example, if a firm ships to the foreign market a number q of units of the good, only q/g (with $g \geq 1$) units arrive at destination in the foreign market. This amounts to saying that foreign sales give the exporting firm a unit revenue of p/g which is lower than the price p paid by foreign consumers. Monopoly profits for the firms are obviously unchanged, while duopoly profits for the top and the bottom quality firms with positive transport costs are (for $i, j = A, B; i \neq j; g \geq 1$):[20]

$$\pi_{1j}^D = p_1(\bar{\theta} - \frac{p_1 - p_2}{u_1 - u_2})(S_j + \frac{S_i}{g}); \qquad \pi_{2i}^D = p_2(\frac{p_1 - p_2}{u_1 - u_2} - \frac{p_2}{u_2})(S_i + \frac{S_j}{g})$$

We can now solve the price stage of the game and write the intertemporal profit

[20]Note that even when transport costs are positive equilibrium prices do not depend on the assumption of segmented v. integrated markets. This is because transport costs affect only market sizes, which in turn do not affect first-order conditions at the price stage of the game.

functions as:

$$\pi_{1j} = \frac{\phi S_j u_1 \bar{\theta}^2}{4} + \frac{4(1-\phi)u_1^2(u_1-u_2)(S_j + \frac{S_i}{g})\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_1^2}{2} \tag{14}$$

$$\pi_{2i} = \frac{\phi S_i u_2 \bar{\theta}^2}{4} + \frac{(1-\phi)u_1 u_2(u_1-u_2)(S_i + \frac{S_j}{g})\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_2^2}{2} \tag{15}$$

$$i, j = A, B; i \neq j; g \geq 1$$

By comparing the expressions above with expressions (5) and (6), one can see that transport costs reduce the relative profitability of the small country firm. Duopoly profits are now multiplied by $(S_A + \frac{S_B}{g})$ for the firm located in the large country A, and by $(S_B + \frac{S_A}{g})$ for country B firm, while both were multiplied by $(S_A + S_B)$ in expressions (5) and (6) with no transport costs. Given that $S_A \geq S_B$ and $g \geq 1$, it follows that $(S_A + \frac{S_B}{g}) \geq (S_B + \frac{S_A}{g})$. Ceteris paribus, transport costs give an advantage to the large country firm, which enjoy a larger captive market. By reducing profitability of the small country firm, this limits its incentive to invest in quality. Hence, it will be more difficult for this firm to be the leader at equilibrium. Figure 5 shows this effect: When transport costs rise ($g = 2$ in the figure) the area where the small country firm can be the leader at equilibrium (E2) is reduced with respect to the case of no transport costs ($g = 1$).

Note also that while in the benchmark case (zero transport costs) the equilibrium with the firm from the small country being the leader always existed if trade liberalisation was immediate ($\phi = 0$), this is no longer true in the case of transport costs. Actually, liberalising trade at the first period is not enough to guarantee that the two firms are playing on a level ground: the large country firm enjoys the advantage of a larger domestic market even if trade occurred from the first period. For large enough transport costs and large enough country differences the equilibrium E2 does not exist even if trade occurs at the very beginning of the game.

4.2 Different preferences for quality, or incomes

We have analyzed so far the case where consumers in two countries have identical average propensity to pay (or taste) for quality ($\bar{\theta}_A = \bar{\theta}_B = \bar{\theta}$), with countries differing only in their population size. Since in vertical product differentiation models a relationship can be established between taste for quality and income (see Tirole(1988,p.86)), we may interpret the case treated so far as one where countries have similar per-capita income but different population size. If trade occurs between countries of similar population size but different per-capita incomes (or different propensities to pay for quality), that is $\bar{\theta}_A \geq \bar{\theta}_B$ and $S_A = S_B$, it is straightforward to see from the profit expressions that we would have similar results to those obtained above. Market A still gives rise to larger demand for the good under monopoly and this gives its firm a better position in the international market. Two equilibria still arise but the one where the leader comes from the small country ceases to exist when the difference between the two countries is above a certain threshold (that is, when $\bar{\theta}_A$ is much larger than $\bar{\theta}_B$) and is always risk-dominated by the other equilibrium. This explains why in the paper we refer to country A indifferently as the rich or the large country.

When $S_A \geq S_B$ but $\bar{\theta}_A \leq \bar{\theta}_B$ two forces of opposite sign are at work. The former enlarges the relative size of market A, whereas the latter reduces it. In particular, country A will have the larger domestic market if $S_A\bar{\theta}_A^2 \geq S_B\bar{\theta}_B^2$. If this condition holds, we can still speak of country A's firm as the one located in the large country, and all the results and discussions above would still hold.

4.3 Asymmetries in Costs

We analyze first the case of asymmetry in the unit costs of production, and then the case of asymmetry in the costs of developing the quality of the goods.

Let us start with the case of asymmetry in production costs. If the large country has also a production cost advantage (for instance, because of cheaper labor), this strengthens

the effect of the larger domestic market for country A's firm. Since both asymmetries increase its profitability and incentive to invest in quality, its chances to be the market leader at equilibrium are higher. The case where the small country firm has a production cost advantage is less trivial. The market scale effect helps the large country firm, whereas the production cost effect favors the small country firm. It is the relative magnitude of these two effects which determine the equilibrium solutions of the game. As we show below, if the cost advantage is high enough, there is a unique equilibrium where the small country firm is the leader.

We will now assume that the production of a given good requires some units of that same good, with the same level of quality u_i, as an input in the production process (think of farmers using seeds or computer manufacturers using computers). This is the only additional cost we introduce to the costs assumed in previous sections. The more inefficient is the firm (the higher its production costs), the fewer the units of the good which are obtained as a final output from any given number of initial units of the good.

Let us write gross profits of firm i as $\Pi_i = p_i e_i q_i$, where e_i is the efficiency parameter in the production process, or an inverse measure of production costs (with $1 \geq e_i \geq 0$) and where p_i and q_i are as usual the price and output of firm i. The parameter e_i acts simply as a rescaling factor on both duopoly and monopoly profits and we can write the intertemporal profit functions of the firms in the presence of production costs as:

$$\pi_{1j} = \frac{\phi e_j S_j u_1 \bar{\theta}^2}{4} + \frac{4(1-\phi)u_1^2(u_1-u_2)e_j S\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_1^2}{2} \tag{16}$$

$$\pi_{2i} = \frac{\phi e_i S_i u_2 \bar{\theta}^2}{4} + \frac{(1-\phi)u_1 u_2(u_1-u_2)e_i S\bar{\theta}^2}{(4u_1-u_2)^2} - \frac{ku_2^2}{2} \tag{17}$$

$$i,j = A,B; i \neq j$$

Without loss of generality we fix $e_B = 1 \geq e_A$. The effect of higher unit costs in

country A is to increase the range of parameter values for which the equilibrium with the small country firm being the leader exists and to decrease the range for which the equilibrium with the large country firm is the leader exists. We can have three possible situations. If size asymmetries are large and cost asymmetries are small, we find only the equilibrium of type E_1 (leader in the large country); for low enough size and cost asymmetries both equilibria exist; finally, for low enough size asymmetries and large enough cost asymmetries, only the type E_2 equilibrium (leader in the small country) exist.[21]

Figure 6 represents this effect in the same space (ϕ, μ) as the previous graphs. The lower efficiency of country A ($e_A = .7$) implies that the area where only the equilibrium with the large country firm being the leader (E1) exists shrinks relative to the case of identical production costs. There also exists a region where this equilibrium disappears altogether. [22]

As for the costs of developing the quality of their goods, we have so far assumed that firms have identical abilities in research and development or advertising activities. This amounts to assuming that the parameter k in the quality improvement function is identical for both firms ($k_A = k_B = k$). If differences in R&D or advertising technologies were in favor of country A, these would reinforce the country size advantage, and the results would just be strengthened. The interesting case is therefore the one where the firm from the small country B is more efficient in introducing innovations and improving quality, so that $k_A \geq k_B$. To simplify the analysis and focus on quality cost asymmetries, we assume that unit production costs are the same in both countries. It turns out that this case is very similar to the one just discussed where firms have identical quality costs but

[21] We have not applied the risk dominance criterion to try and select one of the two equilibria in the region where both exist. This is because in the presence of one additional (cost) parameter the problem becomes even more cumbersome.

[22] This occurs when ϕ is close to 1 and countries are not so different (μ close to .5). To understand why this happens, consider the extreme case where $\phi = 1 - \epsilon$ and $\mu = .5$. In this case, trade opens only at the very last period of the game and equilibrium qualities under liberalization cannot differ much from autarky ones. But since under autarky we have $u_A = (e_A/4)(S/2)\bar{\theta}^2 < u_B = (1/4)(S/2)\bar{\theta}^2$, the former cannot be the top quality at the trade equilibrium. By a continuity argument, one can then explain why in a region where ϕ is close to 1 and μ is close to .5 the E1 equilibrium does not exist.

different production costs. The reason is that the parameter k_i enters multiplicatively the cost expression in the intertemporal profit function, while e_i enters multiplicatively the gross profit term in the same function (recall that $\pi_i = e_i\Pi_i^M(u_i) + e_i\Pi_i^D(u_i, u_j) - k_iG(u_i)$). As a result, a higher k_i affects equilibrium solutions in qualitatively the same way as a lower e_i, all other things being equal. Hence, the discussion made for the case of different unit costs still holds for the case of different quality costs. If the firm coming from the small country has an advantage in quality development costs, this might outweigh its market size disadvantage. The stronger its cost advantage, the earlier trade liberalization and the less unequal country sizes, and the more likely that country B's firm will be the leader at the equilibrium (and in turn the less likely that there exists the equilibrium with country A's firm being the leader).

5 Discussion, and conclusions

In this section we first discuss the role played by some of the assumptions we have used. Then, we make some concluding comments.

5.1 Trade liberalisation with adjustments of quality

Throughout the paper we have assumed that at the moment the game starts firms have never invested nor produced. How does our analysis change if prior to the game the firms have already selected a product quality? Consider the following scenario. At period $t = 0$ each firm j is producing a quality level $\bar{u}_j$, with $j = A, B$. This initial quality level is exogenously given and may depend on various historical accidents, past levels of R&D activities, advertising expenditures and so on. The game is then played as described before (K periods of autarky and $T - K$ of trade) with the difference that firms can update their quality levels at a time t by incurring some adjustment costs. To have a specification as close as possible to the one adopted above, assume a quadratic cost function of quality improvement: $(u_j - \bar{u}_j)^2/2$. The model can then be analyzed in the same fashion as we

have done in the previous sections.

Motta, Thisse and Cabrales (1995) studied the case where initial qualities coincide with the quality a firm would adopt if it were operating in autarky and did not know trade would open at some date in the future (firms can update qualities when unexpected trade integration occurs). As in the present paper, they find that two equilibria might arise, that the equilibrium with the leader being in the small country exists only if country asymmetries are not large, and it is always risk dominated. The similarity with the results obtained here is reassuring and suggests that more sophisticated models which combine the features of the two settings would not give very different results.[23]

5.2 Number of firms, free entry, and welfare

The assumption that there are only two firms in the industry simplifies our analysis considerably. It could be rationalized if there exist important set-up costs which prevent a larger number of firms from operating in the industry. Allowing for a larger number of firms would increase the indeterminacy of the equilibrium outcomes. For instance, if two firms come from country A and one from country B, then we would have equilibria where country B firm might produce the top, medium or bottom quality. The analysis of the existence of the equilibria and the application of the risk dominance criterion would be considerably more complex, but it is unlikely that this would add much to the analysis.

We have also assumed in our basic duopoly case that there exists a firm in each country. This assumption might not be innocuous and the welfare conclusions obtained in the standard case above might be affected. In particular, the trade impact on the welfare of the large country might be negative if most or all the firms operating under free trade were located in the small country. As an illustration, consider the case where

[23] An example of such richer models could be one where firms play a "first-autarky-then-trade" game but could decide on two distinct qualities for each configuration: a quality for the domestic market and another quality for the international market, when it opens. If the latter can be developed improving upon the initial quality (by paying an adjustment cost), then this model would combine the two settings just discussed in a unique but more complex framework.

there exist no transportation costs and where at most two firms can operate at the free trade equilibrium, whereas only one firm can operate under autarky. If $\phi = 1$, that is under autarky, it is easy to check that the welfare of the large country is given by $\mu^2 S^2 \theta^4/16$. If $\phi = 0$, that is if both countries open immediately to free trade, there exists the possibility that both firms operating at the trade equilibrium come from the small country. If this is the case, then the large country would lose all its profits, and its welfare would coincide with the consumer surplus of its citizens, which is given by $.0432\mu S^2\theta^4$. One can then check that trade leads to a welfare loss in the large country if $\mu > .69$. In other words, if a country is much larger than the other and none of the firms operate in it under (immediate) free trade, then the loss of autarky profit outweighs the consumer's gains.[24] This example looks truly like a knife-edge case. It would be enough to assume that transportation costs are different from zero, for instance, to give an advantage to the firms located in the large country, and reestablish a relationship between the size of the market and the nationality of the firms operating at the trade equilibrium. Nevertheless, it is possible that the study of models with many firms yields further surprises. We leave this subject for future research.

Although our analysis suggests a welfare improving role for free trade, the reader should be aware that gains from trade do not necessarily arise in any vertical product differentiation models. In the papers by Shaked and Sutton (1984) and Motta (1992) a country's welfare might decrease following a trade liberalization process. This different outcome deserves an explanation. In those models, the possible adverse effect of trade mainly depends on the fact that the so-called "finiteness property" holds there. As market size increases, a larger number of firms cannot coexist in the industry. Hence, when trade opens (that is, as the size of the market rises), some of the firms formerly operating in autarky have to exit the industry. Since some firms disappear at the trade equilibrium, free trade can have a dramatic impact as the loss in firms' revenues can outweigh consumers gains. In our model instead, the finiteness property does not hold and trade liberalization

[24]See Motta (1992) for a similar result.

has a less dramatic impact on firms profits, and hence on countries' welfare.

5.3 Different dates of market opening

Although optimistic as for the welfare effects on each country as a whole, our model also illustrates the danger that trade liberalisation might represent for a firm coming from poorer, smaller or less technologically advanced countries. The analysis shows that such a firm is likely to be relegated to production of a lower quality at equilibrium: the equilibrium where it is the leader might not exist if asymmetries are large enough; or, if it existed, it would be risk-dominated. It is still possible that such a firm might gain from trade liberalisation, in some circumstances. For instance, this happens when a country is much smaller than the other, firms are otherwise symmetric, and transport costs are not important. Overall, though, our analysis tends to underline the risks that a firm coming from a poorer or a smaller country (other things being equal) might run. It would therefore be natural to wonder what instruments might compensate existing asymmetries. A possible answer might reside in different opening periods for the different markets. For instance, consider what happens if market A is open to imports from country B at a period K_A, while (the smaller) market B was open to trade at a later period $K_B > K_A$. Following a similar procedure as the one used in section 2, we can then derive the two firms' profits as:

$$\pi_A = \phi_A \Pi_A^M + (1 - \phi_A)\Pi_A^D - F, \tag{18}$$

$$\pi_B = \phi_A \Pi_B^M + (\phi_B - \phi_A)\Pi_B^M + (1 - \phi_A)\Pi_B^D - F, \tag{19}$$

where ϕ_A and ϕ_B are a measure of the delay with which trade is liberalised in each country.

It is straightforward to see that the longer ϕ_B with respect to ϕ_A the stronger the possibility for the small country firm to become the leader, since its marginal profitability

of an investment in quality rises. Even though a full policy analysis is beyond our intentions, it should be noted that a delayed opening date for the small country might not be recommendable in general. First, we know that firms located in very small country gain from trade even if they are relegated to production of lower quality goods (see Figure 1) because of the importance of the market expansion effect. Therefore, there would be no reason to grant them a longer period of protection on their domestic market. Second, by looking at the impact of trade liberalization from a broader perspective than the one allowed by our formalization, we should consider the possibility of adverse effects of longer protection of a country's firms. For instance, today's protection might lead to tomorrow's demands for further delay in liberalization of the market. Third, it is not clear why the large country government, or its firms, should accept different opening dates for the two economies. This calls for the study of a bargaining game played by the two countries over the dates of liberalization of each economy. But this sort of issues would be better analyzed by a fully fledged political economy model than in the simple model we have proposed here.

5.4 Conclusions

Our model underlines that domestic market size plays an important role in determining the success of firms in the international markets. Indeed, both the analysis of the existence of equilibrium outcomes and the use of risk dominance as the criterion for equilibrium selection suggest that a firm coming from a large (or rich) country is the likelier market leader under free trade, unless it suffers from strong cost disadvantages (and transport costs are negligible).

Our analysis indicates that even if a country as a whole gains from trade, there is always a firm which loses from trade. This firm can be located either in the large or in the small country, depending mainly on the magnitude of factors such as relative sizes of the country, differences in costs and the delay with which the process of trade liberalization is carried out. We consider the analysis carried out here as a step towards

a better identification of the forces which hurt (or benefit) firms under processes of trade liberalization. We feel this is a necessary step to understand the conditions under which firms oppose (or favor) such processes.

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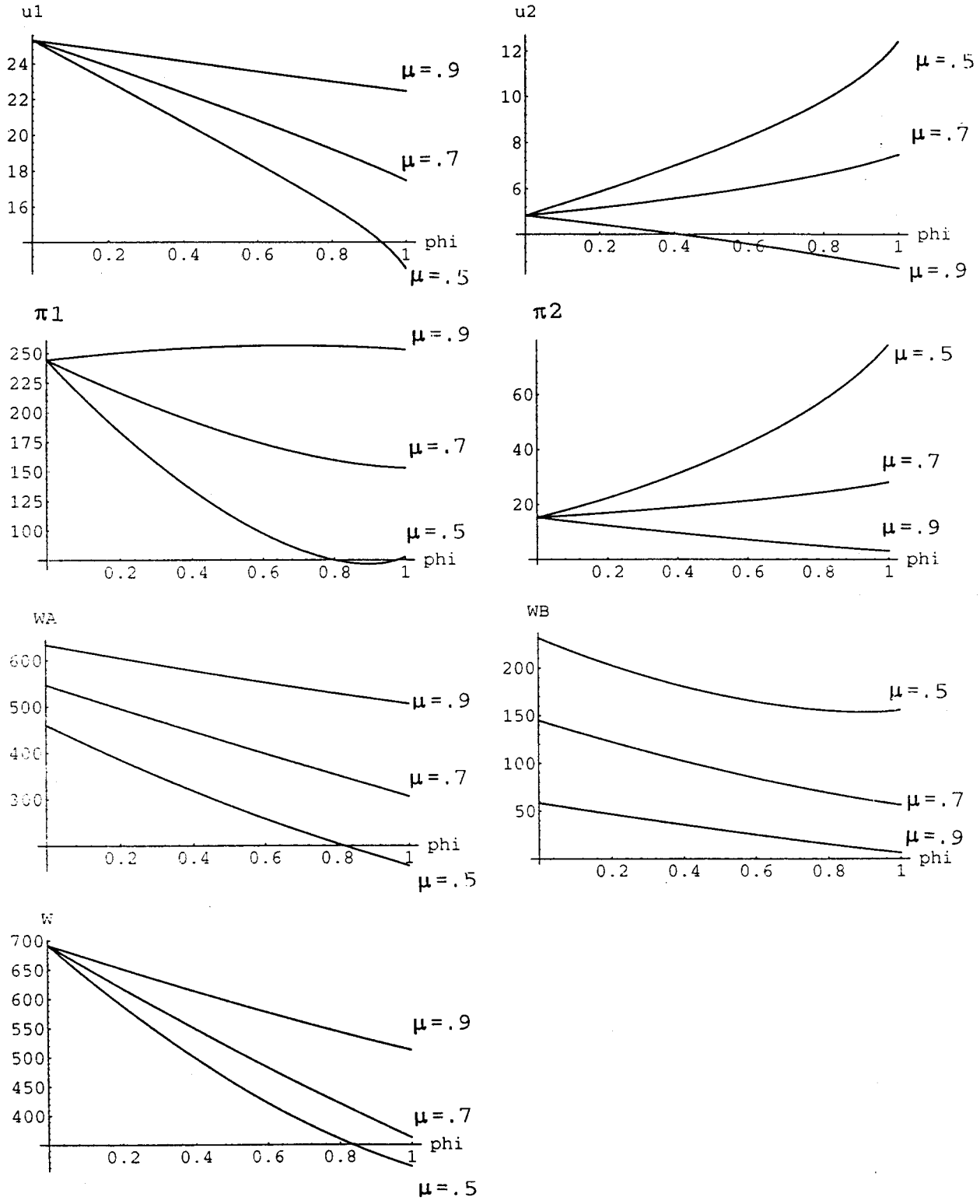

Figure 1. Market leader in the large country. Equilibrium qualities, profits, and welfares.

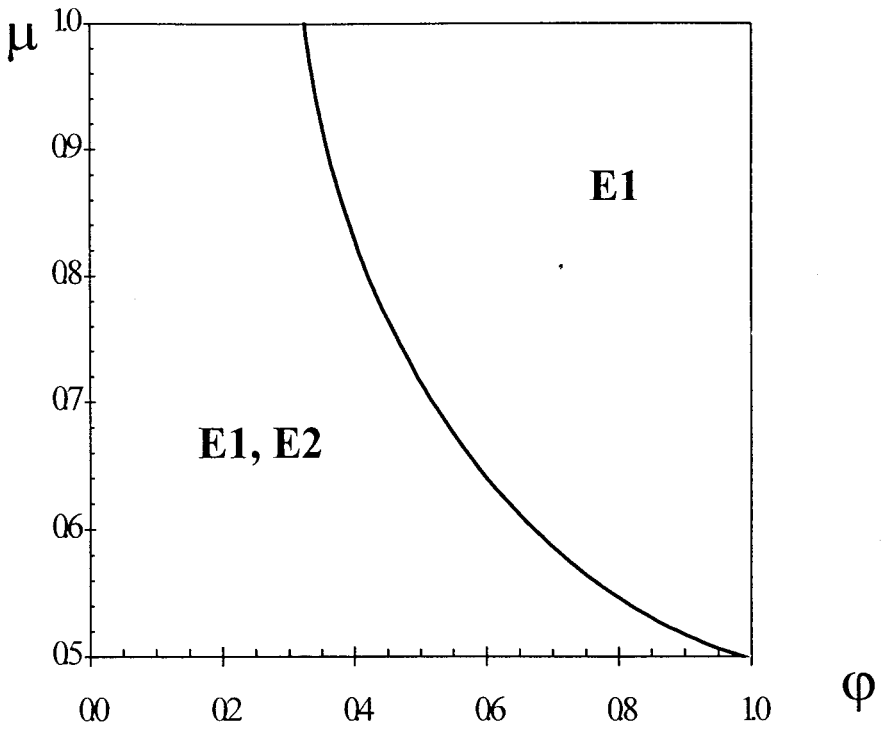

Figure 2 - Existence of equilibria
(E1: leader from large country; E2: from small)

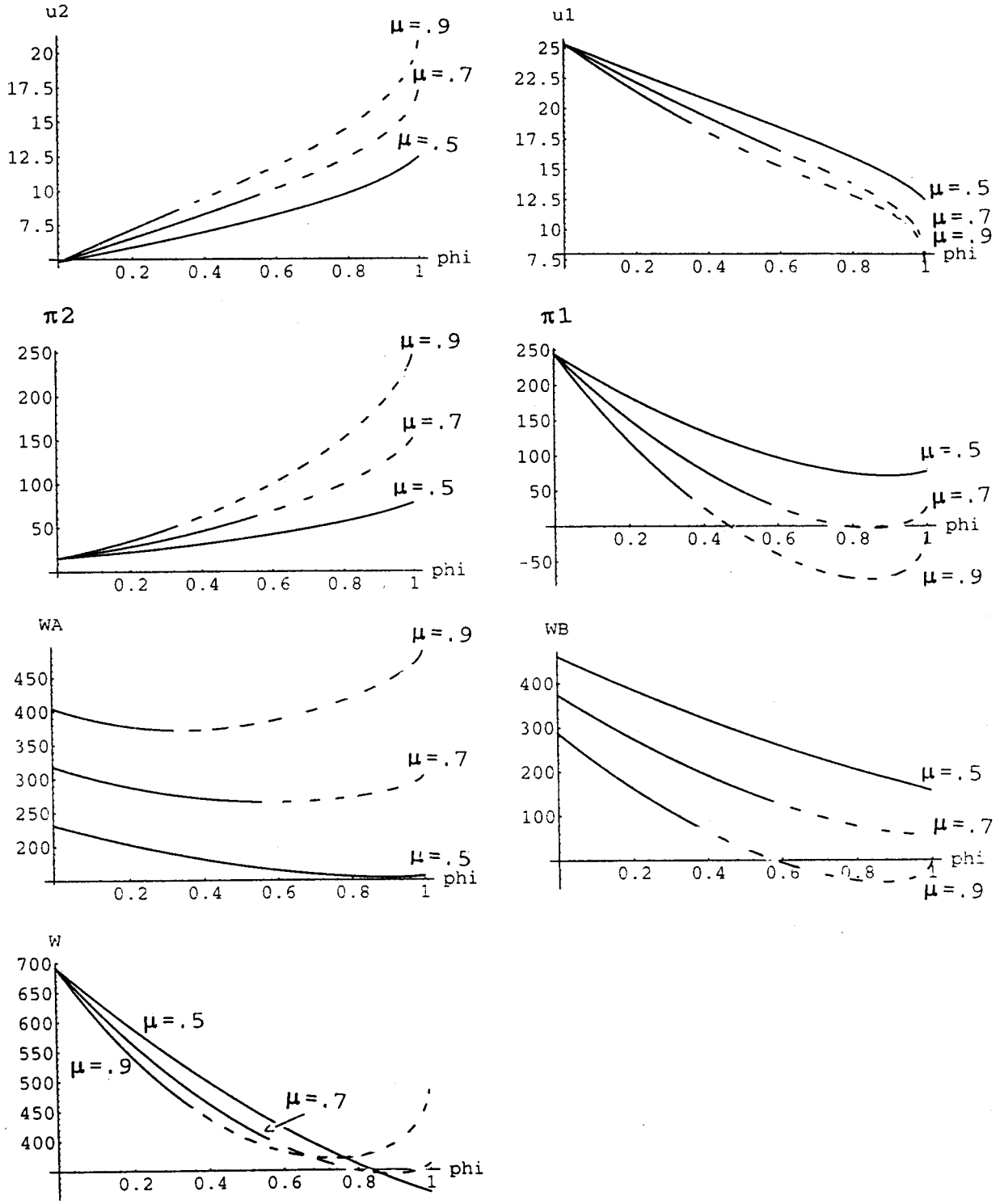

Figure 3. Market leader in the small country. Equilibrium qualities, profits, and welfares.

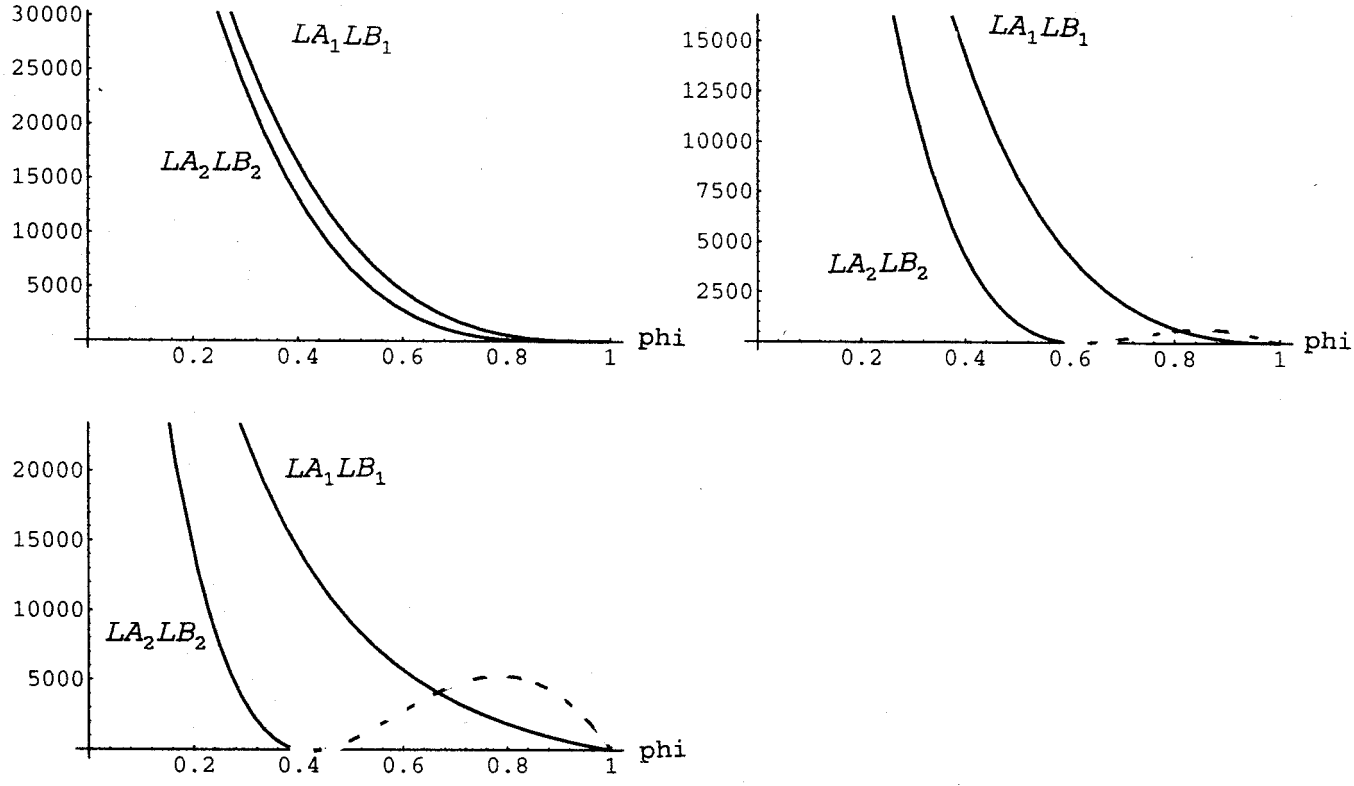

Figure 4. Risk dominance analysis (μ=.55, .7, .9).

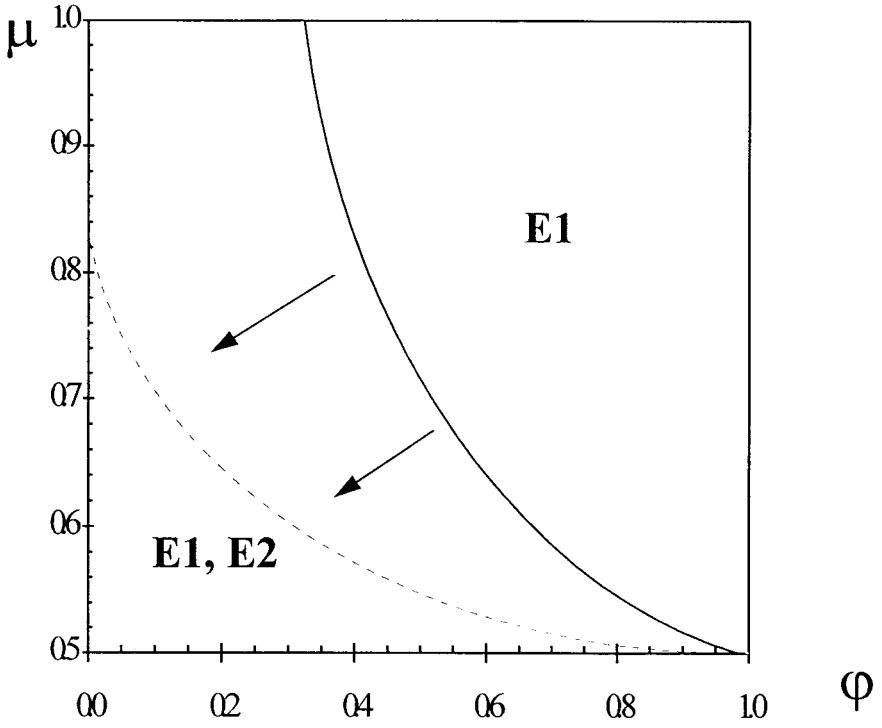

Figure 5 - Existence of equilibria, under transport costs (solid line: g=2; dashed line: g=1)

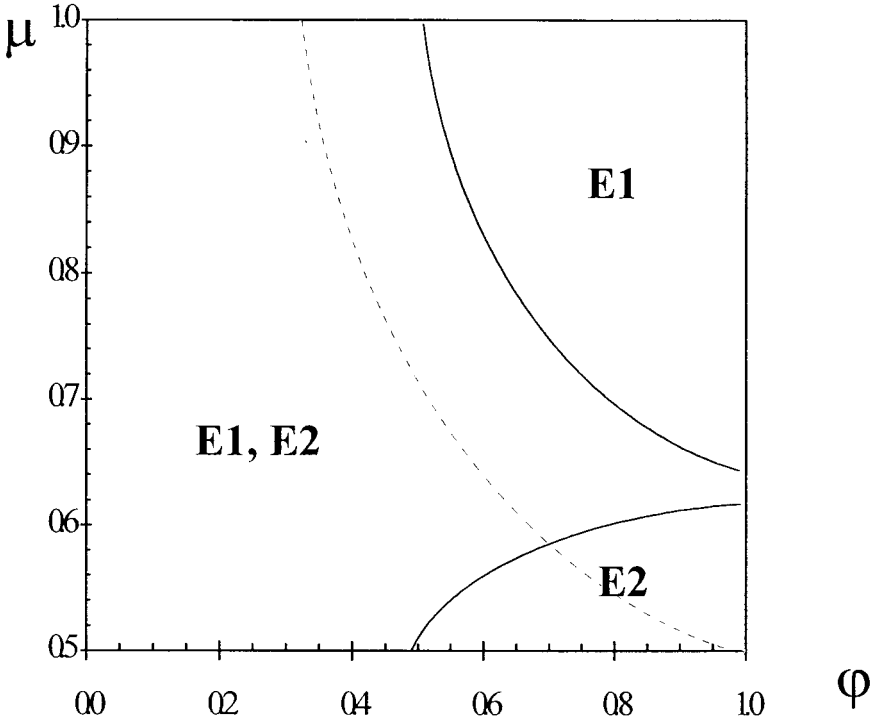

Figure 6 - Existence of equilibria, under productive cost advantage of country B (e_A=.7; e_B=1)