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**“Globalization” and Relocation in a Vertically Differentiated Industry**

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**Abstract**

This paper uses a vertical differentiation duopoly framework to analyze firms' relocation decisions, when the removal of trade barriers or restrictions on capital outflows or inflows (“globalization”) allows them to serve the domestic market through foreign plants in low-wage countries. The relocation of the entire industry yields net welfare costs, but the relocation of one (and only one) firm, may be welfare improving. When the economy is “high- (or low-) quality biased,” the relocation of the firm producing the high- (or low-) quality variant is preferred, on welfare terms, to that of other firms, if the wage differential is large enough.

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## SUMMARY

This paper uses a vertical differentiation duopoly framework to analyze firms' relocation decisions when the removal either of trade barriers or of restrictions on capital outflows or inflows ("globalization") allows them to serve the domestic market through foreign plants employing cheaper foreign labor.

The paper addresses two issues. First, it tries to explain which firms, within a specific industry, have the stronger incentives in relocating their production facilities in low-wage countries. It shows that such incentives are higher for the firm producing the variety that would have a larger market share if the two goods were sold at their marginal cost.

Second, it assesses the welfare consequences of the decision of domestic firms to serve the domestic market through foreign plants. More precisely, it compares domestic welfare under autarchy and under globalization. The recognition of the consequences of relocation on unemployment allows to explicitly take into account the associated variations in workers' surplus, when performing the welfare analysis. In this second-best world, when the complete liberalization of trade and capital flows leads to the relocation of the whole industry, autarchy is strictly better, on domestic welfare terms, than globalization. However, when relocation is a dominant strategy for one (and only one) firm, globalization may unambiguously be welfare improving. Finally, and somehow against the common wisdom, the paper shows that the welfare cost of relocation is lower, the lower is the level of the foreign wage.

## I. INTRODUCTION

The recent negotiations of free trade agreements among heterogeneous countries, such as the NAFTA, as well as the debate over the pros and cons of the enlargement of the European Union eastward (and eventually southward), inflamed the controversy between the partisan of protectionism and the supporters of free trade. Most of the political discussion on this issue is centered on the effects of “globalization” (whatever this term exactly means) on the labor market. In the US, labor organizations opposed the NAFTA on the basis that it would have caused a fall in wages, and fostered inequality and poverty;<sup>1</sup> in Europe, the mass of jobless blames “globalization” as the main cause of their misfortune. The opposition to free trade on the basis of its negative impact on workers’ welfare is not new. The way in which Hicks describes the reaction to free trade in the years of the Great Depression has indeed a flavor of actuality: “The main thing which caused so much liberal opinion in England to loose its faith in free trade was the helplessness of the older liberalism in the face of massive unemployment, and the possibility of using import restriction as an element in an active program fighting unemployment”.<sup>2</sup>

A canny journalist might be tempted to replace “older liberalism” by “newer liberalism”, and publish it as an account of the present situation. However, there is something new, nowadays, in the debate about the “costs” of free trade. This is the idea (i) that a more integrated world provides incentives to multinational firms to relocate their production plants in low-wage countries and (ii) that the mobility of multinational firms creates the conditions for “social dumping” to emerge, i.e., countries may find it profitable to engage in a “race to the bottom” to attract foreign direct investments<sup>3</sup>. In presence of high unemployment, these phenomena, together with the flow of low-skilled emigrants from poor countries, are perceived as the major shortcomings of “globalization”, at least in the developed world.

International trade literature has, at least since Stolper and Samuelson, recognized that workers in capital abundant countries might suffer from free trade, and that in absence of redistributive measures, they would lobby for protectionism. However, while the neoclassical paradigm offers clear insights on the welfare consequences of free trade, it is less helpful in understanding the consequences of the relocation of production plants. In fact, in a perfect competitive economy with constant return to scale technologies, firms’ location does not really matter, and multinational firms have no reason to exist: factor mobility yields the same outcome as free trade. This implies that to study the consequences of “globalization” we have to abandon the Heckscher-Ohlin framework, and consider a model where, because of market

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<sup>1</sup> See for instance “Fast Track Trade negotiating Authority”, AFL-CIO Council, February 19, 1997. Available on the Internet at <http://www.alfcio.org>

<sup>2</sup> Hicks (1959) p.48, quoted in Bhagwati (1994)

<sup>3</sup> See, on this issue Barros and Cabral (1993).

imperfections, location does matter. In particular, we want to assess which firms, within an industry, have the stronger incentives to relocate their production plants, and to measure the welfare effects of relocation in presence of rigidities in the labor market.

To answer these questions one has to consider firms with different characteristics. The asymmetry in the industry can be due to different technological conditions in the production of homogeneous goods, but we believe that a more meaningful and still simple framework describing heterogeneous firms is the vertically differentiated industry model (Gabszewicz and Thisse (1979)).

In this paper, we adopt the vertical differentiation duopoly framework to give a full description of firms' relocation decisions when the removal either of trade barriers or of restrictions on capital outflows/inflows allows them to serve the domestic market through foreign plants. We refer this situation as "globalization," meaning with this term a situation in which both final commodities and production factors are free to move. We identify the advantages associated with production abroad with the possibility of exploiting the wage differential that, because of domestic labor market rigidities, we take as given. Moreover, we assume that firms have to incur a positive fixed cost in order to relocate. Depending on the fixed costs of relocation, and the wage differential, we show that under "globalization" four possible location patterns emerge at equilibrium: Both firms relocate, none of the firms relocates, either only the high-quality firm or only the low-quality firm relocates. Moreover, we show that the location equilibrium is not uniquely determined, and that the last two location patterns may coexist for some range of the parameters.

In order to assess the welfare implications of the relocation of production plants, we compare domestic welfare under autarchy, and under "globalization." The recognition of the consequences of relocation on unemployment leads us to explicitly take into account the associated variations in workers' surpluses, when performing the welfare analysis. In this second best world, we prove that when the complete liberalization of trade and capital flows yields the relocation of the whole industry, autarchy is strictly better, on domestic welfare terms, than "globalization." It is only when relocation is a dominant strategy for one (and only one) of the firms, that "globalization" may unambiguously be welfare improving. Furthermore, we show that the effects of the relocation of the high or of the low-quality firm are different. In particular, defining an economy as "high-quality biased" (resp. "low-quality biased") if under marginal cost pricing and identical labor costs the demand for the high-quality (resp. low-quality) product is larger than the demand for the other variant, we show that the relocation of the firm producing the high-quality variant (resp. the low-quality variant) is preferred, in welfare terms, to the relocation of the other firm, if the wage differential is high enough.

In Section 2, we present the model and we solve for the subgame perfect equilibria of a two stage game in which firms choose whether to relocate or not their production facilities, and then compete in prices. Section 3 is devoted to the welfare analysis of “globalization”, and finally Section 4 concludes.

## II. THE MODEL

We consider an industry where two domestic firms ( $i = 1, 2$ ) produce a vertically differentiated good which is sold in the domestic market only. Under autarchy, the firms have domestic production plants, and hire domestic workers at the current domestic wage  $w$ , which we treat as given. In presence of unemployment,  $w$  can be thought of as a binding minimal legal wage. Starting from this situation, we allow firms to serve the domestic market through foreign plants. We will refer to this situation as “globalization”. Such relocations can be the result of a free trade agreement which reduces trade barriers, as well as the result of new technological opportunities that drastically reduce transportation costs, or else be the consequence of the removal of capital outflow/inflow restrictions. When firms relocate, they incur a relocation cost  $F$ , and they employ foreign labor at the current foreign wage  $w^*$ . The situation we have in mind is one where the domestic wage is higher than the foreign wage so that the difference in labor costs ( $\Delta w \equiv w - w^*$ ) may induce a firm to relocate. This happens when the reduction in labor costs due to the relocation more than offsets the fixed relocation cost. In order to simplify the analysis, we assume that a firm that relocates can re-import the final product at no cost.

The unit variable cost of firm  $i$ ,  $UC_i$ , can be decomposed in a constant marginal technological cost (quality specific)  $\alpha_i$  and a labor cost  $w_i$ . Thus,

$$UC_i = \alpha_i + w_i, \quad \text{where } w_i = \begin{cases} w^*, & \text{if firm } i \text{ relocates;} \\ w, & \text{otherwise.} \end{cases}$$

Without loss of generality, we define  $\Delta Q \equiv Q_1 - Q_2 > 0$ , where  $Q_i$  stands for the quality level of firm  $i$ , and we work under the (very natural) assumption that marginal technological costs are higher for the high-quality product, i.e.,  $\Delta \alpha \equiv \alpha_1 - \alpha_2 > 0$ . The demand side is described by a population of heterogeneous consumers whose marginal willingness to pay for quality,  $\theta$ , is uniformly distributed over the interval  $[\mu - \beta, \mu + \beta]$ . Each consumer buys a single unit of one of the variants at the exclusion of the other, and we work under the assumption that  $Q_2$  is high enough to ensure that at the price equilibrium the market is covered. Consumer of type  $\theta$  is characterized by the utility function  $U_\theta = \theta Q - p$ , where  $p$  stands for the price charged for one unit of a good of quality  $Q$  (see, e.g., Mussa and Rosen (1978)).

In the remaining of the section, we characterize the equilibrium outcome by studying the subgame perfect equilibria of a two stage game, where firms first decide whether to relocate or not, and then compete in prices.

### A. Price Game

As usual, we solve by backward induction, starting from the last stage of the game. We now solve for the price game, under the assumptions:<sup>4</sup>

$$\begin{aligned} \text{A.1)} \quad & \frac{\Delta w}{\Delta Q} < 3\beta; \\ \text{A.2)} \quad & \frac{\Delta \alpha}{\Delta Q} \in [\mu - 3\beta + \frac{\Delta w}{\Delta Q}; \mu + 3\beta - \frac{\Delta w}{\Delta Q}]. \end{aligned}$$

Four cases have to be distinguished according to the geographic market structures determined in the first stage: both firms relocate (R,R), none of the firms relocates (NR,NR), firm 1 (resp. firm 2) relocates and firm 2 (resp. firm 1) does not (R,NR) (resp.(R,NR)). The equilibrium demands  $D_i$ , prices  $p_i$  and variable profits  $\Pi_i$  are given by:

$$\begin{aligned} D_1 &= \frac{1}{2\beta} \left( \frac{\mu + 3\beta}{3} - \frac{\Delta \alpha}{3\Delta Q} - \frac{w_1 - w_2}{3\Delta Q} \right); \\ D_2 &= \frac{1}{2\beta} \left( -\frac{\mu - 3\beta}{3} + \frac{\Delta \alpha}{3\Delta Q} + \frac{w_1 - w_2}{3\Delta Q} \right); \\ p_1 &= \frac{\Delta Q(\mu + 3\beta)}{3} + \frac{2\alpha_1 + \alpha_2}{3} + \frac{2w_1 + w_2}{3} \\ p_2 &= \frac{-\Delta Q(\mu - 3\beta)}{3} + \frac{\alpha_1 + 2\alpha_2}{3} + \frac{w_1 + 2w_2}{3} \\ \Pi_1 &= \frac{\Delta Q}{2\beta} \left( \frac{\mu + 3\beta}{3} - \frac{\Delta \alpha}{3\Delta Q} - \frac{w_1 - w_2}{3\Delta Q} \right)^2; \\ \Pi_2 &= \frac{\Delta Q}{2\beta} \left( -\frac{\mu - 3\beta}{3} + \frac{\Delta \alpha}{3\Delta Q} + \frac{w_1 - w_2}{3\Delta Q} \right)^2. \end{aligned}$$

<sup>4</sup> Which ensure that both firms are active at the price equilibria whatever the geographical configuration.

where

$$w_1 = \begin{cases} w, & \text{in (NR,NR) and (NR,R);} \\ w^*, & \text{otherwise;} \end{cases} \quad w_2 = \begin{cases} w, & \text{in (NR,NR) and (R,NR);} \\ w^*, & \text{otherwise.} \end{cases}$$

### B. The Relocation Game

We are now able to solve for the first stage of the game. Remark that in our framework profits and equilibrium demands depend upon cost differential rather than their absolute values. This implies that the value for these variables, in the situation in which both firms relocate, is the same as in the situation in which none does.

Tedious computations allow us to define the conditions under which each geographical market structure is an equilibrium (see Figures 1-4):

-(NR,NR) is an equilibrium if, and only if,

$$\text{i) } F > \Pi_1(R, NR) - \Pi_1(NR, NR) \equiv A \text{ for } \frac{\Delta\alpha}{\Delta Q} < \mu,$$

$$\text{ii) } F > \Pi_2(NR, R) - \Pi_2(NR, NR) \equiv B \text{ for } \frac{\Delta\alpha}{\Delta Q} > \mu;$$

-(R,R) is an equilibrium if, and only if,

$$\text{i) } F < \Pi_2(R, R) - \Pi_2(R, NR) \equiv D \text{ for } \frac{\Delta\alpha}{\Delta Q} < \mu,$$

$$\text{ii) } F < \Pi_1(R, R) - \Pi_1(NR, R) \equiv C \text{ for } \frac{\Delta\alpha}{\Delta Q} > \mu;$$

-(NR,R) is an equilibrium if, and only if,  $F \in [C, B]$ ;

-(R,NR) is an equilibrium if, and only if,  $F \in [D, A]$ ;

where

$$\begin{aligned}
 A &= \frac{\Delta w}{6\beta} \left( \frac{2(\mu + 3\beta)}{3} - \frac{2\Delta\alpha}{3\Delta Q} + \frac{\Delta w}{3\Delta Q} \right); \\
 B &= \frac{\Delta w}{6\beta} \left( -\frac{2(\mu - 3\beta)}{3} + \frac{2\Delta\alpha}{3\Delta Q} + \frac{\Delta w}{3\Delta Q} \right); \\
 C &= \frac{\Delta w}{6\beta} \left( \frac{2(\mu + 3\beta)}{3} - \frac{2\Delta\alpha}{3\Delta Q} - \frac{\Delta w}{3\Delta Q} \right); \\
 D &= \frac{\Delta w}{6\beta} \left( -\frac{2(\mu - 3\beta)}{3} + \frac{2\Delta\alpha}{3\Delta Q} - \frac{\Delta w}{3\Delta Q} \right);
 \end{aligned}$$

and  $\Pi_i(\cdot, \cdot)$  refers to the profits of firm  $i$  under the configuration within brackets. The same notation applies for all other variables, from now on. In order to better understand the relocation patterns, first notice that the positioning of the ratio  $\frac{\Delta\alpha}{\Delta Q}$ , which can be read as the *incremental cost per unit of quality*, with respect to the willingness to pay interval, is crucial in determining firms' relocation choice. In order to better understand the reason why, a brief digression is here needed.

The concept of vertical differentiation we have used here relies solely on the preference side: If the two variants were offered at the same price, all consumers would be unanimous on the ranking of the variants. Nevertheless, as it has been noticed by Anderson *et al.* [1992], the cost side needs to be properly accounted for. When this is done, differentiation is said to be vertical when all consumers have the same ranking of the variants under marginal cost pricing (and horizontal otherwise). In our economy, when the definition is revised in this way, differentiation is no longer vertical when the incremental cost per unit of quality belongs to the marginal willingness to pay interval.<sup>5</sup> We define an economy as being *low-quality biased* (resp. *high-quality biased*) if under autarchy the demand for the low-quality (resp. high-quality) is larger than the demand for the other variant, when the two variants are priced at their marginal costs. In our specification, it turns out that the economy is low-quality biased if, and only if, the technological cost difference per unit of quality is larger than the mean willingness to pay, i.e., when  $\frac{\Delta\alpha}{\Delta Q} > \mu$ . Furthermore, it can be easily proved that the demand split under marginal cost pricing solves the maximization of gross consumer surplus net of total production costs. Moreover, when both firms face the same labor cost (as in autarchy) the demand split induced by marginal cost pricing maximizes gross consumer surplus net of technological costs. Finally, gross consumer surplus net of technological costs (under marginal cost pricing) is maximum for identical labor costs for both firms ( $w_1 = w_2$ ). Accordingly, we define the *optimal demand split* as the one resulting from marginal cost pricing under autarchy, i.e.,  $D_1 = \min\{1, \frac{1}{2\beta}(\mu + \beta - \frac{\Delta\alpha}{\Delta Q})\}$ .

<sup>5</sup> This when both firms face the same labor costs.

When the economy is high-quality biased, the gains from relocation are higher for the high-quality firm. In fact, by having a larger market share, when it relocates, it benefits more from the lower labor costs, and thus it is better able to compensate for the fixed relocation cost  $F$ . Accordingly, one should expect relocation to be a dominant strategy for the high-quality firm for a larger range of parameters than the one insuring the same result for the low-quality firm. A similar argument can be made for the low-quality biased economy.

When  $\frac{\Delta\alpha}{\Delta Q} < \mu$ , i.e., when the economy is high-quality biased, relocation is a dominant strategy for firm 1 if  $F < C$ , while it is a dominant strategy for firm 2 when  $F < D$ , with  $\frac{\Delta\alpha}{\Delta Q} > \mu \Leftrightarrow C > D$ . As a result, for  $F < D$ , the only subgame perfect equilibrium is such that both firms relocate. Moreover, relocation is a dominated strategy for firm 2 when  $F > B$ , while if firm 2 does not relocate, it is optimal for the high-quality firm to relocate as long as  $F < A$ . Figures 1 and 2 illustrate the location equilibria for a high-quality biased economy, while Figures 3 and 4 for a low-quality biased economy.

If the economy is low-quality biased, relocation is a dominant strategy for firm 2, if  $F < D$ , while it is a dominant strategy for firm 1 when  $F < C$ . Accordingly, for  $F < C$  the only subgame perfect equilibrium is such that both firms relocate. Moreover, relocation is a dominated strategy for firm 1 when  $F > A$ , while if firm 1 does not relocate, it is optimal for the low-quality firm to relocate as long as  $F < B$ . It is worth to notice that the existence of the configuration (NR,R) requires that the interval  $[C, B]$  be non empty, i.e.,  $\frac{\Delta\alpha}{\Delta Q} > \mu - \frac{\Delta w}{2\Delta Q}$ , which is the case in Figure 2, but not in Figure 1. This conditions is clearly never binding when  $\frac{\Delta\alpha}{\Delta Q} > \mu$ , as in Figures 3 and 4. Summarizing, below  $C$  relocation is a dominant strategy for firm 1, while above  $B$  no relocation is a dominant strategy for firm 2. Remark further that for (NR,R) to be an equilibrium, relocation cannot be a dominant strategy for firm 1 and no relocation cannot be a dominant strategy for firm 2. This means that (NR,R) can be an equilibrium only in the region of parameters simultaneously above  $C$  and below  $B$ . Clearly, this region is empty whenever  $C$  is entirely above  $B$ , and it can be proved that this is the case<sup>6</sup> when  $\frac{\Delta\alpha}{\Delta Q} < \mu - \beta$ , see Figure 1. Notice that when  $\frac{\Delta\alpha}{\Delta Q} \notin [\mu - \beta, \mu + \beta]$ , the industry is *strictly vertically differentiated*, i.e., it is vertically differentiated in the sense of Anderson *et al.*

Similarly, the existence of the configuration (R,NR) requires that  $\frac{\Delta\alpha}{\Delta Q} < \mu + \frac{\Delta w}{2\Delta Q}$ , which is the case in Figure 4, but not in Figure 3. This condition is clearly never binding

<sup>6</sup> Notice that if values of the incremental cost per unit of quality lower than the lowest marginal willingness to pay ( $\mu - \beta$ ) are compatible with assumption A.2, then (NR,R) can never be sustained as an equilibrium, if  $\frac{\Delta\alpha}{\Delta Q}$  is lower than this lowest marginal willingness to pay. In fact, Hypothesis A.2 requires that  $\frac{\Delta\alpha}{\Delta Q} > \mu - 3\beta + \frac{\Delta w}{2\Delta Q}$ , thus,  $\frac{\Delta\alpha}{\Delta Q} < \mu - \beta$  is compatible with A.2 if, and only if,  $\frac{\Delta w}{\Delta Q} < 2\beta$ , but this in turn implies that  $\frac{\Delta\alpha}{\Delta Q} < \mu - \frac{\Delta w}{2\Delta Q}$  which violates the necessary condition for (NR,R) to be an equilibrium.

when  $\frac{\Delta\alpha}{\Delta Q} < \mu$ , see Figures 1 and 2. While, if values of  $\frac{\Delta\alpha}{\Delta Q}$  higher than the highest marginal willingness to pay ( $\mu + \beta$ ) are compatible with assumption A.2, then (R,NR) can never be sustained as an equilibrium if  $\frac{\Delta\alpha}{\Delta Q}$  is higher than this highest willingness to pay, see Figure 3. The same kind of reasoning as for the case  $\frac{\Delta\alpha}{\Delta Q} < \mu - \beta$  applies here.

In other words, if the incremental cost per unit of quality is high enough with respect to the marginal willingness to pay (in particular when it is higher than the highest willingness to pay), a situation in which only the high-quality firm (firm 1) relocates cannot be sustained as an equilibrium of this game. This is so, because such an incremental cost is important enough to keep firm 1 from gaining excessively large profits when relocating. In such a situation, the gain from relocation is greater for the low-quality firm. This, in turn, implies that no situation exists in which for the low-quality firm it is not profitable to relocate, if this policy is profitable for the high-quality firm. A similar argument implies that, for values of  $\frac{\Delta\alpha}{\Delta Q}$  low enough, the gain from relocation is greater for the low-quality firm. This explains why, in such a situation, it is not profitable for the high-quality firm to relocate if this policy is profitable for the low-quality firm.

### III. WELFARE ANALYSIS

We define the domestic welfare ( $DW$ ) as the sum of consumers' surplus ( $CS$ ), producers' surplus ( $PS$ ) and workers' surplus ( $WS$ ). Given that most of the discussion concerning relocation is mainly driven by an unemployment concern, we identify domestic workers' surplus with the wage bill.<sup>7</sup>

Consumers', producers' and workers' domestic surpluses as well as domestic welfare can be written as:

$$CS = \frac{1}{2\beta} \int_{\mu-\beta}^{\frac{p_1-p_2}{\Delta Q}} (Q_2 - \theta - p_2) d\theta + \frac{1}{2\beta} \int_{\frac{p_1-p_2}{\Delta Q}}^{\mu+\beta} (Q_1 - \theta - p_1) d\theta;$$

$$PS = D_1(p_1 - \alpha_1 - w(1 - \mathbb{I}_{1=R}) - w^* \mathbb{I}_{1=R}) + \\ + D_2(p_2 - \alpha_2 - w(1 - \mathbb{I}_{2=R}) - w^* \mathbb{I}_{2=R}) - F(\mathbb{I}_{1=R} + \mathbb{I}_{2=R});$$

<sup>7</sup> An alternative way of understanding this measure of workers surplus is to rely on two assumptions: absence of wealth effects and no disutility of work. Under this assumptions, domestic surplus is the maximum of total utility ( $\int_0^\infty (Q\theta + x)f(\theta)d\theta$ , where  $x$  denotes the numeraire good) under the constraint that total numeraire consumption be bounded above by total domestic profits plus the domestic wage bill minus total expenditure on the differentiated goods. This leads directly to a measure of domestic surplus consisting of consumers surplus derived from the consumption of the differentiated goods plus producers surplus (profits) plus workers surplus (the wage bill). This approach parallels that of Brander and Spencer (1987) who work with the two assumptions mentioned above.

$$WS = w(D_1(1 - \mathbb{I}_{1=R}) + D_2(1 - \mathbb{I}_{2=R}));$$

$$DW = \frac{Q_1}{4\beta}(\mu + \beta)^2 - \frac{Q_2}{4\beta}(\mu - \beta)^2 - \frac{(p_1 - p_2)^2}{4\beta\Delta Q} - \alpha_1 D_1 - \alpha_2 D_2 + \\ -w^*(D_1 \mathbb{I}_{1=R} + D_2 \mathbb{I}_{2=R}) - F(\mathbb{I}_{1=R} + \mathbb{I}_{2=R});$$

where

$$\mathbb{I}_{i=R} = \begin{cases} 1, & \text{if firm } i \text{ relocates;} \\ 0, & \text{otherwise.} \end{cases}$$

In the preceding section, we have shown that different geographical configurations can be sustained as subgame perfect equilibria of the game under “globalization.” We are now led to evaluate how the removal of trade barriers, or capital outflows/inflows restrictions, affects total domestic surplus, and the surpluses of the three different agents: producers, workers and consumers.

Under autarchy, prices, profits, and demands are the ones corresponding to the (NR,NR) configuration defined in the previous section. Clearly, in this case there is no first stage game, and these expressions apply for the whole range of parameters.

We firstly notice that when the removal of trade barriers yields the relocation of the whole industry, domestic workers loose their jobs, and their surplus decreases by the amount of the wage bill paid under autarchy ( $w$ ). The market shares of the firms remain unchanged, and the decrease in labor costs is totally passed on to consumers via lower prices. Consumers’ gains are thus given by the price reduction which equals the wage differential ( $\Delta w$ ). Variable profits do not change, while industry total profits decrease by the amount of the relocation costs ( $2F$ ). Clearly the consolidated effect is negative and amounts to ( $2F + w^*$ ). We can thus state that

*“globalization” reduces domestic welfare for the range of parameters that sustain (R,R) as the (unique) subgame perfect equilibrium configuration.*

The other two cases in which the welfare effects of “globalization” have to be ascertained concern the range of parameters for which the configurations (NR,R) and/or (R,NR) emerge at equilibrium.

Consider first the equilibrium (NR,R): The labor force in the industry decreases by the amount of the relocated firm demand and so workers' surplus decreases by  $wD_2(NR, R)$ . Consumers gain since prices decrease. The relocated firm gains, and the other firm loses. However, total industry profits increase since the condition ensuring the existence of a range of parameters sustaining (NR,R) as an equilibrium requires that industry profits be higher than under autarchy.<sup>8</sup> The aggregate welfare effect  $\Delta W \equiv DW(NR, R) - DW(NR, NR)$ , given by

$$\Delta W = \underbrace{\frac{\Delta w}{9\beta} \left( \frac{\Delta a}{\Delta Q} - \mu - \frac{\Delta w}{4\Delta Q} \right)}_{\text{market share effect}} - \underbrace{\frac{w^*}{6\beta} \left( \frac{\Delta a}{\Delta Q} - \mu + 3\beta + \frac{\Delta w}{\Delta Q} \right)}_{\text{social effect}} - F,$$

is thus a priori ambiguous. It can be decomposed in "market share effect," "social effect," and relocation cost  $F$ . The "market share effect" corresponds to the changes induced by the relocation of firm 2 on gross consumer surplus net of technological costs. As discussed in Section 2, the direction of this effect depends on whether the induced change in market shares leads the industry closer to or further away from the optimal demand split. The "social effect" corresponds to the component of the wage bill that while being a cost for the industry is not a part of the domestic workers' surplus. More precisely, it is given by the wage bill payed abroad.

Notice that the "social effect" is nil when  $w^* = 0$ , and negative otherwise. In fact, the wage bill payed abroad is a net loss from the nation's point of view. Thus, the "social cost" of relocation increases with the foreign wage, as well as with the wage differential.

The wage differential matters here because by relocating its production plants the low-quality firm expands its market share and doing so it further increases the foreign wage bill. By relocating its production plants, the low-quality firm incurs a relocation cost  $F$ , and causes a further social cost. This implies that the welfare effect of relocation can be positive only if the change in gross consumers' gains net of technological costs more than compensate these losses. The source of welfare gains, in this model, is the "market share effect." As we have already discussed in Section 2, when both firms incur the same labor costs, the equilibrium demand for the variant the economy is biased for is lower than the "optimal" demand. This implies that, when the economy is high-quality biased ( $\frac{\Delta a}{\Delta Q} < \mu$ ), the relocation of the low-quality firm, causing an expansion of its market share, pushes the economy further away from the optimal demand split. Accordingly, in such circumstances, the market share

<sup>8</sup> In fact, in Section 2, we showed that (NR,R) is an equilibrium if  $F \in [C, B]$ . This implies that  $\Pi_2(NR, R) - \Pi_2(NR, NR) \equiv B > F > \Pi_1(R, R) - \Pi_1(NR, R) \equiv C$ . A necessary condition for the interval  $[C, B]$  to be non empty is that  $\Pi_1(NR, R) + \Pi_2(NR, R) > \Pi_1(R, R) + \Pi_2(NR, NR) = \Pi_1(NR, NR) + \Pi_2(NR, NR)$

effect is unambiguously negative. Thus, when the economy is high-quality biased ( $\frac{\Delta\alpha}{\Delta Q} < \mu$ ), autarchy welfare dominates the situation in which only the low-quality firm relocates. It remains to consider the case in which the economy is low-quality biased, i.e.,  $\frac{\Delta\alpha}{\Delta Q} > \mu$ . If this is the case, the low-quality firm expands its market share, and the “market share effect” is positive as long as  $\frac{\Delta\alpha}{\Delta Q} > \mu + \frac{\Delta w}{4\Delta Q}$ . For very high values of  $\Delta w$ , the increase in firm 2’s market share induced by its labor cost advantages is excessive despite the fact that the economy is biased in favor of the variant it produces: We are in presence of a sort of “overshooting”. In other words, the stronger is the bias in favor of the variant produced by the relocated firm, the larger is the wage differential compatible with a positive “market share effect”. In particular, when  $\frac{\Delta\alpha}{\Delta Q} > \mu + \beta$ , the economy is strictly vertically differentiated and the optimal demand split requires that the low-quality firm serves the whole market, then the positive market share effect is increasing with the wage differential. We have then shown that when the low-quality firm relocates, total welfare is higher the lower is the foreign wage  $w^*$  (because of the social cost) and the more biased is the economy toward the low-quality variety.

From the equations defining welfare, the reader may easily check that

$$DW(NR, R) - DW(NR, NR) > 0 \implies F < \hat{F}, \text{ where}$$

$$\hat{F} \equiv \frac{1}{36\beta} \left( \left( \frac{\Delta\alpha}{\Delta Q} - \mu \right) (4w - 10w^*) - \frac{\Delta w}{\Delta Q} (w - 5w^*) - 18\beta w^* \right).$$

Since the configuration (NR,R), can be sustained as a subgame perfect equilibrium of our game only if  $F > C$ , we have that the relocation of the low-quality firm is welfare improving with respect to autarchy if, and only if,  $F \in [C, \hat{F}]$ . The reader may easily check that this interval is non-empty if the incremental cost per unit of quality is sufficiently high,  $w$  is sufficiently large and  $w^*$  sufficiently small.<sup>9</sup>

Consider now the equilibrium (R,NR). The welfare effects of the relocation of the high-quality firm are the mirror image of those induced by the relocation of the low-quality firm, previously analyzed. The aggregate welfare effect is unambiguously negative when the economy is low-quality biased, while it is ambiguous if the economy is high-quality biased. Thus, when  $\frac{\Delta\alpha}{\Delta Q} > \mu$ , autarchy welfare dominates the situation in which only the high-quality firm relocates. When  $\frac{\Delta\alpha}{\Delta Q} < \mu$ , there exists a non-empty interval of parameters for which (R,NR) is an equilibrium and is preferred, in welfare terms, to autarchy. Again, it can be shown that this situation is the more likely the higher is  $w$  and the lower is  $w^*$ . Accordingly, when the high-quality firm relocates, total welfare is higher the lower is the foreign wage  $w^*$  (because of the social effect) and the more biased is the economy toward the high-quality

<sup>9</sup> The condition for the interval to be non-empty is

$$4w\Delta Q \left( \frac{2\Delta\alpha}{\Delta Q} - 2\mu - 3\beta \right) - 2w^*\Delta Q \left( 7\frac{\Delta\alpha}{\Delta Q} - 7\mu + 6\beta \right) + \Delta w(w - 7w^*) > 0.$$

variety. The effect of the wage differential  $\Delta w$  is again unambiguously negative for high values of the incremental costs per unit of quality, while it is ambiguous if  $\frac{\Delta\alpha}{\Delta Q}$  is low enough. Summarizing, we can state that

*when  $\frac{\Delta\alpha}{\Delta Q} > \mu$ , the configuration (R,NR) is welfare dominated by the autarchic situation. Furthermore there exists a range of parameters for which the configuration (NR,R) welfare dominates the autarchy situation. When  $\frac{\Delta\alpha}{\Delta Q} < \mu$ , the equilibrium configuration (NR,R) is welfare dominated by the autarchic situation. Furthermore, there exists a range of parameters for which the configuration (R,NR) welfare dominates the autarchic situation.*

It follows immediately from the above results that

*the only relocation pattern in which globalization may be unambiguously welfare improving is the one where relocation is a dominant strategy only for the firm producing the variant toward which the economy is biased.*

In other words, it can *never* be the case that *both* (NR,R) and (R,NR) dominate autarchy in welfare terms. This, in turn, implies that for the range of the parameters sustaining multiple equilibria, “globalization” can never be unequivocally said to be welfare improving. To ascertain the conditions under which globalization unambiguously increase domestic welfare, we are led to search for situations in which (i) the equilibrium (NR,R) (or (R,NR)) is preferred to autarchy and (ii) is the unique equilibrium. More precisely, for the case  $\frac{\Delta\alpha}{\Delta Q} > \mu$ , the two conditions reduce to  $F \in [C, \hat{F}]$ , and  $\frac{\Delta\alpha}{\Delta Q} > \mu + \frac{\Delta w}{2\Delta Q}$ . In order for this to occur, we thus need that the social costs of relocation be small and that the “market share effect” be large.

Once we have analyzed the welfare consequences of “globalization” with respect to autarchy, it remains to assess the welfare consequences of alternative location patterns. Here, we are interested in the welfare levels associated to configurations (NR,R) and (R,NR), when both these configuration can be sustained as subgame perfect equilibria. By comparing the two expression, we have that

$$DW(NR, R) - DW(R, NR) > 0 \leftrightarrow (2w - 5w^*)(\Delta\alpha - \mu\Delta Q) > 0,$$

and we can thus state that

*when the economy is low-quality biased ( $\frac{\Delta\alpha}{\Delta Q} > \mu$ ), domestic welfare is higher when only the low-quality firm relocates than when only the high-quality firm relocates if, and only if, the domestic wage is sufficiently larger than the foreign wage ( $w > \frac{5}{2}w^*$ ). When, on the contrary,*

*the economy is high-quality biased ( $\frac{\Delta\alpha}{\Delta Q} < \mu$ ), domestic welfare is higher when only the high-quality firm relocates than when only the low-quality firm relocates if, and only if, the domestic wage is sufficiently larger than the foreign wage ( $w > \frac{5}{2}w^*$ ).*

At this point the intuition behind this result should be straightforward. When a firm relocates its demand increases. If an economy is biased in favor of the low-quality variant, the relocation of the low-quality firm is preferred, if we look at the “market share effect”. Moreover, the higher is the wage differential, the larger are the relative market share advantages associated with the relocation of the low-quality firm. However, the low-quality firm has a larger market share. Thus, the negative social costs of relocation is also stronger. Of course, the social effect is lower the lower is the foreign wage. Thus, if  $w^*$  is small enough, the relocation of the firm producing the variant the economy is biased in favor of, is welfare superior to the relocation of the other firm.

#### IV. FINAL REMARKS

In the recent years, much has been said about the advantages and the costs associated with global market competition. While there is still a large consensus that, in the long run, the free circulation of commodities and factors of production would allow for a better allocation of resources worldwide, it is nonetheless true that, in the short run, the social costs of free trade, and especially of the relocation of production plants towards low-wage countries, may be non-negligible. In Europe, where two-digit unemployment figures are the norm, the hostility towards “unfair trade”, and the relocation of production plants, is widespread in political circles. Also among professional economists some concerns have been expressed about the social (or environmental costs) of global market competition. For instance Maurice Allais, in an editorial on *Le Figaro* (July 5, 1993), with the emblematic title “Un libre-échangeisme suicidaire”, wrote that “Les délocalisations [...] progressent aujourd’hui inexorablement en suscitant inéluctablement partout du chômage”.<sup>10</sup>

The first aim of this paper was that of shedding some light on how the removal of trade and/or capital inflows/outflows restrictions affects the firms’ location decisions. In particular, we wanted to understand which firms, within a specific industry, have the stronger incentives in relocating their production facilities toward low-wage countries. Are they the low-quality firms? Are they the high-quality firms? Does quality really matter? Our model suggests that quality matters, but in an indirect way. In fact, in our duopoly model, the incentives for relocating production plants in low-wage countries are higher for the firm that produces the variety that would have a larger market share if the goods were sold at their marginal cost. This means that when only one firm relocates, chances are higher that it be the

<sup>10</sup> Nowadays, relocations are progressing inexorably [...] and are ineluctably provoking unemployment everywhere.

one towards which the market is biased. If we think that Western economies become more and more biased toward high-quality goods, than we should expect that high-quality firms be the natural candidates for relocation. Our model also suggests that location patterns may not be unequivocally determined, and that multiple location configurations can be sustained as subgame perfect equilibria. Moreover, we have seen that, in presence of multiple equilibria, the direction of the welfare effects of globalization may crucially depend on the equilibrium configuration realized by the economy. We believe that a relevant question deserving further thought is whether this may broaden the scope of an active industrial policy. The question would then be: Can we devise industrial policy tools able to select among multiple equilibria? For instance, one might suggest discriminatory relocation contention/support policies that would affect differently the effective relocation costs borne by each of the firms. Another interesting issue is whether a social clause policy, imposing de facto a minimal wage abroad, could affect the firms' incentives to relocate their production plans, and can thus improve domestic welfare. Cordella and Grilo (1995) provides a tentative answer to such a problem.

The second aim of the paper was that of assessing the welfare consequences of the decision of the domestic firms to serve the domestic market through foreign plants. Our tentative conclusion is that, in many situations, the efficiency gains due to relocation do not offset the losses imposed upon workers in the form of increased unemployment. However, and somehow against the common wisdom, we also prove that the welfare costs of relocation are higher the higher is the wage that the multinational firms pay abroad. Accordingly, *coeteris paribus*, the welfare cost of relocation is smaller toward very low-wage countries (e.g., poor Asian countries), than toward more relatively higher wage countries (e.g., Central Europe, or Mexico). Finally, we would like to stress that we do not think that our analysis offers a rationale for opposing free trade (or foreign direct investment flows). We are convinced that any single country that would oppose "globalization" would, at the same time, jeopardize its long-run growth opportunities. However, we do think that the structural changes induced by the new economic environment may harm large sectors of the society and that "global market competition" would ultimately fail its promises, if not duly accompanied by strong structural and redistributive policies.

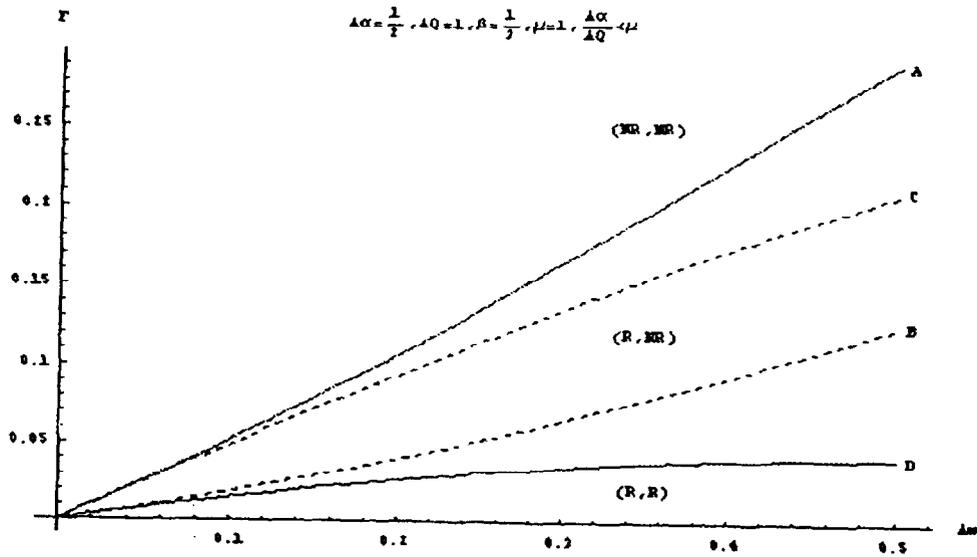


Figure 1: High-Quality Biased Economy: Case 1

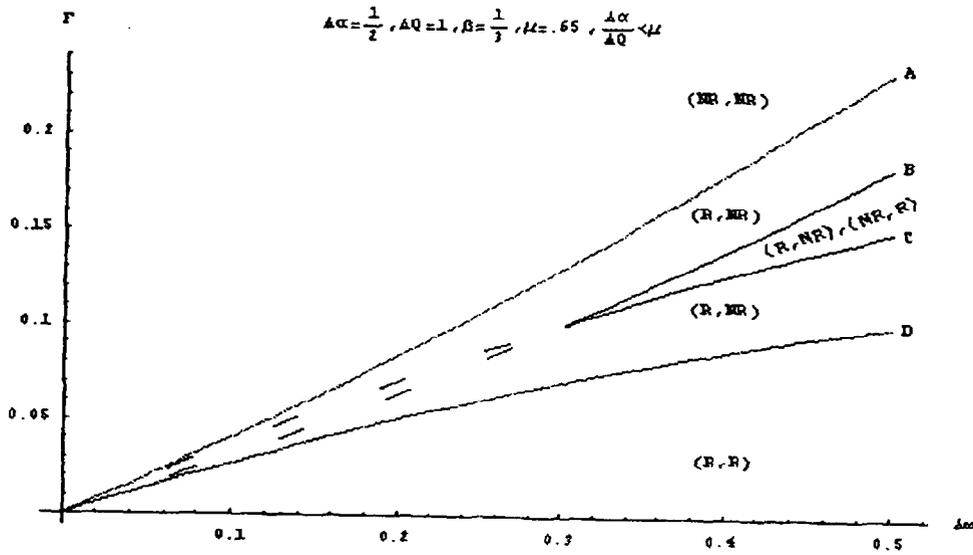


Figure 2: High-Quality Biased Economy: Case 2

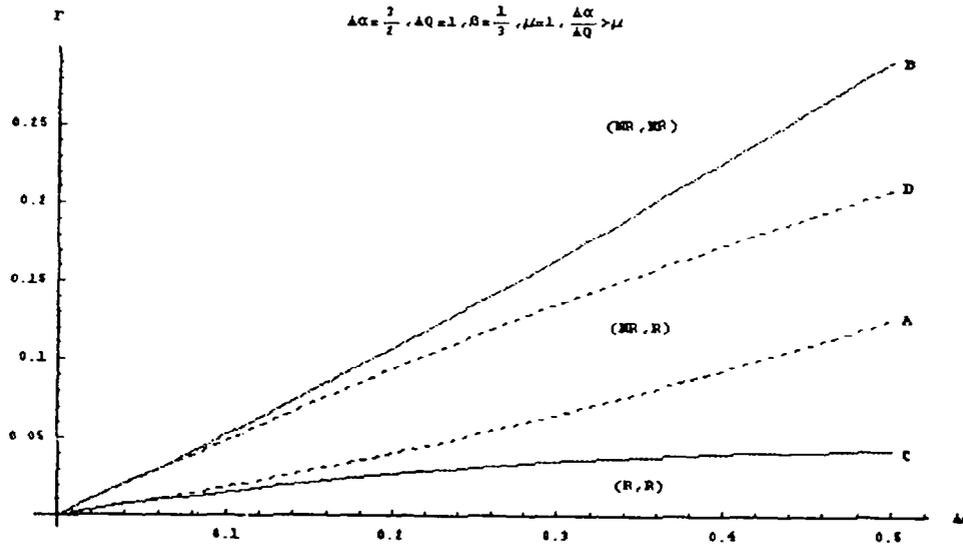


Figure 3: Low-Quality Biased Economy: Case 1

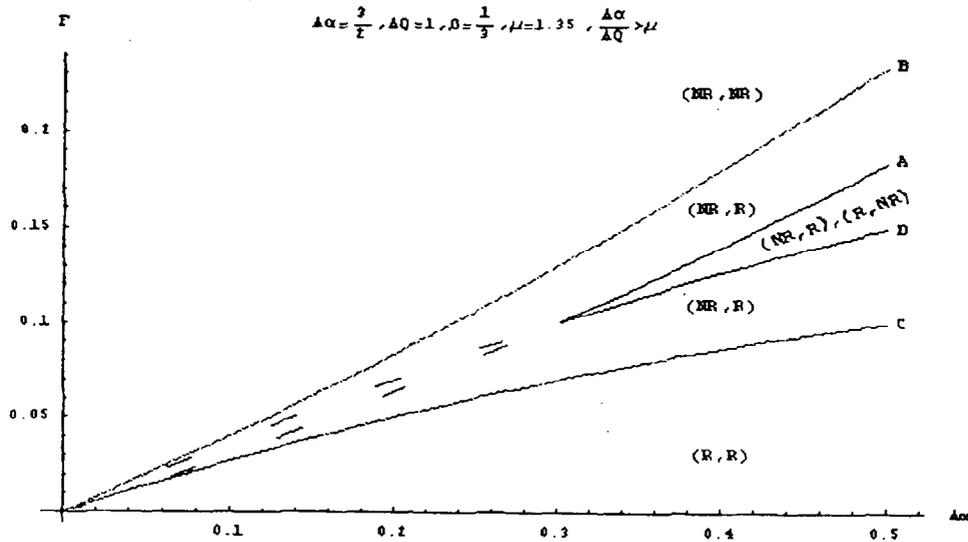


Figure 4: Low-Quality Biased Economy: Case 2

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