Market Integration, the Specialization of Production and Labour Mobility under Endogenous Differentiation[1]

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Abstract

This paper shows that market integration has controversial effects when countries are similar in terms of income but may significantly differ in terms of consumer tastes and the cost of labour. The long run adjustments observed in the specialisation of production (or product differentiation) and prices interact in non trivial ways with labour mobility (and the associated adjustment in the wage differential) to determine the relative performance of firms (as for equilibrium profits) and countries (as for equilibrium social welfare). It is shown that there are interesting cases where the welfare enjoyed by the larger country is smaller than the smaller country's, due to the relative distribution of demand and labour.

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1 Introduction

Ever since early studies by Linder (1961) and Grubel and Lloyd (1975), consumers' preferences and product differentiation have been considered as a key feature to explain the advantages of international trade.

Over the last twenty years, the developments in the theory of international trade have promoted a wide stream of literature on intraindustry trade in differentiated commodities. Most of these contributions exploit the tools provided by the monopolistic competition paradigm *à la* Chamberlin (Dixit and Stiglitz, 1977), where product differentiation is exogenous (Krugman, 1979, 1980, 1981; Helpman, 1981, to mention only a few). Here, free entry ensures a zero-profit condition at equilibrium, under both autarky and free trade. Coupled with consumers' 'love for variety', such a condition ensures that free trade increases welfare in all countries by simply increasing consumers' utility.

The address approach to product differentiation, where firms may strategically exploit the possibility of differentiating their respective production in order to acquire a non-negligible degree of market power, seems to put into question the main claim advocated by the literature mentioned above, namely, that liberalization brings about an increase in welfare by enlarging product variety. Moreover, the address approach assumes that each consumer can univocally rank available goods and identify his preferred variety, so that he can be characterized as an individual who shows a 'love for specificity'. It follows that the purchase of any good that does not entirely match his taste involves a welfare loss, which is very likely to happen whenever firms have significant market power. Still, the issue of endogenous product differentiation has been largely neglected by trade theorists. A few relevant exceptions are Gabszewicz *et al.* (1981), Eaton and Kierzkowski (1984), Shaked and Sutton (1984), Schmitt (1990; 1995), Motta (1992), Lambertini (1997a) and Lambertini and Rossini (1998). In general, all of these papers consider a setting where profit-seeking firms first choose product variety and then compete in the market variable. Eaton and Kierzkowski (1984) adopt a spatial differentiation model *à la* Hotelling (1929) and show that (i) trade may *reduce* rather than increase product variety, and (ii) trade may lead to Pareto-inferior outcomes as compared to autarky. Schmitt (1990, 1995)

address the issue of protection in a spatial model of trade. Gabszewicz *et al.* (1981), Shaked and Sutton (1984), Motta (1992), Lambertini (1997a) and Lambertini and Rossini (1998) deal instead with vertical differentiation, showing that (i) trade liberalization involves a tradeoff between the ability to develop and market goods characterized by higher quality levels than in autarky, and the exit of low-quality goods from the market, due to the increase in price competition; and (ii) intraindustry trade may give rise to outcomes where not necessarily all countries benefit from market integration, depending upon consumer income distributions.[1] Overall, the analysis carried out within this strand of literature entails that no clearcut conclusion can be drawn as to the consequences of trade liberalization on social welfare.

In Lambertini (1997b), the issue of trade in horizontally differentiated commodities is addressed in a world where two countries of different size initially operate in a condition of autarkic monopoly. The opening of trade yields a duopoly where firms compete *à la* Bertrand, and one-way trade from the small to the large country is observed. In the short-run, varieties are given as in autarky, and firms can only adjust prices. I show that the impact effect of trade always benefits the small country, due to a considerable increase in the surplus enjoyed by its inhabitants, while it damages the large country because (i) its firm is hurt by competition from abroad and (ii) the increase in the surplus enjoyed by its inhabitants is insufficient to make up for the profit loss suffered by the firm. Next, the long-run equilibrium arising when firms can also modify locations is analysed. The picture emerging from this scenario is even worse, in that the small country may benefit from trade in the long term provided that it is sufficiently small, while the effect on the large country is consistently negative. These facts derive from the incentive to soften price competition, leading firms to relocate farther apart. As a result, this model allows for two main claims. First, the long-run increase in social welfare, if any, drastically depends on the increase in firms' profit, while the literature on monopolistic competition stresses that it can be expected to derive exclusively from an increase in consumers' utility. Second, the possibility that trade in an imperfectly competitive setting benefits all partners appears to be very weak, if not ruled out, whenever firms have market power and may exploit product differentiation to enhance it. Specifically, the analysis presented below predicts that smaller partners may benefit from trade, while larger ones will lose due to the extraction of consumer surplus

[1] The issue of protection under vertical differentiation is investigated by Krishna (1990).

by foreign producers, as well as the loss incurred by domestic firms that do not export. This also seems to weaken the relevance of the so-called 'home market effect' highlighted by Krugman (1980) in the presence of increasing returns to scale.

The issue arises of an empirical reference for these results. The spatial approach to endogenous differentiation lends itself to two alternative interpretations. The first consists in considering the linear world as a metaphor of the population size in the real one. Hence, if this view is adopted, on the basis of the assumptions that (i) gross consumer surplus is the same across countries; and (ii) the available goods are perfect substitutes if the distance between them shrinks to zero, the above considerations appear to apply to countries where the potential customers of a certain product are characterized by closely comparable willingness to pay, or, as a proxy of the latter, income, but their relative number is different. This would be the case, e.g., when analyzing IIT between EU members like Germany and Portugal, as well as between most of them, considered in isolation, and the United States. The second interpretation takes the linear model as a representation of the distribution of tastes, so that firms' location appears as the choice of the intensity of a relevant characteristic defining the product, e.g., the amount of sugar in a soft drink. If this is the metaphor one has in mind, then the model may be thought to apply to countries whose consumers, while being characterized by the same willingness to pay, completely differ in terms of preferences. An example that may fit is the computer software industry. The average UK user would never accept software other than in English, while it is common, say, in all other EU countries, to buy software whose layout is either in the local language or in English.

The present paper complements the analysis carried out in Lambertini (1997b; see also Tharakan and Thisse, 2002). Here, I will consider a Hotelling-like model where two countries are characterised by different distribution of consumer tastes, with one firm operating in each country. Starting from the benchmark of autarkic monopoly, the two countries integrate in a single market, undergoing a process consisting in two relevant phases: (i) the short run, or impact effects, of integration, where firms can only adjust prices given the degree of product differentiation and the wage differential inherited from autarky, and (ii) the long run effects, allowing for the optimal adjustment of product locations and the convergence of individual countries' wage rate to a single, worldwide level of labour costs. I will consider two representative cases: one in which the distribution of consumer preferences are asymmetric

(with one of the boundaries of the distribution support in common), and one where tastes are symmetric around a common average (and median). In both settings, I will prove that market integration may have ambiguous effects on both profits and welfare. The long run adjustment process affecting the specialisation of production and prices significantly interact with labour mobility to determine the relative performance of firms and countries. I will also highlight the existence of relevant parameter constellations wherein the larger country's long run welfare is smaller than the smaller country's, due to the relative distribution of demand and labour.

The remainder of the paper is organized as follows. The basic setting and the autarkic equilibrium are outlined in Section 2. Sections 3 deals with the short-run and the long-run effects of market integration. Finally, Section 4 contains concluding remarks and brief suggestions for desirable extensions.

2 The model and the autarkic equilibrium

I adopt a horizontal differentiation setting which is a slight variation of the model due to d'Aspremont *et al.* (1979). Two firms operating in a linear world consisting of two countries sell the same physical good. Firm 1 is located in country 1, while firm 2 is located in country 2. They produce at the same constant marginal cost, which can be assumed to be equal to the unit labour remuneration w_i, $i = 1, 2$. Fixed costs are absent, so that relocation is costless. Consumers of both countries are uniformly distributed with density 1 along an interval whose total length can be normalised to 1 for country 1 and to α for country 2. Consumers have unit demands, and consumption yields a positive constant surplus s. Each consumer buys if and only if the net utility derived from purchase is non negative:

$$U = s - td_i^2 - p_i \geq 0, \ t > 0, \ i = 1, 2, \tag{1}$$

where td_i^2 is the transportation cost[2] borne by the consumer living at distance d from firm i, t is the unit transportation cost rate, and finally p_i is the price of variety i. Assume $s \gg t$. This is needed in order for total demand to be always equal to the total population of both countries under both autarky and free trade.

[2] Convex transportation costs are necessary to ensure the existence of a duopolistic price equilibrium in pure strategies for any location pair. See d'Aspremont *et al.* (1979) and Economides (1986).

Under autarky, each firm sets a price such that the net surplus accruing to the marginal consumers living at the borders of each country, i.e., either 0, 1 or α, is nil,

$$p_1^A = s - t(\alpha - x_1)^2;\ p_2^A = s - t(1 - x_2)^2, \tag{2}$$

where apex A stands for *autarky*. Moreover, firms locate at the center of their respective countries, $x_1 = 1/2$ and $x_2 = \alpha/2$. These locations also represent the socially optimal locations in autarky,[3] minimizing total transportation costs SC_i in each country,

$$SC_1 = t\int_0^1 (m - x_1)^2 dm;\ SC_2 = t\int_0^\alpha (m - x_2)^2 dm, \tag{3}$$

where m is the position of a generic consumer. It is worth stressing that, as usual, this class of models allows for two different interpretations which, in principle, are equally plausible. The first consists in thinking of the linear space as a geographical space; according to the second, instead, the linear space represents the space of preferences over some relevant feature of the good. In the present paper, I will privilege this view.

Consumer surplus in each country is defined as

$$CS_1^A = \int_0^1 (s - p_1 - t(m - x_1)^2)dm;\ CS_2^A = \int_0^\alpha (s - p_2 - t(m - x_2)^2)dm. \tag{4}$$

Finally, social welfare in country i is given by $SW_i = \pi_i + CS_i$. The relevant equilibrium magnitudes are thus:

$$p_1^A = s - \frac{t}{4};\ p_2^A = s - \frac{t\alpha^2}{4}; \tag{5}$$

$$\pi_1^A = s - \frac{t}{4};\ \pi_2^A = \alpha\left(s - \frac{t\alpha^2}{4}\right); \tag{6}$$

$$CS_1^A = \frac{t}{6};\ CS_2^A = \frac{t\alpha^3}{6}; \tag{7}$$

$$SW_1^A = s - \frac{t}{12};\ SW_2^A = \alpha\left(s - \frac{t\alpha^2}{12}\right). \tag{8}$$

[3]Since the demand functions are linear in prices, the profit-seeking monopolist chooses the same location as the social planner (Spence, 1975, p. 421). See also Bonanno (1987).

Due to the features of any Hotelling-like model, when full market coverage is assumed, the monopoly equilibrium turns out to implement the socially optimal configuration in terms of both product location and social welfare. Of course this applies only insofar as one is not interested in the distribution of surplus. As long as the size of the welfare pie is the only thing that matters while its slices do not, monopoly pricing is not an issue since the market demand function is not price-elastic.

For these reasons, in the remainder of the analysis I will refrain from comparing the free trade levels of welfare with the autarky level, while I will focus on the effects associated to the fact that different variables are most likely to adjust at different speeds during the integration process.

3 Market integration

By market integration, I refer to a free trade setting where intraindustry trade arises between the two countries, without price discrimination across countries and without any additional transportation cost, other than the quadratic disutility already accounted for in the generic consumer's net surplus (1).

In the remainder, I will consider two benchmark cases. The first, labelled as case A, describes a situation where the lower bound of consumer preferences coincides in the two countries, as in figure 1,[4] where product locations are inherited from autarky, i.e., $x_1 = 1/2$ and $x_2 = \alpha/2$, and the dotted line identifies the location of the two consumers (one in country 1 and the other in country 2) who are indifferent between purchasing variety 1 or variety 2, given the price vector.

[4] Obviously, given the *a priori* symmetry of the model, this case is formally equivalent to the one where the upper bound of consumer preferences coincides.

Figure 1 : Case A

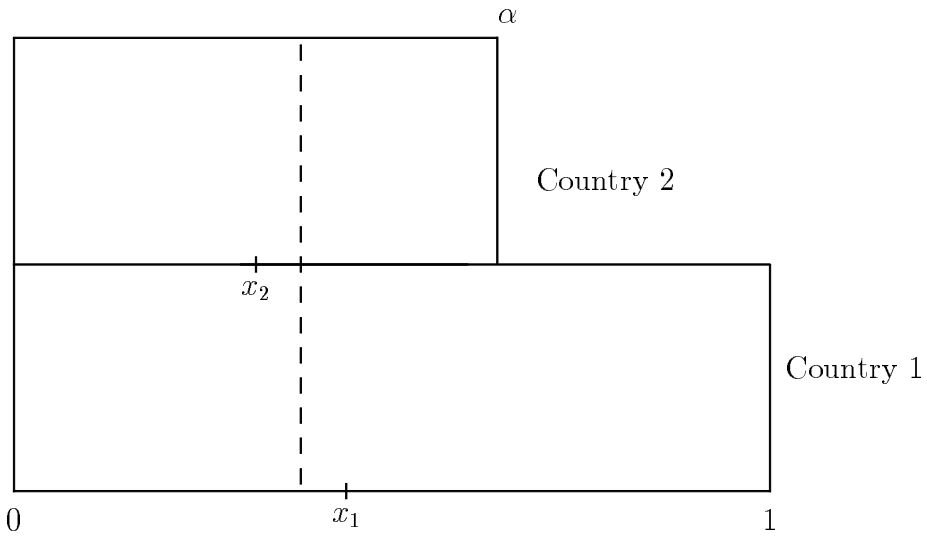
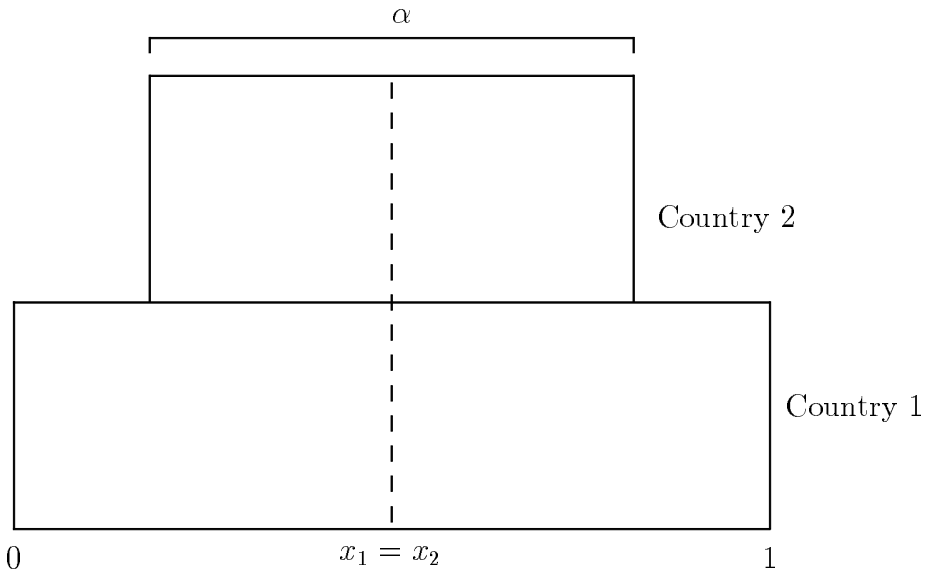


Figure 2 : Case B



The second representative setting, labelled as Case B, is depicted in figure 2, where, once again, it is described the product set inherited from autarky. Consumer preferences are symmetric around 1/2 in both countries, and therefore autarkic locations also coincide, at 1/2.

In both cases, I will investigate two phases. The first, which describes the impact effects of market integration, is a situation where product locations are temporarily sticky, and firms can only adjust prices. The second, describing the long run effects, is a situation where also product location (and thus the specialisation of production) is flexible. In the latter setting, the relevant solution concept is the subgame perfect equilibrium in pure strategies, obtained by backward induction.

3.1 Case A: Impact effects

The distribution of tastes is as depicted in figure 1, and, in the short run, firms can only adjust prices, while the amount of product differentiation is sticky. Given the autarkic locations $\{x_1 = 1/2, x_2 = \alpha/2\}$, the indifferent consumer is located at $\overline{m}$, which solves the following:

$$s - p_1 - t\left(\frac{1}{2} - \overline{m}\right)^2 = s - p_2 - t\left(\frac{\alpha}{2} - \overline{m}\right)^2. \tag{9}$$

Provided that α is sufficiently large to ensure that $\overline{m}$ belong to the region wherein consumer density is equal to two, we have the following market demand functions:

$$\begin{aligned} y_1 &= 2(\alpha - \overline{m}) + 1 - \alpha = \frac{1}{2}\left[3\alpha - 1 - \frac{4(p_1 - p_2)}{t(1-\alpha)}\right] + 1 - \alpha \\ y_2 &= \frac{4(p_1 - p_2) + t(1 - \alpha^2)}{2t(1-\alpha)} \end{aligned} \tag{10}$$

with the corresponding profit functions:

$$\pi_i = (p_i - w_i)\, y_i\ . \tag{11}$$

From the first order conditions (FOCs) w.r.t. prices, we obtain the short run equilibrium prices:

$$p_i = \frac{1}{12}\left[3t\left(1 - \alpha^2\right) + 4(2w_i + w_j)\right]\ , \tag{12}$$

giving rise to the following profits:

$$\pi_i = \frac{\left[4\left(w_i - w_j\right) - 3t\left(1-\alpha^2\right)\right]^2}{72t\left(1-\alpha\right)} \tag{13}$$

and demands:

$$y_i = \frac{3t\left(1-\alpha^2\right) - 4\left(w_i - w_j\right)}{6t\left(1-\alpha\right)} \; . \tag{14}$$

Using these (short run) equilibrium magnitudes, one can immediately verify that:

$$\pi_2 - \pi_1 \propto y_2 - y_1 \propto w_1 - w_2 \; . \tag{15}$$

This chain of inequalities produces our first result:

Lemma 1 *At the short run equilibrium, the firm located in the smaller country enjoys higher market share and profits than the firm located in the bigger country, if the unit wage in the smaller country is lower than that in the bigger country.*

Now examine consumer surplus in the two countries:

$$CS_1 = \int_0^{\overline{m}} \left[s - p_2 - t\left(\frac{\alpha}{2} - z\right)^2 \right] dz + \int_{\overline{m}}^{1} \left[s - p_1 - t\left(\frac{1}{2} - z\right)^2 \right] dz \; ; \tag{16}$$

$$CS_2 = \int_0^{\overline{m}} \left[s - p_2 - t\left(\frac{\alpha}{2} - z\right)^2 \right] dz + \int_{\overline{m}}^{\alpha} \left[s - p_1 - t\left(\frac{1}{2} - z\right)^2 \right] dz \; . \tag{17}$$

The difference

$$CS_1 - CS_2 = -\frac{1}{12}\left(1-\alpha\right)\left[t\left(4 - \alpha\left(2-\alpha\right)\right) - 12s + 4\left(2w_1 + w_2\right)\right] \tag{18}$$

may have either sign, depending upon the values of the relevant parameters $\{\alpha, s, t, w_i\}$. The same, of course, holds for the difference between social welfare levels, $SW_2 - SW_1$. The sign of $SW_2 - SW_1$ may be the same as the sign of $\pi_2 - \pi_1$, or the opposite.[5] This depends upon the fact that the firm located in the smaller country (i.e., 2) may end up serving a larger market

[5] It is worth noting that measuring the welfare difference *per capita* would surely turn to the advantage of the smaller country, as $\alpha \in [0,1]$. This applies also to the remainder of the analysis.

share than firm 1 does. Whenever $y_2 > \alpha$, the domestic labour supply is insufficient to meet market demand for firm 2, which has to hire workers from country 1, where exactly the opposite situation arises (i.e., excess supply on the labour market). Here, two effects operate: the first is an increase in profits for firm 2, via an increase in demand; the second is a decrease in consumer surplus for country 1, given that a non negligible number of its consumers patronise the imported good. It is also worth noting that the employment level is not an issue here, as the assumption of full market coverage also implies full employment, while the relative performance of countries depends upon the distribution of labour across firms.

3.2 Case A: Long run effects

Now examine the long run behaviour of firms, as they adjust the location of products. The indifferent consumer is identified by the following condition:

$$s - p_1 - t\left(x_1 - \overline{m}\right)^2 = s - p_2 - t\left(x_2 - \overline{m}\right)^2, \tag{19}$$

yielding:

$$\overline{m} = \frac{p_2 - p_1 + t\left(x_2^2 - x_1^2\right)}{2t\left(x_2 - x_1\right)}. \tag{20}$$

Therefore, market demands are:

$$y_1 = 2\left(\alpha - \overline{m}\right) + 1 - \alpha = \frac{p_2 - p_1 + t\left(x_2 - x_1\right)\left(1 - \alpha - x_2 - x_1\right)}{t\left(x_2 - x_1\right)}; \tag{21}$$

$$y_2 = 2\overline{m} = \frac{p_2 - p_1 + t\left(x_2^2 - x_1^2\right)}{t\left(x_2 - x_1\right)}. \tag{22}$$

From the FOCs pertaining to the second stage, the equilibrium prices obtain, for a generic location pair:

$$\begin{aligned} p_1 &= \frac{1}{3}\left[2w_1 + w_2 + t\left(x_2 - x_1\right)\left(x_1 + x_2 - 2\left(1 + \alpha\right)\right)\right], \\ p_2 &= \frac{1}{3}\left[w_1 + 2w_2 + t\left(x_1 - x_2\right)\left(x_1 + x_2 + 1 + \alpha\right)\right]. \end{aligned} \tag{23}$$

By plugging these expressions into the profit functions $\pi_i = \left(p_i - w_i\right) y_i$, the relevant profits at the first stage can be written as follows:

$$\pi_1 = \frac{\left[w_1 - w_2 + t\left(x_1 - x_2\right)\left(x_1 + x_2 - 2\left(1 + \alpha\right)\right)\right]^2}{9t\left(x_1 - x_2\right)}; \tag{24}$$

$$\pi_2 = \frac{\left[w_1 - w_2 + t\left(x_1 - x_2\right)\left(x_1 + x_2 + 1 + \alpha\right)\right]^2}{9t\left(x_1 - x_2\right)} \ . \tag{25}$$

Solving the FOCs pertaining to the first stage of the game, one obtains the long run equilibrium locations which characterise the specialisation of production:[6]

$$x_1 = \frac{16\left(w_1 - w_2\right) + 15t\left(1 + \alpha\right)^2}{24t\left(1 + \alpha\right)} \ ; \ x_2 = \frac{16\left(w_1 - w_2\right) - 3t\left(1 + \alpha\right)^2}{24t\left(1 + \alpha\right)} \ . \tag{26}$$

By setting $\alpha = 1$ and $w_1 = w_2$, it can be easily checked that equilibrium locations (26) do indeed coincide with the standard solution of the unconstrained Hotelling model with uniform consumer distribution and quadratic disutility, $x_1 = 5/4$ and $x_2 = -1/4$ (see Lambertini, 1994, 1997c; and Tabuchi and Thisse, 1995). Without further investigation, I can claim:

Lemma 2 *Provided that the ratio* $\dfrac{|w_1 - w_2|}{1 + \alpha}$ *is sufficiently small, the specialisation of production at the long run equilibrium entails that firms locate outside the space of consumer preferences.*

That is, the long run adjustment of product design involves, as it is very often the case,[7] excess differentiation (or, in the jargon of the present model, excess specialisation) in correspondence of the subgame perfect equilibrium.

The profits accruing to firms at the subgame perfect equilibrium are:

$$\begin{aligned} \pi_1 &= \frac{\left[9t\left(1 + \alpha\right)^2 - 16\left(w_1 - w_2\right)\right]^2}{432t\left(1 + \alpha\right)} \ ; \\ \pi_2 &= \frac{\left[9t\left(1 + \alpha\right)^2 + 16\left(w_1 - w_2\right)\right]^2}{432t\left(1 + \alpha\right)} \ , \end{aligned} \tag{27}$$

with

$$\pi_2 - \pi_1 = \frac{4}{3}\left(1 + \alpha\right)\left(w_1 - w_2\right) \ . \tag{28}$$

This proves the following result:

[6] The FOCs are omitted for the sake of brevity. The same holds for the second order conditions for concavity, which are satisfied throughout the calculations carried out in the paper.

[7] On this point, I refer the interested reader to Beath and Katsoulacos (1991) and Anderson *et al.* (1992), *inter alia*, for exhaustive surveys.

Lemma 3 *The firm operating in the country where the unit wage is lower obtains higher profits at the long run equilibrium.*

Equilibrium outputs are:

$$y_1 = \frac{9t\left(1+\alpha\right)^2 - 16\left(w_1 - w_2\right)}{18t\left(1+\alpha\right)} \; ; \; y_2 = \frac{9t\left(1+\alpha\right)^2 + 16\left(w_1 - w_2\right)}{18t\left(1+\alpha\right)} \; , \tag{29}$$

while prices are:

$$p_i = \frac{1}{24}\left[9t\left(1+\alpha\right)^2 + 8\left(w_i + 2w_j\right)\right] \; , \tag{30}$$

and it's easy to check that the following holds:

$$y_2 - y_1 \propto w_1 - w_2 \propto p_2 - p_1 \; . \tag{31}$$

The evaluation of consumer surplus and social welfare is rather involved. In order to simplify matters, suppose the long run adjustment process also entails that $w_1 = w_2 = w$. If so, then we obtain:

$$\pi_1 = \pi_2 = \frac{3t\left(1+\alpha\right)^3}{16} \; ; \; y_1 = y_2 = \frac{1+\alpha}{2} \; ; \; p_1 = p_2 = \frac{3t\left(1+\alpha\right)^2}{8} + w \; , \tag{32}$$

and:

$$SW_1 - SW_2 \propto 24s - 11 - \alpha\left(14 + 17\alpha\right) - 24w > 0 \text{ iff} \tag{33}$$

$$s > \frac{1}{24}\left[11 + \alpha\left(14 + 17\alpha\right) + 24w\right] \equiv \overline{s} > 0 \; . \tag{34}$$

That is, condition (34) establishes the following result:

Proposition 1 *The bigger country enjoys a higher social welfare at the long run equilibrium, provided that (i) the integration process drives the labour cost to the same level, and (ii) market affluence (i.e., the representative consumer's willingness to pay) is sufficiently high. Otherwise, the opposite holds, with the smaller country enjoying a higher welfare.*

The above Proposition can be read in the opposite sense, by saying that 'small is beautiful', i.e., when the willingness to pay is low enough (which, given the support of consumer preferences, amounts to saying that the market is relatively small), the smaller country may perform better than the larger country. Of course, this is also true in some parameter constellations, if the adjustment process does not eliminate (at least, not completely) the wage differential across countries, as it can be verified through simple although rather tedious simulations.

3.3 Case B: Impact effects

Here I briefly focus upon the situation described by figure 2, where the median and average consumers of the two countries coincide, with tastes being symmetrically distributed around 1/2. If so, product locations inherited from autarky also coincide, corresponding both to 1/2. Hence, the impact effects of market integration simply produce either (i) monopoly power for the relatively more efficient firm (which is the one operating in the country with the lower unit wage); or (ii) perfect competition in the form of a standard Bertrand paradox with homogeneous goods, if the unit wage happens to be the same across countries from the very outset. The impact effect, therefore, appears to be rather 'radical', in one sense or the other.

3.4 Case B: Long run effects

With flexible locations, the indifferent consumer is identified by:

$$\overline{m} = \frac{p_1 - p_2 + t\left(x_1^2 - x_2^2\right)}{2t\left(x_1 - x_2\right)} \tag{35}$$

so that the demand functions are:

$$y_1 = \alpha - \overline{m} + \frac{(1-\alpha)}{2} \; ; \; y_2 = 2\overline{m} - \frac{(1-\alpha)}{2} \; . \tag{36}$$

From the FOCs w.r.t. prices, one obtains:

$$p_1 = \frac{1}{6}\left[2\left(2w_1 + w_2\right) - t\left(x_1 - x_2\right)\left(2\left(x_1 + x_2\right) - 3 - 5\alpha\right)\right] , \tag{37}$$

$$p_2 = \frac{1}{3}\left[w_1 + 2w_2 + t\left(x_1 - x_2\right)\left(x_1 + x_2 + 2\alpha\right)\right] . \tag{38}$$

Correspondingly, the profits pertaining to the first stage of the game can be written as follows:

$$\pi_1 = \frac{\left[2\left(w_1 - w_2\right) - t\left(x_1 - x_2\right)\left(2\left(x_1 + x_2\right) - 3 - 5\alpha\right)\right]^2}{72t\left(x_1 - x_2\right)} \; ; \tag{39}$$

$$\pi_2 = \frac{\left[w_1 - w_2 - t\left(x_1 - x_2\right)\left(x_1 + x_2 + 2\alpha\right)\right]^2}{9t\left(x_1 - x_2\right)} \; . \tag{40}$$

The optimal long run locations are:

$$\begin{aligned} x_1 &= \frac{64\left(w_1 - w_2\right) + 3t\left(1 + 3\alpha\right)\left(9 + 11\alpha\right)}{48t\left(1 + 3\alpha\right)}\ ; \\ x_2 &= \frac{64\left(w_1 - w_2\right) + 3t\left[3 + \alpha\left(2 - 21\alpha\right)\right]}{48t\left(1 + 3\alpha\right)}\ , \end{aligned} \tag{41}$$

implying the following profits at the subgame perfect equilibrium:

$$\pi_1 = \frac{\left[9t\left(1 + 3\alpha\right)^2 - 64\left(w_1 - w_2\right)\right]^2}{6912t\left(1 + 3\alpha\right)}\ ;\ \pi_2 = \frac{\left[9t\left(1 + 3\alpha\right)^2 + 64\left(w_1 - w_2\right)\right]^2}{3456t\left(1 + 3\alpha\right)}\ , \tag{42}$$

while output and prices are:

$$y_1 = \frac{9t\left(1 + 3\alpha\right)^2 - 64\left(w_1 - w_2\right)}{72t\left(1 + 3\alpha\right)}\ ;\ y_2 = \frac{9t\left(1 + 3\alpha\right)^2 + 64\left(w_1 - w_2\right)}{36t\left(1 + 3\alpha\right)}\ ; \tag{43}$$

$$p_i = \frac{1}{96}\left[9t\left(1 + 3\alpha\right)^2 + 32\left(w_i + 2w_j\right)\right]\ . \tag{44}$$

If the long run adjustment also drives wages to the same level in the two countries (so that $w_1 = w_2 = w$), we obtain:

$$\begin{aligned} x_1 &= \frac{9 + 11\alpha}{16} > 1 \text{ for all } \alpha \in \left(\frac{7}{11}\,,\ 1\right]\ ; \\ x_2 &= \frac{3 - 7\alpha}{16} < 0 \text{ for all } \alpha \in \left(\frac{3}{7}\,,\ 1\right]\ . \end{aligned} \tag{45}$$

On this basis, I can state:

Lemma 4 *At the long run equilibrium, the degree of product differentiation (or, equivalently, the degree of the specialization of production) is monotonically increasing in α. Moreover, the incentive to differentiate is larger for the firm located in the smaller country.*

This can be quickly ascertained on the basis of (i) the derivatives $\partial x_1/\partial\alpha > 0$ and $\partial x_2/\partial\alpha < 0$, and (ii) the relevant intervals for α, as specified in (45). It is worth stressing explicitly that, for all $\alpha \in (3/7, 7/11)$, the product supplied by firm 2 lies to the left of the lower bound of consumer preferences (i.e., below zero), while the product of firm 1 is still within the upper bound of

consumer preferences (i.e., to the left of one). The incentive to differentiate is clearly higher for firm 1 since it's located in the smaller country, that is, the home demand effect enjoyed by firm 1 is lower than the analogous effect enjoyed by firm 2.

To reinforce this consideration, examine equilibrium demands:

$$y_1 = \frac{1}{8}(1+3\alpha) \; ; \; y_2 = \frac{1}{4}(1+3\alpha) = 2y_1 \, . \tag{46}$$

By using some additional product differentiation (or, by specialising production a little bit more), firm 1 captures 2/3 of the global market. This, in combination with the fact that prices are symmetric at $p_i = w + 3t\,(1+3\alpha)^2/32$, entails:

$$\pi_1 = \frac{3t\,(1+3\alpha)^2}{256} \; ; \; \pi_2 = \frac{3t\,(1+3\alpha)^2}{128} = 2\pi_1 \, . \tag{47}$$

Accordingly:

Lemma 5 *At the long run equilibrium, the profits of the firm located in the smaller country are twice as large as the profits of the firm located in the larger country.*

This comes from the fact that many consumers in the larger country find it preferable to buy the imported good. Of course, this goes alongside with a relocation of the labour force towards the firm operating in country 2. The bearings on social welfare levels can be grasped by evaluating the following expression:

$$SW_1 - SW_2 \propto 192\,(s-w)\,(1-\alpha) - t\left(28 + 81\alpha + 162\alpha^2 - 127\alpha^3\right) \tag{48}$$

with

$$SW_1 > SW_2 \; \forall \; s > w + \frac{t\,(28 + 81\alpha + 162\alpha^2 - 127\alpha^3)}{192\,(1-\alpha)} \equiv \widehat{s} > 0 \; \forall \; \alpha \in [0,1] \, . \tag{49}$$

Condition (49) establishes a result which is formally equivalent to Proposition 1:

Proposition 2 *In the symmetric setting where the average consumer coincide in both countries, the bigger country enjoys a higher social welfare at the long run equilibrium, provided that (i) the integration process drives the labour cost to the same level, and (ii) market affluence (i.e., the representative consumer's willingness to pay) is sufficiently high. Otherwise, the opposite holds, with the smaller country enjoying a higher welfare.*

The profit performance of firms can be offset by the relative satisfaction of consumers, and given that country 1 is larger than country 2, the welfare enjoyed by the former can be higher at the long run equilibrium.

There remains a comparative evaluation to carry out, namely, that between $\overline{s}$ in (34) and $\widehat{s}$ in (49). Given the unit wage rate at the world level, we have:

$$\begin{aligned} \overline{s} - \widehat{s} &= \frac{1}{24}\left[11 + \alpha\left(14 + 17\alpha\right)\right] - \frac{t\left(28 + 81\alpha + 162\alpha^2 - 127\alpha^3\right)}{192\left(1 - \alpha\right)} > 0 \\ \text{for all } t &< \frac{8\left[11 - \alpha\left(17\alpha^2 - 3\alpha - 3\right)\right]}{28 + 81\alpha + 162\alpha^2 - 127\alpha^3} \equiv \widetilde{t}, \end{aligned} \tag{50}$$

where $\widetilde{t}$ is decreasing and convex for all $\alpha \in [0, 1]$, with $\widetilde{t} = 22/7$ in $\alpha = 0$ and $\widetilde{t} = 0$ in $\alpha = 1$. Accordingly, I can formulate the following Corollary to Propositions 1-2:

Corollary 1 *At the long run equilibrium, a sufficient condition for the social welfare to be higher in the larger countries is* $s > \max\left\{\overline{s}\,,\, \widehat{s}\right\}$, *with*

$$\max\left\{\overline{s}\,,\, \widehat{s}\right\} = \begin{cases} \overline{s} \text{ for all } t < \widetilde{t} \\ \widehat{s} \text{ for all } t > \widetilde{t} \end{cases}$$

where $\widetilde{t} = \dfrac{8\left[11 - \alpha\left(17\alpha^2 - 3\alpha - 3\right)\right]}{28 + 81\alpha + 162\alpha^2 - 127\alpha^3}$.

Obviously, as it emerges from the above Corollary, the critical threshold for s is increasing in the level of the transportation cost rate t.

4 Concluding remarks and extensions

The foregoing analysis suggests that market integration has controversial effects when countries are similar in terms of income but may significantly differ in terms of consumer tastes and the cost of labour. The long run adjustments observed in the specialisation of production (or product differentiation) and prices interact in non trivial ways with labour mobility (and the associated adjustment in the wage differential) to determine the relative performance of firms (as for equilibrium profits) and countries (as for equilibrium social welfare). It has been shown that there are interesting cases where the welfare

enjoyed by the larger country is smaller than the smaller country's, due to the relative distribution of demand and labour.

However, a relevant *caveat* must be duly stressed. The aforementioned results drastically depend upon the assumption that a single firm operates with a single good in each country. This is very often adopted in the existing literature on endogenous differentiation. To this regard, indeed, the crucial aspect is the behaviour of the elasticity of substitution between any pair of product varieties. In passing from one variety (or firm) under autarky, to two varieties (or firms) under intraindustry trade with full market integration, the elasticity of substitution decreases in the long run equilibrium, due to the increase in product differentiation. Yet, the existence of pure profits may attract new entrants, and it is very easy to verify that it suffices a third firm (with an additional variety) to increase the elasticity of substitution, which then keeps increasing monotonically as new firms enter the integrated market. The new entrant may operate either in one of the two countries considered in the present paper, or in a third one. This argument has some relevant bearings upon the issue of bilateral *vs* multilateral trade agreements which, to the best of my knowledge, have been largely neglected thus far.

Finally, the model can be fruitfully extended to account for (i) capital accumulation to build up productive capacity, and (ii) R&D investment, either for process or for product innovation. In both cases, an interesting connection with the issue of labour mobility emerges.

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