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TRADE POLICIES, CONCENTRATION, GROWTH AND WELFARE

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Abstract

The aim of this paper is to analyse, through a theoretical model, the effects that the trade integration of two countries may have on industrial location, growth and welfare.

The conclusions reached finally depend both on whether the import or the export costs are affected by the trade policies on which the integration process is based and on whether the rich or the poor country introduces them. In general, when integration leads to an increase of industrial concentration in the rich country, the growth rate increases and welfare improves in both countries. If integration means that industry moves to the poor country, the growth rate decreases; in spite of this, in this case the poor country can also improve its welfare.

Keywords: Trade integration, industrial location, growth, welfare.

JEL Classification: F15, F43, H54, R12

1. Introduction

Since the mid-20th century, international efforts to reduce the costs of trade have intensified. The GATT (now the WTO) has been trying to reduce barriers to trade since 1947, and there are many other international agreements, such as MERCOSUR, with the same intention. The European Union deserves a special mention because, while it does not respond to trade issues alone, it is the furthest-reaching international integration process and the one in which more countries are involved.

In 1957, the founding states of the European Economic Community were in a very similar economic situation, occupied with reconstruction after WWII and with homogenous per capita incomes. Aside from political motives, the main economic aim of this union was the elimination of trade barriers. This measure meant a simultaneous reduction of import costs for member states. The favourable situation of the international economy at the time, together with the good trade results of the lowering of barriers, allowed the Customs Union to be reached two years ahead of schedule, in 1968. However, this was not the end of the story. Once the trade barriers had disappeared, member states continued to implement a series of measures which, although responding to political reasons, also had an effect on commercial relations (and on industrial location, growth and welfare). The clearest example is the harmonisation of legislation carried out through rulings and directives in fields such as competition law or consumer rights, which makes it easier for firms to export to other EU countries or even to establish themselves there.

In fact, as more countries have joined the European Union, the heterogeneity between them has been increasing (mainly, but not only, in terms of per capita income). This has motivated an increase in the number of policies and instruments devoted to homogenising and reducing trade costs.

Among the various types of policies, we can distinguish between those that affect one or several countries and those that modify the overall framework of the Union. The first include the Cohesion Funds and ERDF (European Regional Development Fund), which normally finance infrastructure projects in the member states with the lowest per capita income[1]. Rodríguez-Pose and Fratesi (2004) calculate that, for the period 1989-1999, almost half (49.6 %) of the Structural Funds for Objective 1 regions were allocated to investment in infrastructures, transport and environment. Their effects were local, as they decreased the costs of internal transactions.

We also find policies which affect only the imports or exports of one of the members. The typical political measures on trade, such as tariffs, quotas and other non-tariff barriers, are mainly related to imports. The policies affecting exports are basically export subsidies but also internal legislation in the style of the US anti-trust laws or different types of public aid (such as direct grants, tax incentives for continued training activities in companies) for the improvement of product quality, design, packaging or marketing, which facilitate penetration in external markets. In this group we can also include any public policy devoted to the improvement of industrial technology as a way

[1] Obviously, the main purpose of these investments is not to reduce trade costs but rather to encourage the economic and social cohesion of the poorest regions of the Union, as affirmed in article 158 of the Treaty Establishing the European Community. Paradoxically, although their effects on transaction costs are clear, it does not appear to be empirically demonstrated that the aim of reducing inequality is being achieved. Several studies (see Garcia-Milà and McGuire, 2001, or Boldrin and Canova, 2001) suggest a weak impact of EU regional funds on regional inequalities and convergence.

of favouring external competition (see Pollard and Storper, 1996). Sheringhaus and Rosson (1990) provide a complete set of public measures undertaken by developed countries to foster exports. Recent studies analyse the impact on exports of government export promotion assistance programs (Gencturk and Kotabe, 2001) and of export promotion agencies and their strategies (Rose, 2005; Lederman et al., 2006; and Gil Pareja, 2008). They find a positive and statistically significant effect of these public policies on exports.

Among the measures affecting the overall framework of the Union, we can highlight the introduction of the Euro in 1999, which facilitated trade by reducing uncertainties about exchange rates. Investment in trans-European networks can also be included in this group, since investment in infrastructures facilitates economic integration (Puga, 2002; Vickerman et al., 1999). These measures affect the transaction costs of all the member states at the same time.

Thus, any integration process can involve a wide set of policy measures devoted to reducing transaction costs. Martin and Rogers (1995) defined public infrastructure as any good or service provided by the state which can facilitate the connection between production and consumption. Good infrastructures mean low transaction costs; poor infrastructures represent a situation where trade is difficult because of the high costs incurred. It is evident that transport and communication media can be included among these trade infrastructures, but there are other elements, such as the legal system or the levels of public safety, which have an equally great influence on trade. We will consider the latter, besides the more common transport costs, when we analyse the effects of a reduction of transaction costs.

The aim of this paper is to present, from a theoretical perspective, a model in which to analyse the effects of a reduction in trade costs (in a wide sense, not only transport costs). We consider iceberg costs (Samuelson, 1954): a portion of every good produced is lost in transport and, thus, not finally consumed. The portion lost can be reduced by adequate trade policies.

The interest of our analysis comes from the fact that a trade integration process not only changes internal trade and commercial relations with other countries, but also has repercussions on other key aspects of the spatial and temporal organisation of economic activity. The ample literature in the field of economic geography has discussed its implications for industrial location[2] (the basic mechanisms of transmission in models of economic geography are described, for example, in the survey of Ottaviano and Puga, 1998). But, in a dynamic context, the capacity for sustaining long-run economic growth can also be influenced. Finally, due to this diversity of influences, trade integration also has an impact on social welfare. This is an important dimension because, generally, neither the concentration of activity nor a higher growth rate are necessarily associated with greater levels of welfare (for example, Pfüger and Südekum,

[2] Empirically, the intensity of these effects may vary according to regional characteristics. Huber (2004) analyses the case of the EU during the period 1975-2000 and considers a series of variables (salaries, population growth, investment rates, productivity and salary growth) where the effect of increases has been small, although effects on regional salaries and investment rates are stronger than the rest, at least in the long term. Hanson (1997, 1998) finds that the formation of the North American Free Trade Agreement (NAFTA) led to a less concentrated spatial distribution of production in Mexico because it was more beneficial for firms to be sited along the frontier with the US than in the old industrial belt of Mexico City. Sjöberg and Sjoholm (2004) conclude that the liberalisation of trade in Indonesia did not decrease spatial concentration in the manufacturing industry for the period 1980-1996.

2008, find, in a simple model of economic geography, that the spatial distribution of the most efficient activity depends decisively on the degree of freedom of trade).

In this work, we follow the model developed by Martin and Ottaviano (1999), which joins a framework of endogenous growth similar to Romer (1990) and Grossman and Helpman (1991) with a geographical framework similar to Helpman and Krugman (1985) and Krugman (1991). Martin and Ottaviano's model, which only analysed the role of common international infrastructures, was widened in Martin (1999) to include domestic infrastructures. In both cases, the role of public infrastructures was introduced following the static model of Martin and Rogers (1995), which distinguishes between domestic and common international infrastructures. We will go a step further and consider a wider casuistry, following Lanaspa and Sanz (2004), including asymmetries in what we can refer to, in a broad sense, as import and export infrastructures.

We consider two countries that are heterogeneous in two main aspects. First, in their trade policies, that is to say, the wide set of measures that can promote either imports or exports. This gives value to this paper, since, as far as we know, no work has been devoted to analysing such policies from a theoretical point of view. Second, they are also considered different in their per capita incomes since, as we will see, the effects of any measure can depend on the characteristics of the country that introduces it.

When the integration process consists of a reduction in the costs associated with the internal trade of the rich country, its exports or the imports of the poor country, some firms move from the poor to the rich country and the growth rate accelerates. As a consequence, the welfare of both countries increases. However, when the internal trade of the poor country or its exports are promoted, the firms tend to move to the poor country and the growth rate diminishes. Although the latter effect could be associated with a loss of welfare (which would make this type of policies pointless), this is not necessarily the case for the poor country.

The paper is structured as follows. Section 2 presents the basic characteristics of the theoretical model. Section 3 deals with geography, that is, with the equilibrium distribution of firms. Section 4 determines the steady state growth rate, which depends on industrial location, but also influences it through the resulting distribution of income. Section 5 analyses the effects of economic integration through the impact of different trade policies. Section 6 considers a simpler framework to analyse specific policy measures whose effects are not conclusive in a general framework. Finally, in Section 7, some simulations are carried out to analyse the effects of trade policies on welfare. The work ends with the conclusions.

2. The model

We consider two countries, North and South, which trade with each other. They are identical except for their initial level of capital, K_0 in the North and K_0^* in the South, and their trade policies. We suppose that the initial endowment of capital is greater in the North: $K_0 > K_0^*$. Both countries are inhabited by representative households playing the part of consumers, workers and researchers. There are L families, both in the North and in the South. Labour is mobile between sectors but immobile between countries, which excludes accumulative causation and impedes a catastrophic agglomeration.

Given that the model is almost symmetrical, we will focus on the description of the economy of the North (an asterisk denotes that the variables correspond to the South). The preferences are instantaneously nested-CES and intertemporally CES, with an elasticity of intertemporal substitution equal to the unit:

$$U_0 = \int_0^{\infty} \log\left[D(t)^{\alpha} Y(t)^{1-\alpha}\right] e^{-\rho \cdot t} dt \qquad , \qquad 0 < \alpha < 1 \qquad (1)$$

where $\rho > 0$ is the intertemporal discount rate, Y is the numerary good and D is a composite good à la Dixit-Stiglitz, which consists of a number of different varieties:

$$D(t) = \left[\int_0^{N(t)} D_i(t)^{1-\frac{1}{\sigma}} di \right]^{\frac{1}{\left(1-\frac{1}{\sigma}\right)}} \qquad , \qquad \sigma > 1 \qquad (2)$$

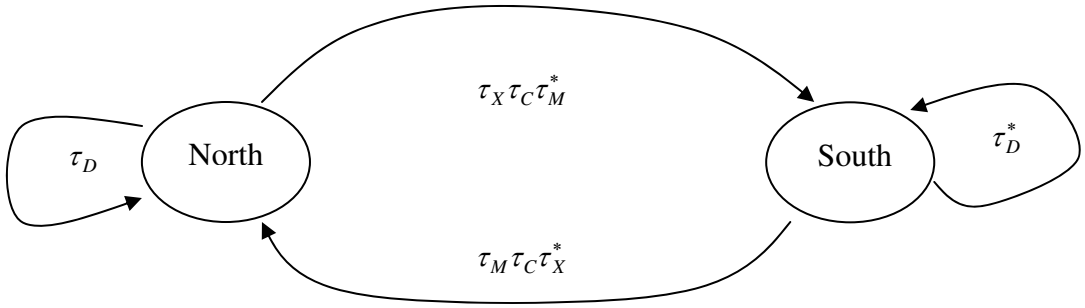
N is the total number of varieties produced between the two countries, and σ is the elasticity of substitution between varieties, assuming that N is high enough. It can be shown that σ is also the demand price elasticity of the demand for each variety. Growth is produced through an increase in the number of varieties.

The value of spending per capita E in terms of the numerary Y is:

$$\int_{i \in n} \tau_D p_i D_i di + \int_{j \in n^*} \tau_M \tau_C \tau_X^* p_j^* D_j dj + Y = E \,, \qquad \tau > 1. \quad (3)$$

The number of manufactured goods produced in each country, n and n^*, is endogenous, with $N = n + n^*$.

Domestic trade costs are represented by the parameters τ_D and τ_D^*, and common international costs by τ_C. The latter affect the flow of trade between the countries, as do the costs of imports (τ_M, τ_M^*) and exports (τ_X, τ_X^*). All the $\tau > 1$ are considered to be iceberg costs, as in Samuelson (1954), which affect only the differentiated good (not the homogenous one), according to the following outline:



That is to say, for the North, for each unit of good traded, only $\tau_D^{-1} < 1$ is available for consumption and, of each unit sent to the South from the North, only $\left(\tau_X \tau_C \tau_M^*\right)^{-1} < 1$ really reaches the consumer. These transaction costs affect internal trade (τ_D for the North and τ_D^* for the South) and international trade ($\tau_X \tau_C \tau_M^*$ for a sale from the North and $\tau_M \tau_C \tau_X^*$ for a sale from the South). Thus, any τ_j captures that a portion of the good is lost in transit and, as in Martin and Rogers (1995),

constitutes a measure of how easy trade is. Reductions in any τ_j denote lower transaction costs and, thus, indicate that trade is easier.

Note that the import costs of a country do not coincide with the export costs of the other because they capture the trade policy decisions taken by each country individually. For example, the North may decide to establish export subsidies (τ_X decreases), which make the market of the other country more accessible for their products. A similar effect can be achieved by the South through a reduction in their import tariffs (τ_M^* decreases). But, although they can have the same effect, they should be considered conceptually as different because the country that introduces the policy is different.

From here on, we will assume that $\tau_{\mathrm{D}} < \tau_M \tau_C \tau_X^*$ and that $\tau_D^* < \tau_X \tau_C \tau_M^*$: it is more expensive in terms of transaction costs to buy a differentiated good from abroad than to buy one made in the same country. We also assume that $\tau_D < \tau_D^*$: the domestic trade costs are lower in the rich country.

The numerary good *Y* is produced using only labour, subject to constant returns in a perfectly competitive sector. As labour is mobile between sectors, the constant returns in this sector tie down the wage rate *w* in each country at each moment. We assume throughout the paper that the parameters of the model are such that the numerary is produced in both countries, that is, that the total demand for the numerary is big enough so as not to be satisfied with its production in a single country. In this way, wages are maintained constant and identical in both countries. A unit of labour is needed to produce a unit of *Y*, so free competition in the labour market implies that $w = 1$ in both countries.

The differentiated goods are produced with identical technology in an industry with monopolistic competition with increasing returns in the production of each variety. To begin to produce a variety of a good, a unit of capital is needed; this fixed cost is the source of scale economies. Also, β units of labour are used to produce a unit of differentiated good. The standard rule of monopolistic competition determines the price of any variety as a margin over the cost of labour: $p^* = p = \beta\sigma/(\sigma - 1)$. The operating profits of a producer are:

$$\pi = p_i x_i(p_i) - \beta x_i(p_i) = \frac{\beta x}{(\sigma - 1)}, \qquad (4)$$

where *x* is the scale of a representative firm, equal for all varieties because of symmetry.

Investment is necessary to produce a new variety, whether in a physical asset (machinery) or an intangible one (patent). The concept of capital used corresponds to a mixture of the two types of investment. The value of the firm which produces a new variety is the value of its unit of capital. The total number of varieties and firms is determined by the stock of capital at any given time: $N = n + n^* = K + K^*$. Once the investment is made, each firm produces the new variety in a situation of monopoly and chooses where to locate its production (we assume that there are no costs of relocating the capital from one country to the other). Unlike firms, households (workers/researchers/consumers) are immobile and, therefore, their incomes are geographically fixed although firms move. In other words, if a firm owner decides to locate production in a country where he does not reside, he will repatriate the profits.

Finally, we assume there is a safe asset which pays an interest rate r whose market is characterised by freedom of financial movement between the two countries ($r = r^*$).

Resolving the first order conditions of the problem of the consumer in the North, we obtain the demands for each variety in the North (D_i) or the South (D_j), and that of the numerary good:

$$D_i = \frac{\sigma - 1}{\beta\sigma} \cdot \frac{\delta_D \alpha E}{\tau_D \left(n\delta_D + n^* \delta_M \delta_C \delta_X^* \right)}, \qquad (5)$$

$$D_j = \frac{\sigma - 1}{\beta\sigma} \cdot \frac{\delta_M \delta_C \delta_X^* \alpha E}{\tau_M \tau_C \tau_X^* \left(n\delta_D + n^* \delta_M \delta_C \delta_X^* \right)}, \qquad (6)$$

$$Y = (1 - \alpha)E, \qquad (7)$$

where $\delta_j = \tau_j^{1-\sigma}$ ($j = D, M, X, C$) are parameters between 0 and 1 which measure the openness of trade. The highest openness is found when $\delta_j = 1$ (there are no trade costs). The expressions of the demand of a consumer from the South will be analogous to the above.

The intertemporal optimisation of the consumers implies that the spending growth rate is, both in the North and in the South, $\frac{\dot{E}}{E} = \frac{\dot{E}^*}{E^*} = r - \rho$, that is, the difference between the interest rate and the intertemporal discount rate. In the steady state, E and E^* must be constant, so $r = \rho$, as we shall see below.

3. Geography

The geographical part of the model refers to the location of the firms, given that the population is immobile between countries[3]. The equilibrium location between firms is determined by four equilibrium conditions. The first two indicate that, when differentiated goods are produced in both countries, the total demand, coming from both North and South, of each variety (including transport costs) must equal supply. Thus, starting from (5) and (6):

$$x = \frac{\alpha L(\sigma - 1)}{\beta\sigma} \cdot \left(\frac{\delta_D E}{N\left[S_n \delta_D + (1 - S_n)\delta_M \delta_C \delta_X^* \right]} + \frac{\delta_X \delta_C \delta_M^* E^*}{N\left[(1 - S_n)\delta_D^* + S_n \delta_X \delta_C \delta_M^* \right]} \right), \qquad (8)$$

$$x^* = \frac{\alpha L(\sigma - 1)}{\beta\sigma} \cdot \left(\frac{\delta_D^* E^*}{N\left[(1 - S_n)\delta_D^* + S_n \delta_X \delta_C \delta_M^* \right]} + \frac{\delta_M \delta_C \delta_X^* E}{N\left[S_n \delta_D + (1 - S_n)\delta_M \delta_C \delta_X^* \right]} \right). \qquad (9)$$

[3] The populations are tied to their country but they are very interested in the location of firms because the more firms in the region, the lower the price index they have to bear. The price indexes are: $P = N^{\frac{1}{1-\sigma}} \left(\frac{\beta\sigma}{\sigma - 1} \right) \left[S_n \delta_D + (1 - S_n)\delta_M \delta_C \delta_X^* \right]^{\frac{1}{1-\sigma}}$ in the North and $P^* = N^{\frac{1}{1-\sigma}} \left(\frac{\beta\sigma}{\sigma - 1} \right) \left[(1 - S_n)\delta_D^* + S_n \delta_X \delta_C \delta_M^* \right]^{\frac{1}{1-\sigma}}$ in the South, where $S_n = \frac{n}{N}$ is the share of manufactured goods produced in the North.

The third condition is the consequence of the free movement of capital between countries ($r = r^*$), which implies an equal retribution via profits:

$$\pi = \pi^* \tag{10}$$

so, in agreement with (4), the same quantity is produced of all the varieties (whether in the North or the South), $x = x^*$. Finally, the fourth condition, already shown, indicates that the total number of varieties is fixed by the world supply of capital at each moment:

$$n + n^* = K + K^* = N\,. \tag{11}$$

Resolving the system formed by these four equations, the optimum size of each firm in equilibrium is obtained:

$$\mathrm{x} = \mathrm{x}^* = \frac{\alpha \mathrm{L}(\sigma - 1)}{\beta\sigma} \frac{\mathrm{E} + \mathrm{E}^*}{\mathrm{N}}\,. \tag{12}$$

The proportion of firms in the North ($S_n = \frac{n}{N}$) is:

$$S_n = \frac{S_E \delta_D^*}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)} - \frac{\left(1 - S_E\right)\delta_M \delta_C \delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)}\,, \tag{13}$$

where $S_E = \frac{E}{E + E^*}$ is the participation of the North in the total spending. The location equilibrium of firms depends on the national spending -greater spending implies a bigger domestic market, which attracts more firms who want to take advantage of increasing returns (home market effect)- and on all the parameters which represent trade costs.

4. Growth and income inequality

Economic growth

Firstly, we will focus on the growth rate of the economy. Starting from the solution of the problem of the intertemporal optimisation of the consumer, we know that, in equilibrium, $\frac{\dot{E}}{E} = \frac{\dot{E}^*}{E^*} = r - \rho$; as the capital flows are free, $r = r^*$ and the growth rate of spending will be the same in both countries. From (13), this implies that the ratio of producing firms in the North, S_n, is also constant in time and, thus, n, n^* and N grow at the same constant rate $g = \frac{\dot{N}}{N} = \frac{\dot{n}}{n} = \frac{\dot{n}^*}{n^*}$.

There are national spillovers in the innovation sector, that is to say, the more firms producing different manufactured goods in the same country, the less expensive the R&D activity[4]. This sector follows Grossman and Helpman (1991), with $\frac{\eta}{n}$ being

[4] This type of knowledge spillovers is closer to the concept of Jacobs (1969) than to that of Marshall-Arrow-Romer (MAR). The empirical evidence for these external effects between different industries in the same geographical unit is documented in, for example, Glaeser et al. (1992) and Henderson et al. (1995).

the cost in terms of labour of an innovation in the North and $\frac{\eta}{n^*}$ in the South. The immediate conclusion of this formulation of the sector is that, for efficiency reasons, research activity will only take place in one of the two countries, namely, the one with more firms producing the manufactured goods (which will be the rich country, the North). No researcher would have an incentive to start R&D activity in the other country. This formulation makes the analytical treatment of the model easier. More generally, if there is a certain degree of diffusion of knowledge at international level (Hirose and Yamamoto, 2007), R&D would be concentrated in the country with fewer innovation costs; in this case, trade policies could generate changes in the location of this activity.

The value of the firm is given by its unit of capital and, as the market is competitive, this value (v) will be the production cost of the unit of capital, $v = \frac{\eta}{n} = \frac{\eta}{NS_n}$. Thus, v decreases at the same rate at which N increases: $\frac{\dot{v}}{v} = -g$. As the number of varieties rises, the profits and value of each firm diminish, which can also be interpreted as the future flow of discounted profits $\left(v(t) = \int_t^{\infty} e^{-[R(s)-R(t)]} \frac{\beta x(s)}{\sigma - 1} ds \right)$, where R represents the cumulative discount factor. Taking into account the condition of arbitrage between the capital market and the safe asset, the relation between interest rates and the value of capital will be:

$$r = \frac{\dot{v}}{v} + \frac{\pi}{v} \ . \qquad (14)$$

The restriction of world resources, $E + E^* = 2 + (r\eta)/(LS_n)$, ensures that spending is constant over time; so, in the steady state $r = \rho$. Finally, we must take into account the restriction of the world labour market: total labour is distributed between the production of differentiated goods, the production of the numerary good and R&D:

$$\eta \frac{g}{S_n} + \frac{\sigma - \alpha}{\sigma} L(E + E^*) = 2L \ . \qquad (15)$$

In the steady state (its calculation is given in appendix A), the variables will grow at a constant rate. By substituting in (14) the benefits obtained in (4) and the optimum size of the firms in the equilibrium given by (12), and taking into account (15) and the condition $r = \rho$, we obtain that the steady state growth rate of K and K^* (the same for both countries) is given by:

$$g = \frac{2L}{\eta} \cdot \frac{\alpha}{\sigma} S_n - \left(\frac{\sigma - \alpha}{\sigma} \right) \rho = g(S_n). \qquad (16)$$

This rate depends upon the structural parameters of the model ($L, \eta, \alpha, \sigma, \rho$); it also has a linear dependence on the variable that represents geography (S_n).

World income distribution

Secondly, we want to know how this growth rate affects the inequality of income between the countries; let us remember that we have assumed that the North is initially the richer ($K_0 > K_0^*$). The per capita income of each country is the sum of labour income, which we have already seen is the unit, plus the capital income, which is the value of per capita wealth multiplied by the equilibrium interest rate. Thus, for the North, it will be $E = 1 + r\frac{Kv}{L} = 1 + \rho\frac{Kv}{L}$. If we substitute v applying the arbitrage equation (14), the equilibrium profits given by (4) and the optimum production scale obtained in (12), it is possible to express spending as a function of *g*:

$$E = 1 + \frac{2\alpha\rho S_K}{(\sigma - \alpha)\rho + \sigma g}, \qquad (17)$$

where $S_K = \frac{K}{K + K^*}$ is the share of capital owned by the North, which is maintained constant because K, K^* and N grow at the same rate *g* in the steady state. Similarly, for the South:

$$E^* = 1 + \frac{2\alpha\rho(1 - S_K)}{(\sigma - \alpha)\rho + \sigma g}. \qquad (18)$$

We previously defined the ratio $S_E = \frac{E}{E + E^*}$, which represents the participation of the North in the total income or spending. Substituting the expressions (17) and (18), we obtain:

$$S_E = \frac{1}{2} \cdot \frac{\sigma(\rho + g) + \alpha\rho(2S_K - 1)}{\sigma(\rho + g)}. \qquad (19)$$

If, as we have assumed, the North is richer and $S_K > \frac{1}{2}$, then $S_E > \frac{1}{2}$. However, the relationship of S_E with the growth rate is negative: a greater number of varieties diminishes the value of capital and, given that the North has more capital, the distance is reduced in relative terms.

Finally, to carry out the analysis in the following section, we want to relate geography (S_n) with the growth rate *g*. To do so, we substitute (19) in (13), obtaining:

$$S_n = \frac{1}{2} \cdot \left\{ \left[\frac{\delta_D^*}{(\delta_D^* - \delta_X \delta_C \delta_M^*)} - \frac{\delta_M \delta_C \delta_X^*}{(\delta_D - \delta_M \delta_C \delta_X^*)} \right] + \left[\frac{\delta_D^*}{(\delta_D^* - \delta_X \delta_C \delta_M^*)} + \frac{\delta_M \delta_C \delta_X^*}{(\delta_D - \delta_M \delta_C \delta_X^*)} \right] \cdot \frac{\alpha\rho(2S_K - 1)}{\sigma(\rho + g)} \right\} =$$
$$= S_n[S_E(g)]. \qquad (20)$$

5. Effects of trade integration

As we explained in the introduction, the purpose of this paper is to analyse the consequences of a trade integration process, which is represented through a decrease in trade costs. We distinguish between domestic and international costs and, within the latter, common, import and export costs. Remember that, while domestic and common

international costs can be easily associated with physical trade infrastructures (although they are not necessarily so), import and export costs also include the whole range of trade policies that affect the sales to, or the purchases from, abroad. We carry out our analysis from the perspective of the effects of these policies on industrial location, growth rate and welfare.

We adopt the simplifying assumption that the reduction of any of these costs requires no financing from either of the countries, either because the measures involve no cost or because the financing comes from, for example, an international organisation. There are two reasons for this. Firstly, we are using a broad concept of costs that encompasses very different elements. Dismantling administrative obstacles (like tariff barriers) is essentially free of cost, but physical infrastructures do require a strong outlay. Given this heterogeneity of trade policies, it is difficult to choose a single formula of financing that applies to all of them. Secondly, the explicit consideration of means of financing would make the treatment of the model cumbersome without adding qualitatively different results.

In the previous section, where we considered that the two countries are different (one rich and one poor), we obtained two equations, (16) and (20), which relate the growth rate with the distribution of firms, and vice versa. The function $g = g(S_n)$ is linear and increasing: given that technological spillovers are local, the higher the industrial concentration, the lower the innovation costs and the greater the growth rate. The function $S_n = S_n(g)$ is convex and decreasing. Remember that this equation includes the inequality of incomes, $S_n = S_n[S_E(g)]$, and that this decreases as g increases via the reduction of the monopolistic profits of the firms. At the same time, as the differences in income vanish, industrial concentration and the rich country's market size decrease as a consequence of the "home market effect". These functions are represented in Figure 1.

The variations in any type of trade costs do not affect the straight line $g = g(S_n)$, which depends only on the structural parameters of the model. They will only affect the curve $S_n = S_n(g)$, changing its position and inclination.

Below, we look at the different effects of trade integration according to the specific type of trade costs that are reduced.

Domestic trade costs

When commercial integration takes the form of a reduction in domestic costs, it increases the effective internal demand (domestic consumers bear fewer transport costs) and thus attracts firms to the country in which the policy has been implemented. If it is the North, which is the richer country and thus has a bigger market, firms will decide to move to the North to take more advantage of increasing returns and the ratio S_n will increase (remember that there are no relocation costs). Concentration improves the growth rate (Figure 2); the more manufacturers located in the North, the lower the innovation costs in the R&D sector:

$$\frac{\partial S_n}{\partial \delta_D} > 0, \frac{\partial g}{\partial \delta_D} > 0.$$

The same reasoning is applied if the poor country reduces its domestic trade costs: more firms are attracted, wanting to better exploit its growing returns and its increasing effective internal demand. But the effect on the growth rate is different: as firms move to the South, the externalities derived from the variety of products in the North are reduced, the costs of the research sector are increased, and the economy's growth rate (Figure 3) decreases:

$$\frac{\partial S_n}{\partial \delta_D^*} < 0, \frac{\partial g}{\partial \delta_D^*} < 0.$$

However, this benefits the inhabitants of the North, because the rate at which their capital loses value (g) is reduced; this implies from (19) that income inequality increases.

Import-enhancing policies

When one of the countries reduces its import costs, it becomes easier to reach its market from the other country (think, for example, of a lowering of tariffs). If the North carries out such measures, the effective demand of the consumers of the North for the goods produced in the South will increase, so some firms located in the North will decide to move to the South. For these firms, this movement means two advantages. On the one hand, they can better satisfy the demand of consumers in the South when the costs of sending a unit from the North ($\tau_X \tau_C \tau_M^*$) are replaced by just the internal transport costs (τ_D^*) of the South (remember that $\tau_D^* < \tau_X \tau_C \tau_M^*$). On the other hand, firms moving to the South benefit from the increase in effective demand due to the reduction in import costs (from which they would not benefit if they stayed in the North). The relocation of manufacturing firms also has a negative effect on R&D as it provokes an increase in research costs through the reduction of externalities in the North and, thus, also negatively affects the growth rate of the economy (a similar situation to that of Figure 3):

$$\frac{\partial S_n}{\partial \delta_M} < 0, \frac{\partial g}{\partial \delta_M} < 0.$$

When the South is the country that introduces policies that reduce its import costs, firms will move to the North, benefiting from the increase in effective demand of the consumers in the South for the goods produced in the North and from the reduction in transport costs when substituting $\tau_M \tau_C \tau_X^*$ by τ_{D} ($\tau_{\mathrm{D}} < \tau_M \tau_C \tau_X^*$). But the effects on growth will be positive: with the increase in the number of firms located in the North, the cost of R&D decreases and the economy's growth rate increases (a similar situation to Figure 2):

$$\frac{\partial S_n}{\partial \delta_M^*} > 0, \frac{\partial g}{\partial \delta_M^*} > 0.$$

Moreover, from (19), the inequality of income between the two countries is reduced.

To sum up, the country that decides to dismantle trade barriers (thus reducing import costs) will lose firms, so neither country has incentives to carry out this measure unilaterally. If the two countries decide to carry out an equal and simultaneous change, that is, a joint lowering of trade barriers, the effect on the location of industries and

growth is indeterminate. Thus, a joint lowering of trade barriers can lead to a rise in the growth rate only in some specific cases (Appendix B).

Export-enhancing policies

The policies that reduce export costs make it easier to penetrate the market of the other country, i.e., the market potential is increased for the firms of the country implementing these policies. If the North carries out such measures, more firms will come from the South because it is now less expensive to send goods from the North to the South, and in the richer country increasing returns can be exploited better. With the increase in the number of firms, research costs will be reduced, thanks to the national spillovers, and the growth rate will rise (a similar situation to Figure 2):

$$\frac{\partial S_n}{\partial \delta_X} > 0 \,, \frac{\partial g}{\partial \delta_X} > 0 \,.$$

But if the poor country reduces its export costs, it will also be capable of attracting firms. The lowering of transport costs means an increase in the effective demand of consumers in the North for the goods produced in the South; the firms which move to the South can benefit from this increase, as well as from the reduction in trade costs associated to sales in the South (from $\tau_X \tau_C \tau_M^*$ to τ_D^*). The effect on the growth rate will be negative (a situation identical to Figure 3), as the number of firms in the country where the most efficient R&D sector is located will decrease:

$$\frac{\partial S_n}{\partial \delta_X^*} < 0 \,, \frac{\partial g}{\partial \delta_X^*} < 0 \,.$$

In this case, the trade policy will achieve its aim of attracting more firms and increasing economic activity; the country which improves its export costs receives new firms, while the other country loses them. However, what happens if the two countries agree to stop subsidising exports? As in the case of the joint lowering of tariffs, a co-ordinated action produces an indeterminate result. Again, depending on the initial conditions, trade integration based on a joint action on export infrastructures might increase growth (Appendix B).

International common trade costs

Determining the effect of a reduction in common international trade costs is more difficult. Differentiating (16) and (20) and grouping terms, we obtain:

$$dS_n = \left[1 + \left(\frac{\delta_D^*}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)} + \frac{\delta_M \delta_C \delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)} \right) \frac{\rho\left(2S_K - 1\right)\frac{L}{\eta}\alpha^2}{\left[\sigma\left(\rho + g\right)\right]^2} \right]^{-1} \cdot$$

$$\cdot \left[\left(\frac{\delta_D^* \delta_X \delta_M^*}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)^2} + \frac{\delta_M \delta_X^* \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2} \right) S_E - \frac{\delta_M \delta_X^* \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2} \right] d\delta_C \gtrless 0$$

The effect remains indeterminate. The first bracket has a positive sign as long as the North is richer ($S_K > 1/2$) but, in the second bracket, we can identify two opposite effects:

1. A positive effect corresponding to the first term, whose magnitude depends on S_E and which we identify with the home market effect; the change in δ_C means that it is less costly to send goods to the South, so it is more attractive for firms to be located in the North, where the market is bigger and they can take better advantage of increasing returns. Evidently, if S_E is greater, concentration will probably be accentuated due to a greater home market effect.
2. But the reduction in common trade costs also means a decrease in the cost of sending goods from the South to the North. And the lower the costs of importing in the North and exporting in the South, the bigger the decrease in transaction costs from South to North in relative terms, and the more firms will decide to relocate in the South. This negative effect is captured in the second term. The competition effect is also operative. We must not forget that the monopolistic profits decrease with the number of firms so, if S_n decreases, so does the growth rate of new firms.

6. Homogenous countries

In the previous section, we have analysed the effects of integration in the most general framework possible, that is, considering that countries can differ both in wealth and in their trade policies. However, when analysing changes in common trade costs or simultaneous variations in export or import costs, we could not determine their effects on the growth rate or on industrial location. In order to carry out this analysis, we have to adopt a simplifying assumption that the countries are homogenous and differ only in their international trade policies[5].

Thus, we suppose now that the two countries have the same wealth ($S_E = 1/2$)[6], that is, equal supply of capital ($K_0 = K_0^*$) which implies that $S_K = 1/2$, and the same domestic trade costs ($\delta_D = \delta_D^*$). With this simplification we eliminate one of the two effects (the home market effect) that cause the indetermination. Under these conditions ($S_K = 1/2$ and $\delta_D = \delta_D^*$), if the two countries have the same market size ($S_E = 1/2$), the distribution of firms and the growth rate will depend only on the different trade costs and (20) changes to:

$$S_n = \frac{1}{2}\left[\frac{\delta_D}{\left(\delta_D - \delta_X \delta_C \delta_M^*\right)} - \frac{\delta_M \delta_C \delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)}\right],$$

while condition (16) remains intact:

$$g = g(S_n).$$

Remember that R&D will take place only in the country with more firms. In the earlier sections, it was the North, due to its superior initial supply of capital and the

[5] The conclusions obtained in the previous section on changes carried out in only one country in import or export costs are maintained under this simplification.

[6] This supposition implies that equality of income is maintained constant over time and is independent of the growth rate.

home market effect, which allowed us to affirm that most firms would be set up in the country with a bigger market and, thus, more demand. Now the location of firms will depend solely on the different trade costs and firms will locate in the country with the easiest access to the market of the other.

Let us suppose that the North has more firms ($S_n > 1/2$); this is the case when the condition $\delta_M \delta_C \delta_X^* < \delta_X \delta_C \delta_M^*$ holds, that is, it is easier to send goods to the South from the North than vice versa. When asymmetries in per capita income and domestic trade costs are eliminated, this makes the North more attractive to firms than the South, and most will be located there. If this condition is fulfilled, S_n will be a horizontal straight line with positive order in the origin.

We will analyse the effects of integration when the countries are obliged to implement some kind of policy simultaneously.

Import-enhancing policies

Let us consider an equal and simultaneous lowering of import costs in the two countries ($d\delta_M = d\delta_M^*$), similar to lowering trade barriers:

$$\frac{dS_n}{d\delta_M} = \frac{1}{2}\delta_D \delta_C \left[\frac{\delta_X}{\left(\delta_D - \delta_X \delta_C \delta_M^*\right)^2} - \frac{\delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2} \right] \gtrless 0 .$$

As can be seen, even maintaining the condition $\delta_M \delta_C \delta_X^* < \delta_X \delta_C \delta_M^*$, the effects on industrial concentration and on the growth rate remain indeterminate and depend on the export costs in both countries. If the North has lower export costs ($\delta_X \geq \delta_X^*$), the effect is positive. Firms take advantage of the lowering of trade barriers to locate in the country with lower export costs, that is, the country where it is easier to have access to the market of the other, and so industrial concentration will increase. And the increase in the number of firms in the North will provoke an increase in the growth rate of the economy. But, if $\delta_X < \delta_X^*$, the effect remains indeterminate, depending on the values of the different trade costs.

Export-enhancing policies

Now we will analyse a simultaneous and identical reduction in export costs in both countries ($d\delta_X = d\delta_X^*$). The expression obtained is the following:

$$\frac{dS_n}{d\delta_X} = \frac{1}{2}\delta_D \delta_C \left[\frac{\delta_M^*}{\left(\delta_D - \delta_X \delta_C \delta_M^*\right)^2} - \frac{\delta_M}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2} \right] \gtrless 0 .$$

Maintaining the condition $\delta_M \delta_C \delta_X^* < \delta_X \delta_C \delta_M^*$, if the South has lower import costs ($\delta_M^* \geq \delta_M$), this measure constitutes an incentive for firms to move to the country which is more difficult to access from outside, the North (remember that we can identify import costs with tariffs and trade barriers in general). Thus, the effect on industrial concentration is positive, which benefits the R&D sector and increases the growth rate of the economy. However, if $\delta_M^* < \delta_M$, the sign is indeterminate, depending again on the relation between the trade costs of the two countries.

Common international trade costs

In the simplified framework of this section, the reduction of common international trade costs has a clear and positive sign: $\frac{dS_n}{d\delta_C} > 0$, given that a reduction in δ_C makes it even easier to reach the market of the South from the North. The greater concentration of firms in the North has the known positive effect on the growth rate of the economy, as research costs are decreased. This change is represented in Figure 4.

7. Welfare

In previous sections, we have seen how trade integration could, depending on certain conditions, carry firms to the rich country, or not, and improve the growth rate, or not. However, nothing has been affirmed about the desirability of one or the other situation. In this section, we will address this gap.

The indirect utility function of a household in the North is:

$$V = \frac{1}{\rho}\ln\left\{\alpha^{\alpha}(1-\alpha)^{1-\alpha}\left(\frac{\sigma-1}{\beta\sigma}\right)^{\alpha}\left(1+\frac{2\alpha\rho S_K}{(\sigma-\alpha)\rho+\sigma g}\right)N_0^{\frac{\alpha}{\sigma-1}}\left(S_n(\delta_D-\delta_M\delta_C\delta_X^*)+\delta_M\delta_C\delta_X^*\right)^{\frac{\alpha}{\sigma-1}}e^{\frac{\alpha g}{\rho(\sigma-1)}}\right\}. \tag{21}$$

Similarly, for the South:

$$V^* = \frac{1}{\rho}\ln\left\{\alpha^{\alpha}(1-\alpha)^{1-\alpha}\left(\frac{\sigma-1}{\beta\sigma}\right)^{\alpha}\left(1+\frac{2\alpha\rho(1-S_K)}{(\sigma-\alpha)\rho+\sigma g}\right)N_0^{\frac{\alpha}{\sigma-1}}\left(\delta_D^*-S_n(\delta_D^*-\delta_X\delta_C\delta_M^*)\right)^{\frac{\alpha}{\sigma-1}}e^{\frac{\alpha g}{\rho(\sigma-1)}}\right\}. \tag{22}$$

Differentiating the indirect utility for the North with respect to S_n, and taking into account that $\frac{\partial g}{\partial S_n} = \frac{2L}{\eta}\cdot\frac{\alpha}{\sigma}$, the impact of an increase in industrial concentration is obtained as:

$$\frac{\partial V}{\partial S_n} = -\frac{4\alpha^2 L S_K}{\eta\left[(\sigma-\alpha)\rho+\sigma g+2\eta\alpha\delta S_K\right]\left[(\sigma-\alpha)\rho+\sigma g\right]}+\frac{2\alpha^2 L}{\sigma\eta\rho^2(\sigma-1)}+$$
$$+\frac{\alpha}{\rho(\sigma-1)}\cdot\frac{(\delta_D-\delta_M\delta_C\delta_X^*)}{\left(S_n\delta_D+(1-S_n)\delta_M\delta_C\delta_X^*\right)}\gtrless 0.$$

The effect on welfare remains indeterminate. As in Martin and Ottaviano (1999), there are three effects:

a) The first is the negative impact of an increase of *g* on the wealth of the North, captured in the first addend of the above expression. The increase of industrial concentration in the North diminishes the cost of R&D and raises the growth rate. This provokes a reduction of monopolistic profits and, thus, further lowers per capita income in the North.

b) The second addend captures the positive impact on the growth rate, which increases the utility of individuals due to the love-of-variety effect implied by their preferences.

c) The last addend captures the increase in welfare due to the decrease in transport costs for consumers in the North when S_n rises.

A similar expression is obtained for the South:

$$\frac{\partial V^*}{\partial S_n} = -\frac{4\alpha^2 L(1-S_K)}{\eta[(\sigma-\alpha)\rho+\sigma g+2\eta\alpha\rho(1-S_K)][(\sigma-\alpha)\rho+\sigma g]} + \frac{2\alpha^2 L}{\sigma\eta\rho^2(\sigma-1)} - \frac{\alpha}{\rho(\sigma-1)} \cdot \frac{(\delta_D^* - \delta_X\delta_C\delta_M^*)}{\left(S_n\delta_X\delta_C\delta_M^* + (1-S_n)\delta_D^*\right)} \gtrless 0,$$

with the difference that the sign of the third effect will be the opposite as an increase in industrial concentration in the North provokes an increase in the transport costs which will have to be borne by the consumers of the South, reducing their welfare.

Both the indirect utility functions and their derivatives are too complex to evaluate analytically, so we will carry out the analysis via simulations. We want to know how welfare will vary in the two regions after changes in trade costs which provoke variations in the distribution of firms. To simplify, we analyse discrete variations, focusing only on the sign of change in the utility of the two countries, which is obtained in (21) and (22) by evaluating the direct impact of the changes in the trade policies as well as the indirect effects due to the changes in S_n and g.

Table 1 shows the effects of reductions in trade costs, both domestic and international, of the rich and poor countries[7].

In general, the results suggest that, if trade integration through the reduction of any kind of trade costs leads to industrial concentration in the rich country, the overall growth rate of the economy will rise, generating improvements in the welfare of both the rich and the poor country. If industrial concentration decreases in the rich country and industry moves to the poor country, the growth rate falls although, in spite of this, the poor country can increase its welfare.

The key parameters for an increase of welfare in the poor country are the distribution of capital, which directly influences the equilibrium location of firms and, thus, influences the growth rate, and the relation between domestic and international transport costs. From (20), we can see how the nearer S_K is to $1/2$, the less impact there will be from a change in any trade policy on the proportion of firms in the rich country and, thus, on the growth rate. Therefore, the nearer S_K is to $1/2$, the more likely it is that the welfare of the poor country will improve.

These results highlight the advantages that can be derived for the countries from co-ordinated policy measures, but they also open the way to the possibility of individual strategic behaviours which could lead to trade wars to try to claim a greater share of world demand.

8. Conclusions

This paper analyses the consequences of trade integration between countries that may be different in their wealth and in their trade policies, or similar. The aim is to study how industrial concentration, the growth rate of the economy and welfare are affected.

[7] The remaining parameters are $N_o = 10$, $\sigma = 4$, $\alpha = 0.6$, $\beta = 1$, $\eta = 12$, $L = 3$, $\rho = 0.06$, $S_k = 0.6$, similar values to those habitually used in the literature.

Productivity growth is endogenous and based on spillovers in innovation. Since these spillovers are assumed to be local, R&D activities are only carried out in one of the countries; thus, the greater the industrial concentration in that country, the greater the growth rate of the economy. The theoretical framework follows Martin and Ottaviano (1999), but include asymmetries which allow countries to present different trade policies: our model distinguishes between domestic and international trade costs and, within the latter, common, import and export costs.

The differences in factor endowments (and, thus, in income), on the one hand, and in trade policies, on the other, are two elements which interact when determining both the spatial distribution of economic activity, growth and welfare and their evolution.

The results we find with this classification coincide with Martin (1999) on the effects of domestic trade costs but differ on the effects of international costs. In Martin (1999), an unambiguous positive relationship between lower international transaction costs and growth was found. In our framework, the trade integration process can lead to a rise in industrial concentration, the growth rate and welfare, or not, depending on which country adopts the measures needed for integration and which specific costs are reduced. If the rich country reduces its domestic or export costs, or the poor country reduces its import costs, industrial concentration rises in the rich country, while the economic growth rate and welfare rise in both countries. However, when the poor country reduces its domestic costs or introduces export-enhancing policies (or the rich country reduces its import costs), integration leads to a lowering of industrial concentration and a drop in the growth rate. Although less growth could be associated with lower welfare, we find that this is not necessarily the case, since the poor country can improve its welfare, which would justify the adoption of these policies.

In order to make the analysis clearer for some specific policies, such as the reduction of common international trade costs, a joint lowering of tariffs or a simultaneous reduction of export subsidies, we have had to simplify the model by considering more homogeneous countries. Any of these measures could lead to an increase in industrial concentration, the growth rate and welfare in both countries, as long as firms concentrate in the country whose market potential has been widened by the policies.

To sum up, we can say that a trade integration process does not have a monotonic effect on industrial concentration, the economic growth rate or the welfare of the countries involved in it, and the final result depends on which country introduces the political measures and what type of trade cost is affected by that decision.

Appendix A: Steady state equilibrium.

Starting from (13), (16) and (19), the value of S_n in the steady state is the solution of the second degree equation:

$$2S_n^2 L\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right) -$$
$$- S_n\left[L\delta_D^*\left(\delta_D - \delta_M \delta_C \delta_X^*\right) - L\delta_M \delta_C \delta_X^*\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right) - \rho\eta\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right)\right] -$$
$$- \rho\eta\left[S_K \delta_D^*\left(\delta_D - \delta_M \delta_C \delta_X^*\right) - (1 - S_K)\delta_M \delta_C \delta_X^*\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\right] = 0.$$

The valid solution is:

$$S_n = \frac{\left[L\delta_D^*\left(\delta_D - \delta_M \delta_C \delta_X^*\right) - L\delta_M \delta_C \delta_X^*\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right) - \rho\eta\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right)\right] + \sqrt{\Delta}}{4L\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right)}$$

where

$$\Delta = \left[L\delta_D^*\left(\delta_D - \delta_M \delta_C \delta_X^*\right) - L\delta_M \delta_C \delta_X^*\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right) - \rho\eta\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right)\right]^2 +$$
$$+ 8L\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\left(\delta_D - \delta_M \delta_C \delta_X^*\right) \cdot \rho\eta\left[S_K \delta_D^*\left(\delta_D - \delta_M \delta_C \delta_X^*\right) - (1 - S_K)\delta_M \delta_C \delta_X^*\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)\right]$$

The other root is greater than the unit. From this equilibrium value of S_n, we can obtain that of *g* starting from (11) and that of S_E from (14).

Appendix B: Simultaneous variations in import and export costs.

We first suppose a simultaneous and identical variation in import costs ($d\delta_M = d\delta_M^*$). Differentiating (11) and (15) and grouping terms, we obtain:

$$dS_n = \left[1 + \left(\frac{\delta_D^*}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)} + \frac{\delta_M \delta_C \delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)}\right)\frac{\rho\left(2S_K - 1\right)\frac{L}{\eta}\alpha^2}{\left[\sigma\left(\rho + g\right)\right]^2}\right]^{-1} \cdot$$

$$\cdot\left[\left(\frac{\delta_D^* \delta_X \delta_C}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)^2} + \frac{\delta_C \delta_X^* \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2}\right)S_E - \frac{\delta_C \delta_X^* \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2}\right] d\delta_M \gtrless 0.$$

For an identical and simultaneous improvement in export costs ($d\delta_X = d\delta_X^*$), we obtain a similar expression:

$$dS_n = \left[1 + \left(\frac{\delta_D^*}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)} + \frac{\delta_M \delta_C \delta_X^*}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)}\right)\frac{\rho\left(2S_K - 1\right)\frac{L}{\eta}\alpha^2}{\left[\sigma\left(\rho + g\right)\right]^2}\right]^{-1} \cdot$$

$$\cdot\left[\left(\frac{\delta_D^* \delta_M^* \delta_C}{\left(\delta_D^* - \delta_X \delta_C \delta_M^*\right)^2} + \frac{\delta_C \delta_M \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2}\right)S_E - \frac{\delta_C \delta_M \delta_D}{\left(\delta_D - \delta_M \delta_C \delta_X^*\right)^2}\right] d\delta_X \gtrless 0.$$

As in the case of common trade costs, described at the end of Section 5, the sign of the variation in industrial location (and, thus, of the variation in the growth rate) remains indeterminate.

References

[1] Boldrin, M. and F. Canova (2001). Inequality and convergence: Reconsidering European Regional Policies. Economic Policy 16 (32), 205-253.

[2] Garcia-Milà, T. and T. McGuire (2001). Do interregional transfers improve the economic performance of poor regions? The case of Spain. International Tax and Public Finance 8 (5), 281-95.

[3] Gençtürk, E. F. and M. Kotabe (2001). The Effect of Export Assistance Program Usage on Export Performance: A Contingency Explanation. Journal of International Marketing 9, 51-72.

[4] Gil Pareja, S., R. Llorca Vivero and J. A. Martínez Serrano (2008). Measuring the impact of regional export promotion: The Spanish case. Papers in Regional Science 87 (1), 139-146.

[5] Glaeser, E.L., H. Kallal, J. Scheinkman and A. Schleifer (1992). Growth in cities. Journal of Political Economy 100, 1126-1152.

[6] Grossman, G. and E. Helpman (1991). Innovation and growth in the world economy. MIT Press, Cambridge, MA.

[7] Hanson, G. H. (1997). Increasing returns, trade and the regional structure of wages. Economic Journal 107, 113-33.

[8] Hanson, G. H. (1998). North American economic integration and industry location. Oxford Review of Economic Policy 14, 30-44.

[9] Helpman E. and P. Krugman (1985). Market structure and foreign trade. MIT Press, Cambridge, MA.

[10] Henderson, V., A. Kuncoro and M. Turner (1995). Industrial development in cities. Journal of Political Economy 103 (5), 1067-1090.

[11] Hirose, K. and K. Yamamoto (2007). Knowledge spillovers, location of industry, and endogenous growth. Annals of Regional Science 41, 17-30.

[12] Huber, P. (2004). An empirical analysis of the regional effects of European integration. Manuscript, WIFO, Vienna.

[13] Jacobs, J. (1969). Economy of Cities. Vintage, New York.

[14] Krugman, P. (1991). Increasing returns and economic geography. Journal of Political Economy 99, 483-499.

[15] Lanaspa, L. and F. Sanz (2004). Regional policy and industrial location decisions. Investigaciones Económicas XXVIII (1), 67-87.

[16] Lederman, D., M. Olarreaga and L. Payton (2006). Export promotion agencies: What works and what doesn't. World Bank Policy Research Working Paper 4044.

[17] Martin P. (1999). Public policies, regional inequalities and growth. Journal of Public Economics 73, 85-105.

[18] Martin P. and G.I.P. Ottaviano (1999). Growing locations: industry location in a model of endogenous growth. European Economic Review 43, 281-302.

[19] Martin P. and C.A. Rogers (1995). Industrial location and public infrastructure. Journal of International Economics 39, 335-351.

[20] Ottaviano, G.I.P. and D. Puga (1998). Agglomeration in the global economy: A survey of the 'New Economic Geography'. World Economy 21 (6), 707-731.

[21] Pflüger, M. and J. Südekum (2008). Integration, agglomeration and welfare. Journal of Urban Economics 63, 544-66.

[22] Pollard, J. and M. Storper (1996). Metropolitan employment change in dynamic industries in the 1980s. Economic Geography 72, 1-22.

[23] Puga, D. (2002). European regional policies in light of recent location theories. Journal of Economic Geography 2, 373-406.

[24] Rodríguez-Pose, A., and U. Fratesi (2004). Between Development and Social Policies: The Impact of European Structural Funds in Objective 1 Regions. Regional Studies 38 (1), 97-113.

[25] Romer, P. (1990). Endogenous technical change. Journal of Political Economy 98: 338-54.

[26] Rose, A. (2005). The foreign service and foreign trade: Embassies as export promotion. NBER Working Paper 11111.

[27] Samuelson, P. (1954). The transfer problem and transport costs, II: analysis of effects of trade impediments. Economic Journal 64, 264-289.

[28] Sheringhaus, F.H. and P. Rosson (1990). Government Export Promotion. Routledge.

[29] Sjöberg, Ö. And F. Sjoholm (2004). Trade liberalization and the geography of production: agglomeration, concentration, and dispersal in Indonesia's manufacturing industry. Economic Geography 80 (3), 287-310.

[30] Vickerman, R.; K. Spiekemann, and M. Wegener (1999). Accesibility and economic development in Europe. Regional Studies 33 (1), 1-15.

Figure 1. – Growth rate and firms location.

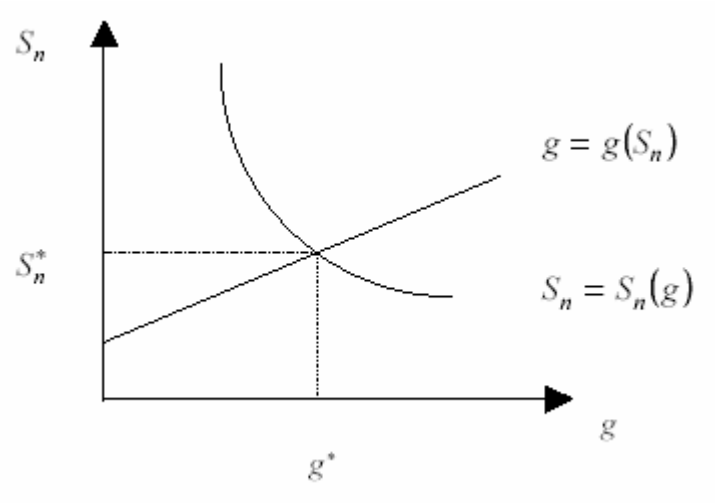


Figure 2. – Reduction in domestic trade costs in the rich country.

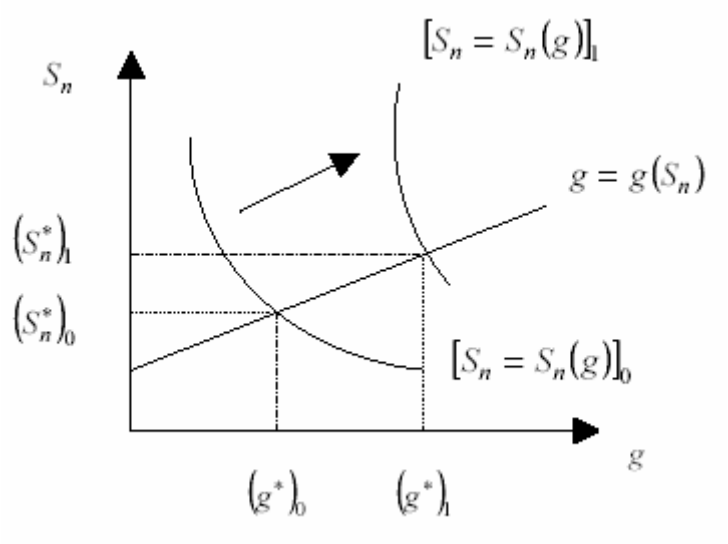


Figure 3. – Reduction in domestic trade costs in the poor country.

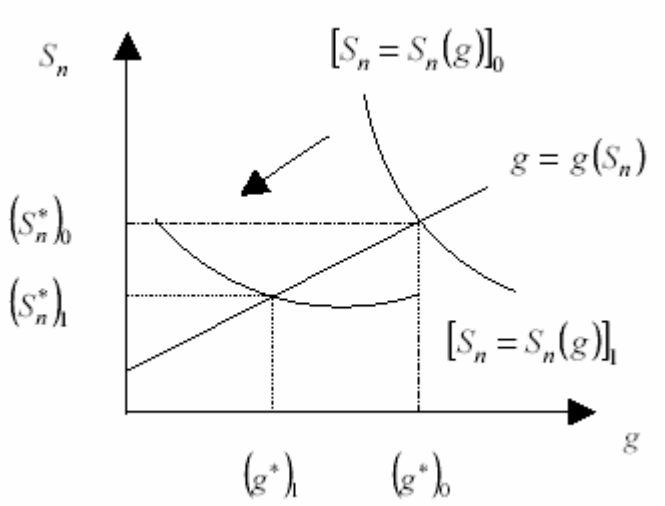


Figure 4. – Reduction in common international trade costs.

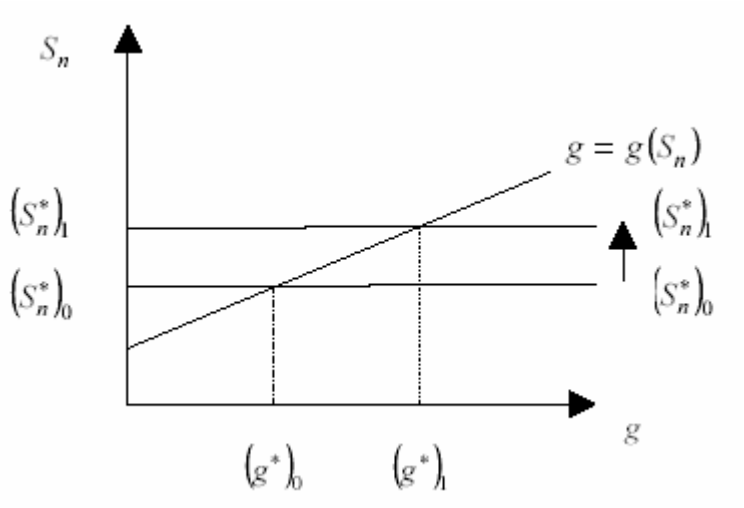


Table 1. – Effects of trade policies on concentration, growth and welfare.

δ_D	δ_D^*	$\delta_X\ \delta_C\ \delta_M^*$	$\delta_X^*\delta_C\ \delta_M$	ΔS_n	Δg	ΔV	ΔV^*
0.95	0.8	0.7	0.6				
0.96	-	-	-	(+)	(+)	(+)	(+)
-	0.81	-	-	(-)	(-)	(-)	(+)
-	-	0.71	-	(+)	(+)	(+)	(+)
-	-	-	0.61	(-)	(-)	(-)	(+)