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Liberalisation of International Trade – The Case of Asymmetric Countries

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Abstract

The aim of this paper is to analyse the welfare consequences of the processes of liberalisation of trade between asymmetric states in terms of the various sizes and effectiveness of their economies and the type of international exchange. These characteristics ultimately define the distribution of benefits from the liberalisation of international trade. When it is inter-industry or vertical intra-industry and barriers in trade are smaller than the difference in the effectiveness of the economies, the trade liberalisation undoubtedly contributes to improved social welfare, regardless of the level of effectiveness and the size of the economy. In the situation, however, of horizontal intra-industry trade, changes in the welfares of asymmetric countries, caused by their progressing trade liberalisation, depend on the sizes and effectiveness of their economies. The welfare of society in either a very big and ineffective or in a small and very ineffective country could even decrease in such a situation. This is the case when the increase in consumers' surplus is not sufficient to compensate for the decreasing profits of firms.

Keywords: liberalisation of trade, welfare, asymmetric countries

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1 Introduction

Observing contemporary liberalisation processes between asymmetric countries, it is worthwhile to think about their economic consequences. Assuming therefore such a research perspective, this paper deals – in a model way – with an analysis of the welfare consequences of processes of liberalization between countries which produce varied commercial goods and which, at the same time, are characterized by different levels of technical effectiveness and different sizes of their economies.

The economic game model which has been constructed examines the impact of bilateral international (intra- and inter-industry) trade on the level and structure of the welfares of liberalising countries with asymmetric economies. Being the core of this paper, the model of this game is a generalization of the model by Hine, Torres and Wright (2000), presented in the paper "Does Trade Liberalisation Damage Firms in Large Countries? Cost and Size Asymmetries in Intra-Industry Trade". The authors adopt in the model which they developed an assumption of perfect substitutability of commercial goods, as an example of intra-industry trade. They do not consider imperfect substitutability at all and the complementarity of economies either, which corresponds either with bilateral inter-industry trade or with two-way vertical intra-industry trade. Thus, their conclusions are only partially substantiated by the presented model. Problems of asymmetry in international trade are also considered by authors such as Park (2000), Bond and Park (2002), as well as Gori and Lambertini (2012).

2 Economic Game Model

In the model, we shall consider two countries (1 and 2) whose societies consume two goods. They are produced in an imperfectly competitive industry – with the use of constant returns to scale technology – separately in both economies, i.e. each of the economies produces only one differentiated good under analysis. In addition to that, in both these countries there is also a perfectly competitive sector producing a homogeneous good which acts as a numeraire good in these economies.

On the production side, there are no capacity limits. Manufacturing activities in the imperfectly competitive industry, in the economies concerned, are organized within individual firms, denoted by 1 and 2, according to the specifications of their respective economies. The degree of product differentiation of both firms is between perfect substitutability and perfect complementariness (except the case of their full independence). In this way, the nature of the goods in question is constituted – as substitutes or complements. Firms compete one with another in the international product market. The market game is a quantitative one of the Cournot type, and each of the firms perceives each of the economies as a separate segment of the international product market, which is the result of the existence of positive costs involved in international trade. These costs comprise the costs of transactions, transport, customs, etc. Since tariff barriers are now relatively low in most countries across the world, in order to simplify the analysis, the study shall focus solely on the types of trading costs which do not generate budgetary revenues and the magnitude of which depends on the political will of the countries in question. Hence, the costs to be considered with be so-called "behind-the-border" costs relating to the activities of governments – manifesting themselves through the existence of poor institutions and poor infrastructure penalising international trade. (see e.g. Prabir De 2006). Being relevant for the functioning of the sphere of international trade in the contemporary world, these particular costs shall be denoted by t. Additionally, like in J. Brander (1981) and J. Brander and P. Krugman (1983), we assume that the firms under consideration have the following Cournot perception: they don't take total output (domestic + export) as given but assume the output of the other firm in each market separately as given.

The model also assumes that inverse demand functions of the firms concerned – with the constraints resulting from the fulfilment of the conditions of balanced international trade (in which the amounts of social consumption expenditures in both countries should equal the volumes of their respective productions) – can be presented in the following form:

$$p_{ii} = \alpha - \frac{\beta}{s_i} q_{ii} - \frac{\gamma}{s_i} q_{ji} \tag{1}$$

$$p_{ji} = \alpha - \frac{\beta}{s_i} q_{ji} - \frac{\gamma}{s_i} q_{ii} \tag{2}$$

$i, j = 1, 2$; $i \neq j$, where:

p_{ii} – price of the good produced by firm i, sold in country i;

p_{ji} – price of the good produced by firm j, sold in country i,

q_{ii} – volume of the good produced in economy i, to be consumed in society i,

q_{ji} – volume of the good produced in economy j, to be consumed in society i (volume of imports of country i),

s_i – size of the market in the country i.

We also assume, like in T. Fisher, D. Prentice and R. Waschik (2010), that an increase in the size of the market means more consumers. Assuming now that on the consumption side there is a continuum of consumers – workers of the same type – we get, like in A. Alesin, E. Spolaore, R. Wacziarg (2005), even when the technology exhibits constant returns to scale – a positive relationship between the market size and economic performance and, hence, between the market size and income that interacts in the market. In this way, assuming the same technical effectiveness of the economies under analysis, in the model under consideration, market size i coincides with the economic size of country i – both in terms of its population and national product. On the other hand, where there is a difference in the technical effectiveness of these economies, market size i coincides with the economic size of country i in terms of population only. Because of this, in the present paper, s_i is also a measure of the country's size.

Additionally in the model, demands as assumed – like in A. Dixit (1979) – to arise from quasi-linear preferences that are represented by a quadratic utility function:

$$v_i\left(q_{ii}, q_{ji}, q_0\right) = V_i\left(q_{ii}, q_{ji}\right) + q_0, \tag{3}$$

where: q_0 is the consumption of the numeraire good, and

$$V_i = \alpha\left(q_{ii} + q_{ji}\right) - \frac{1}{2}\left(\frac{\beta}{s_i}q_{ii}^2 + 2\frac{\gamma}{s_i}q_{ii}q_{ji} + \frac{\beta}{s_i}q_{ji}^2\right),\ i = 1, 2,\ i \neq j \tag{4}$$

Because there are no income effects on the international duopoly industry, we can analyse it in isolation. The inverse demand functions are then the partial derivatives of function V_i.

The model also assumes that the prices, volumes of production and unit profits are non-negative, and that:

$$\alpha > 0, \quad \beta \geq |\gamma| > 0, \quad s_i > 0. \tag{5}$$

Then, it should be noted that when

$$\gamma > 0, \tag{6}$$

the products of the economies are substitutes, and international trade – if effected – is horizontal intra-industry trade. Then – like in J. Hackner (2000) – the degree of substitutability is interpreted in terms of horizontal product differentiation.

In turn, when

$$\gamma < 0, \tag{7}$$

then the goods produced by both economies are complementary one to the other, and international trade – if it occurs – is either inter-industry trade, where $s_i \neq s_j$, $i, j = 1, 2$, $i \neq j$, or vertical intra-industry trade, if $s_i = s_j$, like in D. Davis (1995).

If, on the other hand

$$\gamma = 0 \tag{8}$$

then each firm is characterised by monopolistic market power.

In the model under consideration, we also assume that the cost functions of the firms take the form:

$$C_i(q_i) = c_i q_i, \quad i = 1, 2 \tag{9}$$

where:

$$q_i = q_{ii} + q_{ij} \quad i, j = 1, 2, \quad i \neq j. \tag{10}$$

The differences in the technical effectiveness of both economies are then expressed in the differentiated unit costs of the analysed firms. Then

$$c_i \neq c_j \quad i,j = 1,2, \quad i \neq j. \tag{11}$$

Note now that with all of the above assumptions, when we introduce the denotations

$$\alpha_i = \alpha - c_i, \tag{12}$$

$$\alpha_j = \alpha - c_j - t, \tag{13}$$

$$\beta_i = \frac{\beta}{s_i}, \tag{14}$$

$$\beta_j = \frac{\beta}{s_j}, \tag{15}$$

$$\gamma_i = \frac{\gamma}{s_i}, \; i,j = 1,2, \quad i \neq j \tag{16}$$

then, in this formal approach, prices are net of marginal costs, and the functions generated in such a way, i.e. the functions $V_i^{'}$, $i,j = 1,2$ are as general as possible – like in R. Clarke, D. Collie (2003) – given their functional form and constant marginal costs, representing differentiated preferences of both societies.
In our considerations, we therefore deal with two aspects of product differentiation. One relates to parameters α, and the other with parameters γ. Indeed, α measures quality in the vertical sense. Ceteris paribus, an increase in α means in increase in the marginal utility of consuming product i whilst α_i and α_j reflect the net absolute advantage for firms, i and j, respectively. In turn, where they are larger than zero, parameters γ_i measure substitutability between the products or, where smaller than zero, they measure their complementarity. Where α is identical for both societies and $\beta_i = \beta_j = \gamma_i$, then goods are perfect substitutes, and where $\beta_i = \beta_j = -\gamma_i$ we deal with perfect complements. Then, however, the maximization problem of the consumers may not have a solution.
With such assumptions, the firms' profits can be expressed as:

$$\Pi_i = \Pi_{ii} + \Pi_{ij} = (p_{ii} - c_i)\, q_{ii} + (p_{ij} - c_i - t)\, q_{ij} \tag{17}$$

or, after substituting the required formulae for inverse demand functions, i.e. for price functions – as:

$$\Pi_i = \left(\alpha - \frac{\beta}{s_i} q_{ii} - \frac{\gamma}{s_i} q_{ji}\right) q_{ii} - c_i q_{ii} + \left(\alpha - \frac{\gamma}{s_j} q_{jj} - \frac{\beta}{s_j} q_{ij}\right) q_{ij} - c_i q_{ij} - t q_{ij}. \tag{18}$$

Assuming that the objective of firms is to maximize their profit functions, we can now derive their reaction functions, that is the rules followed in the international product market, in order to choose, for the anticipated decisions of their competitors, such volumes of production for sale in the country concerned and for export as to maximize their profits.

It should also be noted that even in the case of inter-industry trade or vertical intra-industry trade, firms in actual reality compete with one another, and so this situation too can be modelled as a duopolistic non-cooperative game. This is the case because with essential income constraints of societies – which is implicitly assumed in the model – undertakings will always compete one with another for their share in such incomes. Note also, after N. Singh and X. Vives (1984), that the Cournot competition with complements is the dual of Bertrand competition with substitute products, like in R. Clarke I D. Collie (2003).

Due to the analysed linearity of the demands of firms and the constancy of the average unit costs, in the problem of maximization of the functions of the firms' profits, the second-order conditions are always fulfilled. In turn, the first-order conditions in the issue under consideration take the following analytical form:

$$\frac{\partial \Pi_i}{\partial q_{ii}} = 0, \tag{19}$$

$$\frac{\partial \Pi_i}{\partial q_{ij}} = 0, \tag{20}$$

or, in the extended version:

$$\alpha - \frac{2\beta}{s_i} q_{ii} - \frac{\gamma}{s_i} q_{ji} - c_i = 0, \tag{21}$$

$$\alpha - \frac{2\beta}{s_j} q_{ij} - \frac{\gamma}{s_j} q_{jj} - c_i - t = 0, \tag{22}$$

$i, j = 1, 2;\ i \neq j$.

Transforming the above necessary conditions for both undertakings, we can get their reaction functions:

$$q_{ii} = \frac{\alpha s_i}{2\beta} - \frac{\gamma}{2\beta} q_{ji} - \frac{c_i s_i}{2\beta}; \tag{23}$$

$$q_{ij} = \frac{\alpha s_j}{2\beta} - \frac{\gamma}{2\beta} q_{jj} - \frac{c_i s_j}{2\beta} - \frac{t s_j}{2\beta}; \tag{24}$$

$$q_{jj} = \frac{\alpha s_j}{2\beta} - \frac{\gamma}{2\beta} q_{ij} - \frac{c_j s_j}{2\beta}; \tag{25}$$

$$q_{ji} = \frac{\alpha s_i}{2\beta} - \frac{\gamma}{2\beta} q_{ii} - \frac{c_i s_i}{2\beta} - \frac{t s_i}{2\beta}. \tag{26}$$

Simultaneous fulfilment of the expectations of the firms under consideration in the international product market will occur in the Nash equilibrium. Then, the optimum volumes of production for both firms – to satisfy the domestic demand in the countries concerned and for export – are given in the form of the following formulae:

$$q_{ii} = \frac{2\beta s_i(\alpha - c_i) - \gamma s_i(\alpha - c_j - t)}{4\beta^2 - \gamma^2}, \tag{27}$$

$$q_{ij} = \frac{2\beta s_j(\alpha - c_i - t) - \gamma s_j(\alpha - c_j)}{4\beta^2 - \gamma^2}, \tag{28}$$

$$q_{jj} = \frac{2\beta s_j(\alpha - c_j) - \gamma s_j(\alpha - c_i - t)}{4\beta^2 - \gamma^2}, \tag{29}$$

$$q_{ji} = \frac{2\beta s_i(\alpha - c_j - t) - \gamma s_i(\alpha - c_i)}{4\beta^2 - \gamma^2}, \tag{30}$$

and their respective equilibrium prices are:

$$p_{ii} = \alpha - \frac{\beta[(2\beta - \gamma)\alpha - 2\beta c_i + \gamma(c_j + t)] - \gamma[(2\beta - \gamma)\alpha - 2\beta(c_j + t) + \gamma c_i]}{4\beta^2 - \gamma^2}, \tag{31}$$

$$p_{ij} = \alpha - \frac{\beta[(2\beta - \gamma)\alpha - 2\beta(c_i + t) + \gamma c_j] - \gamma[(2\beta - \gamma)\alpha - 2\beta c_j + \gamma(c_i + t)]}{4\beta^2 - \gamma^2}, \tag{32}$$

$i, j = 1, 2$; $i \neq j$.

However, due to the perception by firms of so-called 'segmented markets' which is applied in this model (see E. Helpman 1984), the system of four equations (23)-(26) can be partitioned into two separable symmetric subsystems, like in J. Brander (1981). Therefore, further in the paper, we shall consider only one subsystem of equations: (23) and (26), which corresponds to the market in country i.

For the equilibrium quantities – volumes of production and prices – so specified in the international product market, we can now calculate their respective equilibrium quantities for the particular elements of the welfares of societies of the countries concerned.

As in the research approach of Hine, Torres, Wright (2000), this model assumes that the components of social welfares are the profits of undertakings and consumer surpluses which, in the present analysis, are a valid measure of consumers welfare, owing to the assumption made in the paper on quasi-linear preferences. Hence the welfares of the societies in question can be expressed as the sums of the firms' profits and the consumers' surpluses:

$$W_i = \Pi_{ii} + \Pi_{ij} + CS_i = \Pi_i + CS_i, \quad i, j = 1, 2, \quad i \neq j \tag{33}$$

where: W means a social welfare and CS means consumers' surplus.

In turn, the equilibrium consumers' surplus of the i-th society can be presented in the following form:

$$CS_i = V' - \Pi_{ii} - \Pi_{ji} = V' - (p_{ii} - c_i)\, q_{ii} - (p_{ji} - c_j - t)\, q_{ji} = \frac{\beta}{2s_i}\left(q_{ii}^2 + q_{ji}^2\right) + \frac{\gamma}{s_i} q_{ii} q_{ji}, \tag{34}$$

At this point, by differentiating with respect to t the equilibrium elements of the welfares of the societies under consideration, we are able to study the welfare consequences of the processes of liberalisation of trade between asymmetric countries in terms of the various sizes and effectiveness of their economies and the type of international exchange – which, after all, is the aim of these analyses.

We shall therefore study first how the removal of trade barriers affects the level of profits of an undertaking in the i-th economy. For this purpose, we shall determine the sign of the derivative

$$\frac{\partial \Pi_i}{\partial t} \tag{35}$$

Let us note, first of all, that

$$sgn\frac{\partial \Pi_i}{\partial t} = sgn\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right] + sgn\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i\right)q_{ij}\right] + sgn\frac{\partial}{\partial t}\left(-tq_{ij}\right) \tag{36}$$

Further, note that

$$\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right] = \left(p_{ii}-c_i\right)\frac{\partial q_{ii}}{\partial t} + q_{ii}\frac{\partial\left(p_{ii}-c_i\right)}{\partial t} \tag{37}$$

and that

$$\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i\right)q_{ij}\right] = \left(p_{ij}-c_i\right)\frac{\partial q_{ij}}{\partial t} + q_{ij}\frac{\partial\left(p_{ij}-c_i\right)}{\partial t}. \tag{38}$$

Because of this, we calculate the signs of the derivatives of interest to us.

Thus

$$\frac{\partial q_{ii}}{\partial t} = \frac{\gamma s_i}{4\beta^2-\gamma^2} > 0, \tag{39}$$

when international trade is horizontal intra-industry trade, whilst if it is vertical intra-industry or inter-industry trade, then

$$\frac{\partial q_{ii}}{\partial t} = \frac{\gamma s_i}{4\beta^2-\gamma^2} < 0. \tag{40}$$

In turn, the sign of the derivative

$$\frac{\partial\left(p_{ii}-c_i\right)}{\partial t} = \frac{-3\beta\gamma}{4\beta^2-\gamma^2} \tag{41}$$

is negative for international horizontal intra-industry trade, whilst being positive for international vertical intra-industry, or inter-industry trade.

It appears therefore that the sign of the derivative

$$\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right] \tag{42}$$

is impossible to determine without more detailed specifications of the function. However, if we realise that such derivative – in an economic interpretation – means a change in the profit, which is caused by reduced trade barriers, and that the change is the sum of two partial effects – the change in the profit caused by the change in the volume of the good produced in economy i, to be consumed in society i, and the change in the profit resulting from a change in the price of these goods – and that firms maximizing profits always operate in the elastic part of the linear demand curve, it is clear that the quantity effect dominates over the price effect, so that the derivative under consideration is larger than zero for horizontal intra-industry trade, and smaller than zero in the case of inter-industry trade or vertical intra-industry trade. When the production of countries is substitutive, a reduction in trade barriers increases competition in their home markets, and thus a decrease in profits from the production intended to satisfy the demands in these markets. The losses for bigger countries are higher than for smaller ones, and smaller for more effective countries than for less effective ones. In the case of complementary goods, on the other hand, the situation is the reverse. For bigger countries, the profits from the production intended to satisfy the demands in their home markets are higher than for smaller ones. This is by analogy to less effective countries. This is indicated by the signs of the following derivatives:

$$\frac{\partial}{\partial s_i}\left\{\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right]\right\} \tag{43}$$

and

$$\frac{\partial}{\partial c_i}\left\{\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right]\right\}. \tag{44}$$

One of them equals

$$\frac{\partial}{\partial s_i}\left[\left(p_{ii}-c_i\right)\frac{\gamma s_i}{4\beta^2-\gamma^2}\right]+\frac{\partial}{\partial s}\left[\left(\frac{-3\beta\gamma}{4\beta^2-\gamma^2}\right)q_{ii}\right]. \tag{45}$$

Due to the domination of the quantity effect over the price one, it is larger than zero when

$$\gamma > 0, \tag{46}$$

and smaller than zero when

$$\gamma < 0. \tag{47}$$

The other of the derivatives equals

$$\frac{-2\gamma s_i}{4\beta^2-\gamma^2} \tag{48}$$

and is smaller than zero when

$$\gamma > 0, \tag{49}$$

and larger than zero when

$$\gamma < 0. \tag{50}$$

In turn,

$$\frac{\partial q_{ij}}{\partial t} = -\frac{2\beta s_j}{4\beta^2 - \gamma^2} < 0 \tag{51}$$

always, regardless of the type of international trade, i.e. the volume of exports increases when the trade barriers are reduced. In such a situation, the export volume is bigger when the scale of the foreign market is bigger. On the other hand

$$\frac{\partial \left(p_{ij} - c_i\right)}{\partial t} = \frac{2\beta^2 + \gamma^2}{4\beta^2 - \gamma^2} > 0 \tag{52}$$

Hence the sign of the derivative

$$\frac{\partial}{\partial t}\left[\left(p_{ij} - c_i\right) q_{ij}\right] = \left(p_{ij} - c_i\right)\frac{\partial q_{ij}}{\partial t} + q_{ij}\frac{\partial \left(p_{ij} - c_i\right)}{\partial t} \tag{53}$$

is impossible to determine without more detailed specifications of the function. However, by analogy with the derivative

$$\frac{\partial}{\partial t}\left[\left(p_{ii} - c_i\right) q_{ii}\right] \tag{54}$$

it is clear that the quantity effect dominates over the price effect, so that

$$\frac{\partial}{\partial t}\left[\left(p_{ij} - c_i\right) q_{ij}\right] < 0 \tag{55}$$

Additionally, the sign of the derivative

$$\frac{\partial}{\partial t}\left(-t q_{ij}\right) \tag{56}$$

is positive, hence the reduction in t will weaken the quantitative effect which will continue to dominate anyway. As a result, this will mean that liberalisation of international trade will always induce an increase in the profits from exports.

Having regard to the foregoing research results, it can be concluded that when the productions of the economies concerned are complementary, the derivative

$$\frac{\partial \Pi_i}{\partial t};\ i = 1, 2 \tag{57}$$

is always negative, i.e. a reduction in trade barriers will contribute to increased profits of firms in the liberalising economies, regardless of the degree of their effectiveness or the sizes of their markets. However, these characteristics will determine the distribution of benefits from the liberalisation of international inter-industry trade or international vertical intra-industry trade.

The above finding corresponds with proposition 2 presented in the paper by R. Clarke and D. Collie (2003):

"Under Bertrand duopoly, with linear demand and constant marginal costs, there are always gains from multilateral free trade".
The situation is not so unambiguous when the productions of the integrating economies are substitutive. Then, after all – as proven above – the sign of the derivative

$$\frac{\partial}{\partial t}\left[\left(p_{ii}-c_i\right)q_{ii}\right] \tag{58}$$

is positive, but the sign of the derivative

$$\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right] \tag{59}$$

is negative. Which of the effects will prevail will depend on additional determinants, i.e. the effectiveness and sizes of the markets.
It can be stated, generally, that the latter effect is dominant when the increment of benefits from exports, caused by a reduction in trade barriers, exceeds the increment of losses in the home market generated by their reduction. Let us think now of what factors favour such a situation.
In order to answer this question, the signs of the following derivatives need to be determined:

$$\frac{\partial}{\partial c_i}\left\{\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right]\right\} \tag{60}$$

and

$$\frac{\partial}{\partial s_j}\left\{\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right]\right\}. \tag{61}$$

One of them concerns the impact of the effectiveness of production of economies on the change in the profit from their exports, induced by a reduction in trade barriers. The other of the derivatives conceptualises the impact of the size of the foreign market on the scale of the changes in the profit of the undertaking which exports substitutive goods, generated by liberalisation processes.
Indeed, the derivative

$$\frac{\partial}{\partial c_i}\left\{\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right]\right\} \tag{62}$$

equals

$$\frac{-\left(8\beta^3+4\beta^2\gamma+4\beta\gamma^2+\gamma^3\right)s_j}{\left(4\beta^2-\gamma^2\right)^2} \tag{63}$$

and is smaller than zero. It means that the more ineffective the country is, the more its profits from exports grow with the decrease in trade barriers.
As concerns the other of the derivatives under consideration, i.e. the derivative

$$\frac{\partial}{\partial s_j}\left\{\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right]\right\}, \tag{64}$$

it equals

$$\frac{\partial}{\partial s_j}\left[(p_{ij}-c_i-t)\frac{\partial q_{ij}}{\partial t}\right]+\frac{\partial}{\partial s_j}\left[q_{ij}\frac{\partial\left(p_{ij}-c_i-t\right)}{\partial t}\right]. \tag{65}$$

Since the derivative

$$\frac{\partial}{\partial s_j}\left[(p_{ij}-c_i-t)\frac{\partial q_{ij}}{\partial t}\right]=\frac{-2\beta}{4\beta^2-\gamma^2}\left(p_{ij}-c_i-t\right) \tag{66}$$

is smaller than zero, and the derivative

$$\frac{\partial}{\partial s_j}\left[q_{ij}\frac{\partial\left(p_{ij}-c_i-t\right)}{\partial t}\right] \tag{67}$$

equals

$$\frac{\left(2\beta^2+\gamma^2\right)\left[2\beta\left(a-c_i-t\right)-\gamma\left(a-c_j\right)\right]+\left(4\beta^2-\gamma^2\right)\left[2\beta c_i+\left(a-c_i\right)\left(2\beta-\gamma\right)\right]}{\left(4\beta^2-\gamma^2\right)^2} \tag{68}$$

maintaining the assumption that $q_{ij}>0$is positive, then, due to the domination of the quantitative effect over the price effect, the derivative

$$\frac{\partial}{\partial s_j}\left\{\frac{\partial}{\partial t}\left[\left(p_{ij}-c_i-t\right)q_{ij}\right]\right\}. \tag{69}$$

is negative. It means that the larger the importer's market is, the profits from export grow when the trade barriers are reduced.

The conclusion from these findings is as follows. The chance that the increment of profits from exports, caused by reduced trade barriers, exceeds the increment of losses in the home market, generated by their reduction, grows with:

1. the ineffectiveness of the country even though the level of profits depends on the initial share of exports – which is conditioned on the relative costs of production – in the country's total production. The more effective the country is initially the higher its profits from exports which, however, decrease with the liberalisation of the economy, and
2. the size of the foreign market.

Let us now detail the second conclusion. Indeed, if the increment of profits from exports, caused by reduced trade barriers, is to exceed the increment of losses in the home market, generated by their reduction, this should mean – for firms maximizing profits, for which the quantity effects dominate over the price effects – that

$$\frac{\partial q_{ij}}{\partial t}>\frac{\partial q_{ii}}{\partial t} \tag{70}$$

meaning that

$$\frac{\partial q_i}{\partial t} < 0. \tag{71}$$

Because, however,

$$\frac{\partial q_i}{\partial t} = \frac{\gamma s_i - 2\beta s_j}{4\beta^2 - \gamma^2}, \tag{72}$$

then the derivative is smaller than zero when

$$\gamma s_i - 2\beta s_j < 0. \tag{73}$$

Let us note that when $\gamma > 0$ and tends to zero, meaning that when goods become less and less substitutive, then the chance that the increment of profits from exports, caused by reduced trade barriers, exceeds the increment of losses in the home market, generated by their reduction, grows – regardless of the relative sizes of both economies. When, on the other hand, $\gamma > 0$ and $\gamma \to \beta$, the aforementioned condition takes a clearer form:

$$\beta (s_i - 2s_j) < 0 \Leftrightarrow s_i < 2s_j \tag{74}$$

which means that the increment of profits from exports, caused by reduced trade barriers, exceeds the increment of losses in the home market, generated by their reduction, when the home market is less than two times smaller than the foreign market. Otherwise, that is when $\gamma > 0$ and $\gamma \to \beta$, and

$$s_i > 2s_j, \tag{75}$$

or, more generally, when the condition

$$s_i > 2\frac{\beta}{\gamma} s_j, \tag{76}$$

is fulfilled, the increment of losses in the home market, caused by reduced trade barriers, exceeds the increment of profits from exports, generated by their reduction. It is noteworthy at this point that the foregoing finding – in accordance with formula (75) – corresponds with the most relevant proposition in the paper of Hine, Torres, Wright of 2000, i.e. proposition 3:

"From an initial situation of reciprocal intra-industry trade a decrease in trade costs will increase the output of the smaller country, and will decrease the total output of the larger country if $2s_1 < s_2$."

In turn, the version of the proposition – in accordance with formula (76) – is a clear extension of this proposition 3, for $\gamma > 0$.

For example, when

$$\gamma = \frac{\beta}{2}, \tag{77}$$

then, *ceteris paribus*, for a country to lose in the liberalisation processes, its domestic market should be more than four times larger than its foreign market, i.e.

$$s_i > 4s_j. \tag{78}$$

Ultimately, this means, in the case under analysis – of two way horizontal intra-industry trade – that only undertakings in:

1. a very big and relatively ineffective country, or
2. a very small and very ineffective one

will lose on the reduction in trade barriers but, as a result of progressing liberalisation processes their losses will be smaller and smaller – but they do not necessarily need to be eliminated completely, and the types of countries under analysis may therefore wish to use trade barriers to increase the profits of domestic firms.

Generally, the smaller the differences between the sizes of the economies and levels of effectiveness between states, the more advantageous to both parties the liberalisation processes between these states should be.

Concluding the analysis of the market game under consideration, the issue of stability of the two-way trade equilibrium should be examined. Indeed, a guarantee for the stability of the equilibrium under analysis is the fulfilment of the following condition:

$$\frac{\partial^2\Pi_i}{\partial q_{ii}^2}\frac{\partial^2\Pi_j}{\partial q_{ji}^2} - \frac{\partial^2\Pi_j}{\partial q_{ii}\partial q_{ji}}\frac{\partial^2\Pi_i}{\partial q_{ji}\partial q_{ii}} > 0, \quad i,j = 1,2, \quad i \neq j \tag{79}$$

which is an analogue to the stability condition of Marshall-Lerner. Since in the present model

$$\frac{\partial^2\Pi_i}{\partial q_{ii}^2} = \frac{\partial^2\Pi_j}{\partial q_{ji}^2} = -\frac{2\beta}{s_i}, \tag{80}$$

and

$$\frac{\partial^2\Pi_i}{\partial q_{ji}\partial q_{ii}} = \frac{\partial^2\Pi_j}{\partial q_{ii}\partial q_{ji}} = \frac{-\gamma}{s_i}, \tag{81}$$

then the condition for the stability of two-way international trade equilibrium (79) is fulfilled because

$$\frac{4\beta}{s_i^2} - \frac{\gamma^2}{s_i^2} > 0, \tag{82}$$

regardless of whether $\gamma > 0$, or whether $\gamma < 0$.

Additionally, the fact that

$$\frac{\partial^2\Pi_i}{\partial q_{ji}\partial q_{ii}} = \frac{\partial^2\Pi_j}{\partial q_{ii}\partial q_{ji}} \tag{83}$$

results in the uniqueness of the above equilibrium (see J. Brander, P. Krugman, 1983).

Another issue to be dealt with now is the determination of the impact of reduced trade barriers on the changes in consumer surpluses. For this purpose, the sign of the derivative

$$\frac{\partial CS_i}{\partial t} \tag{84}$$

needs to be determined.
Since

$$CS_i = \frac{\beta}{2s_i}\left(q_{ii}^2 + q_{ji}^2\right) + \frac{\gamma}{s_i} q_{ii} q_{ji} \tag{85}$$

and

$$\frac{\partial q_{ii}}{\partial t} = \frac{\gamma s_i}{4\beta^2 - \gamma^2} \tag{86}$$

and

$$\frac{\partial q_{ji}}{\partial t} = \frac{-2\beta s_i}{4\beta^2 - \gamma^2}, \tag{87}$$

so

$$\frac{dCS_i}{dt} = \frac{-1}{4\beta^2 - \gamma^2}\left[\beta\gamma q_{ii} + \left(2\beta^2 - \gamma^2\right) q_{ji}\right]. \tag{88}$$

For $\gamma > 0$, clearly

$$\frac{\partial CS_i}{\partial t} < 0. \tag{89}$$

On the other hand, where $\gamma < 0$, then

$$\frac{\partial CS_i}{\partial t} < 0, \tag{90}$$

when

$$(a - c_i)\,\gamma^3 < (a - c_j - t)\left(4\beta^3 - 3\beta\gamma^2\right). \tag{91}$$

Even if $\gamma \to \beta$, then, when the following assumption is fulfilled

$$t < c_i - c_j, \tag{92}$$

then

$$\frac{\partial CS_i}{\partial t} < 0 \tag{93}$$

or, when the difference in the effectiveness of the economies is greater than the barriers in foreign trade, the derivative under consideration is always smaller than zero, regardless of whether it is horizontal intra- or vertical intra- or inter-industry trade.
This means that the consumers' surpluses will essentially grow when trade liberalisation deepen and the exchange is bilateral.
Summarising this study, it is to be concluded that in order to determine the welfare

consequences of trade liberalisation of asymmetric countries, the sign of the following derivative should also be considered:

$$\frac{\partial W_i}{\partial t}. \tag{94}$$

It equals the sum of the derivatives:

$$\frac{\partial W_i}{\partial t} = \frac{\partial \Pi_i}{\partial t} + \frac{\partial CS_i}{\partial t}. \tag{95}$$

Since the signs of the first component of the sum may be both positive and negative, it is not possible to determine, on an *a priori* basis, the impact of the liberalisation of international trade on social welfare. It is only a specification of the type of international exchange that enables the attainment of significant research results.

3 Conclusions

When two-way international trade is of inter-industry or vertical intra-industry nature and barriers in trade are smaller than the difference in the effectiveness of the economies, the increase in its volume, induced by trade liberalisation, undoubtedly contributes to improved social welfare, regardless of the level of effectiveness and the size of the economy.

In the case of bilateral horizontal intra-industry trade, on the other hand, changes in the welfares of asymmetric countries, caused by their progressing trade liberalisation, depend on the sizes and effectiveness of their economies.

The welfare of society in either a very big and ineffective or in a small and very ineffective country could even decrease in such a situation. This is the case when the increase in consumers' surplus is not sufficient to compensate for the decreasing profits of firms. In turn, the welfares of societies in countries in which the differences between the sizes of the economies and levels of effectiveness between them are not very significant, increase in the analysed conditions of international trade.

In reality, it is unlikely that countries would export to other economies essentially only products substitutive to their production, and hence in the structure of international trade, the share of inter-industry or vertical intra-industry trade in groups of countries which liberalise their trade is undoubtedly considerable and this weakens, and perhaps even compensates for the aforementioned shortages in the welfares in either very big and ineffective or small and very ineffective countries. This means, essentially, that in reality, a decisive majority of asymmetric countries can be involved in the processes of liberalising economies because this improves the welfare of their societies.

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