

# **The impact of trade liberalization on market structures when production costs are different**

Marie-Françoise Calmette <sup>a,b</sup>

<sup>a</sup> *ARQADE, Université des Sciences Sociales, Toulouse*

<sup>b</sup> *Associated researcher IDEI, Université des Sciences Sociales, Toulouse*

## **Abstract**

This paper examines the impact of trade liberalization on market structures in a model with asymmetric firms such that comparative-advantage basis for trade exists. We show that, for intermediate values of the trade cost, the non-cooperative game leads to an asymmetric market structure. More over, trade liberalization does not provide more domestic competition in the lower cost country, even if trade cost is completely abolished, for a difference between production costs high enough. Another result is that the tariff-jumping argument must be reconsidered when market structures are endogenous. We show that trade cost has no determinate direct impact on the firms' decision to merge internationally.

*Keywords:* Trade integration; Mergers; tariff-jumping argument, market structures.

*JEL classification :* F15 ;F23 ;L13 ;R38

\*Corresponding author: M.F. CALMETTE, ARQADE, Université des Sciences Sociales, 21 Allée de Brienne, 31000 Toulouse, France. Tel:33(0)561128533; fax:33(0)561128538.E-mail address: calmette@univ-tlse1.fr.

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### **Abstract:**

This paper examines the impact of trade liberalization on market structures in a model with asymmetric firms such that comparative-advantage basis for trade exists. We show that, for intermediate values of the trade cost, the non-cooperative game leads to an asymmetric market structure. More over, trade liberalization does not provide more domestic competition in the lower cost country, even if trade cost is completely abolished, for a difference between production costs high enough. Another result is that the tariff-jumping argument must be reconsidered when market structures are endogenous. We show that trade cost has no determinate direct impact on the firms' decision to merge internationally.

### **1-Introduction**

In the international economics literature, there has been a methodological evolution in analysing the relationship between domestic market structures and international trade flows.

For a long time, it was generally admitted that an open economy, without tariffs or quotas, should provide more domestic competition and more domestic producers' performance<sup>1</sup>.

Among the first, White (1974) has explored the possibility of a reverse relationship: he has demonstrated that, under some conditions, market structures can influence trade flows.

However, close to the tradition of the received theory of international trade, he assumes that the domestic producer (or producers) takes world prices as given.

When the emergence of imperfect competition in international trade became evident, it has been established that governments' actions have different impacts in an oligopolistic market and in a competitive one, and that market structures may be a deliberate policy choice (Dixit, 1984). Next, Salant et al (1983) have shown, in a domestic context, the necessity to recognize that the firms' merger decisions are endogenous. Horstmann and Markusen (1992) analyze the formation of endogenous market structure in international trade with identical marginal

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<sup>1</sup> See for example Caves and Jones (1973).

costs across countries<sup>2</sup>. Later, Maggi (1996) examines the impact of optimal trade policies with endogenous competition pattern, under complete and incomplete information.

The increasing process of trade liberalization has induced a rich literature on foreign direct investments, multinational enterprises and the firms' location choice (see for example Motta (1992) and Motta and Norman, (1996)), but the literature on merger behaviour during trade liberalisation was scarce. Horn and Persson (2001,(a)) take the last key step of the analysis of the relationship between market structures and international trade. They provide, in a more general framework, a symmetric model of an oligopolistic industry which examines firms' merger behaviour. Assuming that firms' costs are the same in each country, they obtain results contrary to the "tariff-jumping" argument<sup>3</sup> since they conclude that firms merge internationally with low trade costs and domestically with high trade costs. Applying the method developed by Horn and Persson, Straume (2003), introduces an asymmetry by considering that one firm is unionised, whereas the others are not. He does not consider the possibility of national mergers since he assumes, in an international oligopoly model, that there are three firms, each located in a different country. He obtains a tendency towards international mergers between unionised firms for low trade costs and a tendency towards international mergers between non-unionised firms for high trade costs. Spearot (2004) finds also some support for the "tariff jumping" hypothesis. By considering a model where both upstream and downstream firms have market power, he shows that international mergers are preferred when trade costs are high. However, it is assumed, in all these articles, that firms' marginal production costs are identical. Nevertheless, if it seems now evident that the model proposed by Horn and Persson is the suitable one in order to analyse the equilibrium interactions between merger formation and trade liberalization, it seems also necessary to examine if their results hold when trade liberalization occurs between heterogeneous firms

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<sup>2</sup> Because they aim to analyze the plant location decisions by firms, they assume different firm-specific and plant-specific fixed costs.

<sup>3</sup> Motta (1992) develops also "some unconventional conclusions".

and countries. For example, considering that firms located in different countries face different level of production costs could be helpful in order to derive some predictions about mergers formation following customs unions or free trade areas between such countries. Wage differentials are often large between regional agreements' members: for example, in the North American Free Trade Agreement, Canadian and U-S wages were higher than in Mexico and differences in production costs were significant in Mercosur, Caricom or Comesa. More recently, the EU enlargement involves high wage differentials between old and new members<sup>4</sup> and a central question is whether the last enlargement's consequences on market structures will be the same as the precedent, or not. More particularly, it is natural to ask if the entry of lower production cost countries in the EU will lead to more competitive market structures.

In a completely symmetric model, as shown by Horn and Persson (2001,(a)), a decrease in trade cost give rise most of the time to a symmetric duopoly structure, with either domestic mergers for higher values of trade costs or international mergers for lower trade costs: faced to the same trade and production costs, national and foreign firms have an incentive to form a similar market structure. When choosing the market structure in a first stage, all firms face the same trade-off: an incentive to form a national merger or an incentive to avoid trade costs by forming an international merger. Because of the firms' symmetry, one structure dominates the other at a common value of the trade cost.

In a model with asymmetric firms such that comparative-advantage basis for trade exists, intuition suggests that trade liberalization could give rise to asymmetric market structures. We know<sup>5</sup> that firms with different production costs can coexist in an imperfectly competitive market and are able to export under the condition that trade plus production costs fall short of the other country's autarky price. Nevertheless, the higher-cost firms have a

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<sup>4</sup> For example, in many sectors, labor costs in France are five times higher than in the Czech republic.

<sup>5</sup> See Brander and Krugman (1980).

disadvantage on the foreign market and a level of trade cost exists such that they are unable to export while the lower-cost firms keep on trading. In such a context, one could expect that firms have different incentives to choose market structure according to trade costs.

The aim of this paper is two-fold: (i) to show the impact of trade liberalization on market structures when countries have different marginal production costs and (ii) to confront our model to the tariff-jumping argument.

The paper is organized as follow. We present the model in section 2. Assuming in a first step that international mergers are not allowed, we analyse the different possible market structures according to the level of trade cost. Section 3 characterizes the equilibrium mechanisms. We show that for high or low trade costs, firms in each country choose the same market structures. For intermediate values of the trade cost, firms with the higher production cost have a defensive strategy and choose the less concentrated market structure in order to prevent foreign firms from getting too large a part of the market. By contrast, the lower cost firms are protected by the trade cost and have an incentive to choose the monopoly structure, even if there is no cost saving from merger. It follows that for intermediate values of the trade cost, the non-cooperative game leads always to a stable asymmetric market structure. Another result is that trade liberalization does not provide more domestic competition in the lower cost country, even when trade cost is completely abolished, for a difference between production costs high enough. Models focusing on identical firms ruled out this possibility. In section 4 we consider the case where international mergers are allowed. When merging, firms may choose either to avoid trade cost or to produce only in the lower cost country. As in the symmetric production costs models, we obtain results at variance with the tariff-jumping argument: firms prefer merging nationally with high trade costs and internationally with low trade costs. Moreover when firms merge internationally, they choose the marginal

cost saving model rather than the trade cost saving one, when the difference between production costs is large enough. We conclude in section 5 with a summary of the findings.

## 2. The model

Following Horn and Persson (2001 (a)), assume that the production of a homogeneous good needs one unit of an asset and that four owners are endowed with such units. Owners 1 and 2, and their assets are located in country H (home). Owners 3 and 4 (and their assets) are located in country F (foreign). The firms' technology is described by a constant marginal cost,  $C_H$  in home and  $C_F$  in foreign with  $C_H > C_F$ . Markets are segmented and we assume that firms must pay a trade cost ( $t$ ) when they export. We assume that  $C_H < 1$  and  $0 \leq t \leq 1$  to ensure that outputs and profits are not negative. In each country, there is an identical linear demand:  $P = 1 - Q$ .

In a first step, assume that merging with a foreign firm is not allowed<sup>6</sup>. There are several ways in which international mergers can be ruled out. One is to assume that national authorities do not permit it because of the strategic part played by the concerned sector (the electricity sector is one example).

In a first stage, national owners have the choice between two market structures only. They cooperate<sup>7</sup> to choose, in each country, the structure of the national market by forming one or two firms. The second stage is a Cournot game where firms compete non-cooperatively on both markets, taking as given the firms' choice and the market structure in the other country.

As enlightened by Brander and Krugman (1983), the rivalry of oligopolistic firms in segmented markets may lead to a two-way trade equilibrium under the condition that the autarky price in each country exceeds the marginal cost of exports (production cost plus trade

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<sup>6</sup> We will consider international merger further, in section 4.

<sup>7</sup> Because they are faced to a same production cost, at a country level.

cost) by the other. In the case of countries facing the same demand and the same marginal production cost, both countries export and a two-way trade occurs at a same limit value of  $t$ .

In our more general case with different marginal production costs in countries, foreign will export only if:

$$P_A^H > C_F + t \quad (1)$$

And home will export if 
$$P_A^F > C_H + t \quad (2)$$

Where  $P_A^i$  ( $i=H, F$ ) are the autarky prices.

From (1) and (2) it is obvious that the countries' capacity to export depends on the level of the production and trade costs, but also on the national market structures, which determine the autarky prices. It is straightforward that foreign (respectively home) exports are less likely to occur with two national independent firms in home (respectively foreign) than with a national monopoly. In a more competitive market, the effect of lowering autarky price is to reduce the range of trade costs for which foreign exports are sustainable.

Even if firms choose the same market structure in both countries, because  $C_H$  and  $C_F$  are different, the limit values of  $t$  for which exports occur are different.

Let us first determine these limit values.

#### *The limit values of $t$ according to the market structures*

At the beginning of the game,  $t=1$  and there is a monopoly in each country in autarky. When the game starts,  $t$  decreases and in each country, firms choose between two strategies: a national duopoly  $M_o^H = \{1,2\}$  for home and  $M_o^F = \{3,4\}$  for foreign, or a national merged structure,  $M_N^H = \{12\}$ , respectively  $M_N^F = \{34\}$ <sup>8</sup>. The more competitive is one country's market, the lower is the level of trade cost that prevents the other country's exports.

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<sup>8</sup> See Appendix 1 for the characterization of the following values of  $t$ .

According to (2), home firms are able to export, when foreign firms are in structure  $M_o^F$ , if  $0 < t < t_o$ <sup>9</sup>, with

$$t_o = \frac{1}{3} + \frac{2}{3}C_F - C_H \quad (3)$$

And, when foreign firms are in structure  $M_N^F$ , if  $t < t_N$ , with

$$t_N = \frac{1}{2} + \frac{C_F}{2} - C_H. \quad (4)$$

According to (1), the values of  $t$  allowing foreign firms' exports are  $t < \bar{t}_o$  (when home firms are in structure  $M_o^H$ ) with

$$\bar{t}_o = \frac{1}{3} + \frac{2}{3}C_H - C_F \quad (5)$$

And  $t < \bar{t}_N$  (when home firms are in structure  $M_N^H$ ) with

$$\bar{t}_N = \frac{1}{2} + \frac{C_H}{2} - C_F \quad (6)$$

Obviously, if  $C_H = C_F$ ,  $t_o = \bar{t}_o$  and  $t_N = \bar{t}_N$ . It is easy to check that, with  $C_H > C_F$ , we have always  $\bar{t}_o > t_o$ ,  $\bar{t}_N > t_N$ ,  $t_o < t_N$  and  $\bar{t}_o < \bar{t}_N$ . However, whether  $\bar{t}_o < t_N$  or  $\bar{t}_o > t_N$  depends on the difference between the production costs. If this difference is very tiny, then  $\bar{t}_o < t_N$ , but when  $C_H > \frac{1}{10} + \frac{9}{10}C_F$ , then  $\bar{t}_o > t_N$ . Because we want to illustrate how trade liberalization does impact on the market structures when production costs are significantly different, we will focus on this last case.

We summarize the results in figure 1 which gives the  $(t, C_H)$  pairs corresponding to the limit values of  $t$  defined above, for  $C_F = 0$ .

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<sup>9</sup> This range of trade costs exists for all values of  $C_H < \frac{1}{3} + \frac{2}{3}C_F$ .



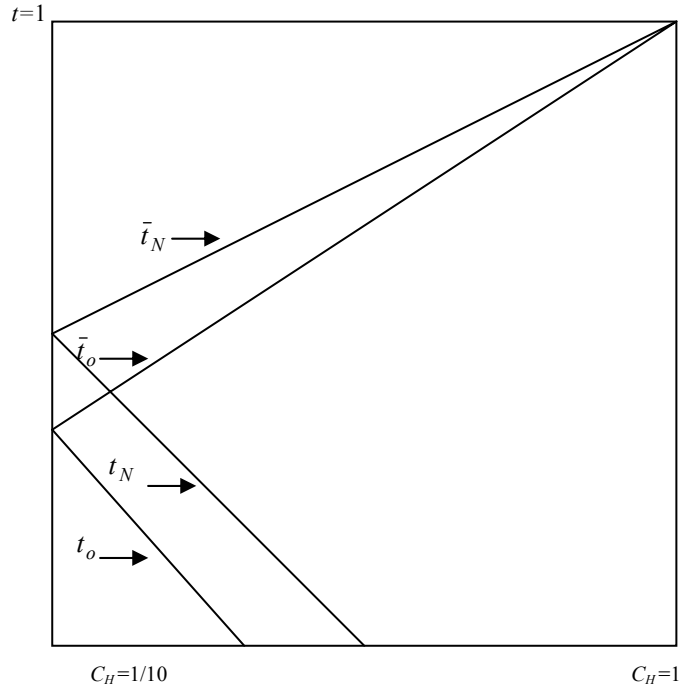


Fig.1 The limit values of  $t$

For  $(t, C_H)$  pairs above the line  $\bar{t}_N$ , both countries are in autarky, whatever the chosen market structures.

For  $(t, C_H)$  pairs such that  $\bar{t}_o < t < \bar{t}_N$ , both countries are in autarky if the other country has chosen  $M_o^i$  ( $i=H, F$ ) and foreign is able to export at the condition that home is in structure  $M_N^H$ .

For  $(t, C_H)$  pairs under  $\bar{t}_o$  and to the right of the line  $t_N$  (this implies that  $C_H > 1/10$ ), foreign exports whatever the chosen market structure by home but home is unable to export whatever the foreign market structures.

For  $t_o < t < t_N$ , a two-way trade occurs when both countries are in  $M_N$  but home is not yet able to export if foreign is in the duopoly structure.

Finally, for  $0 < t < t_o$ , a two-way trade occurs whatever the countries' market structures.

Let us note that with identical firms ( $C_H = C_F$ ), only three ranges of trade costs must be considered: for  $t_N = \bar{t}_N < t < 1$ , both countries are in autarky, whatever the chosen market

structures. Between  $t_N = \bar{t}_N$  and  $t_o = \bar{t}_o$ , both countries are able to export at the condition that, in the other country, firms have chosen to merge. Finally for  $0 < t_o = \bar{t}_o$ , a two-way trade occurs whatever the countries' market structures.

The above results suggest that, for low ( $0 < t_o$ ) and high ( $\bar{t}_N < t < 1$ ) trade costs, we should expect that firms have incentives to choose non cooperatively the same market structure in both countries ( $M_o^o = 1,2,3,4$  or  $M_N^N = 12,34$ ). When the non-cooperative outcome is the symmetric duopoly structure ( $M_o^o$ ) we have to check if firms could prefer to collude and choose the monopoly structure  $M_N^N$ . The other interesting case is when foreign firms have a comparative advantage when home chooses structure  $M_N^H$  (if  $t_N < \bar{t}_N$ ) or  $M_o^H$  (if  $t_o < \bar{t}_o$ ). In these cases we should expect that firms will choose different market structures in home and foreign and it is necessary to check if such asymmetric market structures are likely to occur in equilibrium.

### *The different possible equilibrium market structures*

Before stating the possible equilibrium market structures, we need to define the firms' criterion for choosing between  $M_o$  and  $M_N$ . Following the Industrial Organization literature, we assume that national firms choose, in the first stage, the market structure leading in the second stage to the higher **combined** profit ( $\Pi_{M_N}$  or  $2\Pi_{M_o}$ ). When  $M_N$  is chosen, national firms divide up profits equally, since they are identical.

Let us note that, in the merger literature, it is generally admitted that mergers reduce variable costs<sup>10</sup>. Most of the time when marginal costs are constant, it is assumed, for simplicity, that the marginal cost in a merged firm is the minimum of the marginal costs of the merging firms. In our model, national mergers do not give rise to any cost savings. Because we want to focus

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<sup>10</sup> About the sources of possible efficiency gains due to a merger, see Motta M., 2004.

on the market structure impact on trade through the autarky prices, we insulate this impact from any other change in cost. Our interesting result is that national mergers may arise even while production costs are unaffected by them. This contrasts with the traditional result obtained by Salant et al (1983) in a homogeneous product Cournot model (without efficiency gains from merger) where merger is detrimental to merging partners<sup>11</sup>.

Let us now define the equilibrium market structures in Cournot fashion. Denote  $M_o^N$  (respectively  $M_N^o$ ), the structure when home chooses  $M_o^H$  (respectively  $M_N^H$ ) and foreign chooses  $M_N^F$  (respectively  $M_o^F$ ) (See Figure 2). A symmetric non-cooperative equilibrium, with a duopoly in each country ( $M_o^o$ ) occurs if

$$2\Pi^{H_{M_o^o}} \langle \Pi^{H_{M_N^o}}, 2\Pi^{H_{M_o^N}} \rangle \Pi^{H_{M_N^N}} \quad (7)$$

$$\text{And } 2\Pi^{F_{M_o^o}} \langle \Pi^{F_{M_o^N}}, 2\Pi^{F_{M_N^o}} \rangle \Pi^{F_{M_N^N}} . \quad (8)$$

Inversely, the non-cooperative game leads to a symmetric equilibrium with national merged structures ( $M_N^N$ ) if:

$$2\Pi^{H_{M_o^o}} \langle \Pi^{H_{M_N^o}}, 2\Pi^{H_{M_o^N}} \rangle \Pi^{H_{M_N^N}} \quad (9)$$

$$\text{And } 2\Pi^{F_{M_o^o}} \langle \Pi^{F_{M_o^N}}, 2\Pi^{F_{M_N^o}} \rangle \Pi^{F_{M_N^N}} \quad (10)$$

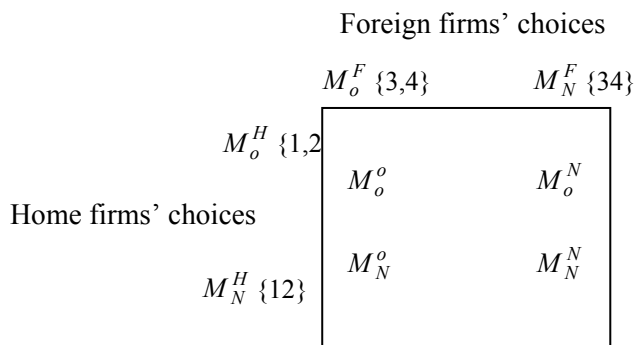


Fig.2 The firms 'choices

<sup>11</sup> Perry and Porter (1985) show that merger is profitable, even if firms compete on quantity, when there exist enough efficiency gains from the merger.

When (7) and (8) hold, we must analyze the likelihood of collusion between national and foreign firms. Remember that international merger are forbidden but firms are able to choose a collusive strategy, even if the competition authorities prohibit such a collusive behavior<sup>12</sup>. Firms prefer deviating from the non cooperative equilibrium structure if they benefit from a more concentrated structure, namely if:

$$2\Pi^{F}_{M_o^o} \langle \Pi^{F}_{M_N^N} \text{ and } 2\Pi^{H}_{M_o^o} \langle \Pi^{H}_{M_N^N} . \quad (11)$$

If (7) and (10) hold (in the same way, when (8) and (9) hold), then a non-cooperative *asymmetric* equilibrium is possible with a  $M_o^N$  (or  $M_N^o$ ) structure. In this case, it will be interesting to verify if firms in the less concentrated structure benefit from the merger in the other country<sup>13</sup>, namely if  $2\Pi^{H}_{M_o^o} \langle 2\Pi^{H}_{M_o^N}$  or  $2\Pi^{F}_{M_o^o} \langle 2\Pi^{F}_{M_N^o}$ .

### 3. Equilibrium mechanisms

In characterizing equilibrium, we assume that, in each country, firms aim at maximizing the combined profit through their choice of market structure, taking as given the other country market structure. Firms' profits depend on whether they are able or not to export and whether foreign firms export or not. It follows that the equilibrium is determined by the interaction of three parameters: the difference between production costs, trade cost and the market structures. We consider that marginal production costs are constant, while the decrease in the trade cost is the result of a regional agreement. Note that, deliberately, we do not explicitly interpret  $t$  which, for example, may include tariff and non tariff barriers, foreign market accessibility, transport and distribution costs. The result of the agreement is a decrease in trade cost, by removing tariffs between members, but the final level of  $t$

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<sup>12</sup> International mergers are observable by a Court while a collusive strategy may stay unobservable.

<sup>13</sup> This result should generalize in an international context the free rider problem shown by Salant et al (1983): following a merger formation, the outsiders may gain more than the participating firms to the merger (see also, Horn and Persson (2001,b)).

depends on the other trade costs' components. Assuming that  $t = 1$  is the pre-agreement trade cost, we consider now the firms' strategic market structure decisions, according to  $t$ . Because the relationship between  $t$  and marginal costs will clearly influence the firms' choice of market structures, let us summarize our results in as simple a fashion as possible: in figure 3 we show the equilibrium market structures for various pairs of values of  $t$  and  $C_H$ ,  $C_F$  being fixed<sup>14</sup>.

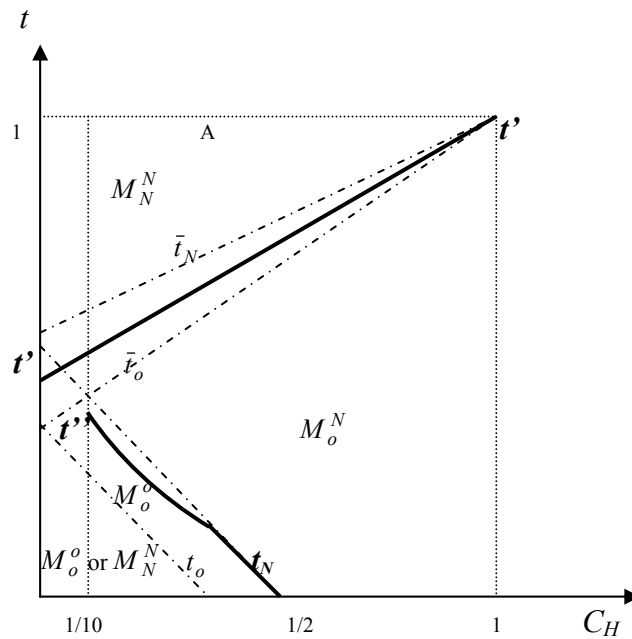


Fig.3 The equilibrium market structures

The heavy lines are the boundaries defining the  $(t, C_H)$  pairs for which an endogenous change in equilibrium market structure occurs while the light lines are the limit values of  $t$  (defined in section 2) for which countries exports occur. For  $(t, C_H)$  pairs above the boundary  $t't'$ , home and foreign firms prefer merging nationally. In the region of the parameter space under  $t't'$  and to the right of the boundary  $t''t_N$ , the Cournot game leads to an asymmetric equilibrium  $M_o^N$ . Under this boundary,  $M_o^o$  is the non cooperative equilibrium market structure.

Let us give some necessary qualifications to these results.

<sup>14</sup> In fig.3, we take  $C_F$  to be zero without loss of generality.

As underlined above, a symmetric equilibrium is more likely to occur for high or low levels of trade cost.

**Proposition 1** *There exists a value  $t'$ , ( $\bar{t}_o < t' < \bar{t}_N$ ), such that for all  $t > t'$  the Cournot game equilibrium results in a national monopoly in each country.*

➤ Starting from a point like A where  $t = 1$  and moving downwards until  $t$  reaches the light line  $\bar{t}_N$ , countries are in autarky and their profits do not depend on the other country market structure. In that special case, maximizing profits leads to

$$\Pi^H_{M_o^o} = \Pi^H_{M_N^o} = \left( \frac{1}{3} - \frac{C_H}{3} \right)^2 \quad (12)$$

$$\Pi^F_{M_o^o} = \Pi^F_{M_N^o} = \left( \frac{1}{3} - \frac{C_F}{3} \right)^2 \quad (13)$$

or 
$$\Pi^H_{M_N^N} = \Pi^H_{M_o^N} = \left( \frac{1}{2} - \frac{C_H}{2} \right)^2 \quad (14)$$

$$\Pi^F_{M_N^N} = \Pi^F_{M_o^N} = \left( \frac{1}{2} - \frac{C_F}{2} \right)^2 \quad (15)$$

It is evident that,  $\forall i = H, F$ ,  $2\Pi^i_{M_o^o} < \Pi^i_{M_N^N}$ , for all values of the home production cost  $C_H$  such that  $t > \bar{t}_N$ . Because of the anti-competitive effect of the high trade cost, firms don't care about the foreign market and can choose in their home market a monopoly structure which maximizes their joint profit. Note that because of the relationship between the trade cost and the home production cost on the foreign capacity to export, the value of  $\bar{t}_N$  is decreasing with  $C_H$ . It follows that the smaller is the difference between production costs the lower is the value of  $t$  for which both countries stay in autarky.

➤ A further decrease in  $t$  under  $\bar{t}_N$  allows foreign firms to export if home firms continue to choose the monopoly structure. In this case, foreign firms' profits are given by:

$$\Pi^F_{M_N^o} = \left(\frac{1}{3} - \frac{C_F}{3}\right)^2 + \left(\frac{1}{4} - \frac{C_F}{2} + \frac{C_H}{4} - \frac{t}{2}\right)^2 \quad (16)$$

$$\text{or } \Pi^F_{M_N^N} = \left(\frac{1}{2} - \frac{C_F}{2}\right)^2 + \left(\frac{1}{3} - \frac{2C_F}{3} + \frac{C_H}{3} - \frac{2t}{3}\right)^2 \quad (17)$$

where the first parts of the relations are the profit made on the national foreign market while the second parts represent the profit obtained by exporting.

It follows that, because they are still protected by the trade cost, foreign firms' dominant strategy is to choose the monopoly structure<sup>15</sup>. In this range of trade costs, home firms never export and foreign firms have an anti-competitive incentive to form a national merged structure.

For home firms, the output of the game depends on the relative values of  $(t, C_H)$ . On the one hand, home firms want to avoid the monopoly structure in order to prevent foreign firms from exporting but on the other hand they have also a national anti-competitive incentive to merge. Choosing the duopoly structure, their profits are still given by (12) and we can see that  $\Pi^H_{M_o^N}$  does not depend on  $t$ . In contrast, when they merge, their profit in the  $M_N^N$  structure, given by (18) in the range of trade costs  $\bar{t}_o \langle t \langle \bar{t}_N$ , increases with  $t$ .

$$\Pi^H_{M_N^N} = \left(\frac{1}{3} - \frac{2C_H}{3} + \frac{C_F}{3} + \frac{t}{3}\right)^2. \quad (18)$$

It follows that, when the anti-competitive effect of the trade cost is high enough  $(t) \langle t'$ , home firms prefer the merged structure: the boundary  $t \langle t'$  gives the  $(t, C_H)$  pairs for which the home firms are indifferent between choosing a national duopoly or a national monopoly ( $\Pi^H_{M_N^N} = 2\Pi^H_{M_o^N}$ ). Above this boundary, home firms choose the monopoly structure. It follows that for all  $(t, C_H)$  pairs above  $t \langle t'$ , the non cooperative game leads to the  $M_N^N$  structure.

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<sup>15</sup> It is easy to check that  $2\Pi^F_{M_o^o} \langle \Pi^F_{M_o^N}$  and  $2\Pi^F_{M_N^o} \langle \Pi^F_{M_N^N}$  where  $\Pi^F_{M_o^o}$  and  $\Pi^F_{M_o^N}$  are still given by (13) and (15).

**Proposition 2** *The non-cooperative Cournot game may result in a stable asymmetric market structure  $M_o^N$  for a large range of values of trade cost and a high enough difference between production costs, or for intermediate values of  $t$ , whatever the difference  $(C_H - C_F)$ .*

➤ Consider first the  $(t, C_H)$  pairs under the boundary  $t't'$  and above the light line  $\bar{t}_o$ . In this parameter space, home firms prefer a more competitive structure in order to decrease the foreign competition and foreign firms, protected by the trade cost whatever their market structure, prefer merging. It is interesting to note that, in this range of  $(t, C_H)$  pairs, the equilibrium leads to autarky in both countries while for higher values of trade cost  $(t' < t(\bar{t}_N))$ , foreign was able to export. This discontinuity in trade is a particular result which contrasts with the usual idea in international trade literature that a higher decrease in trade cost would unambiguously induce more trade.

It remains to check if, in this case of asymmetric market structure equilibrium  $M_o^N$ , home firms benefit from the foreign merger. The answer is no: as we have stressed above, home profits (which are still given by (12)) are identical in  $M_o^o$  and  $M_o^N$ . In both cases, home firms are in autarky and the level of trade cost isolates the less concentrated structure from any gain from the foreign merger.

➤ For further decrease in  $t$  under  $\bar{t}_o$  and to the right of the straight line  $t_N$ , the asymmetric market structure  $M_o^N$  is still the unique equilibrium, but now foreign firms are able to export even if home firms have chosen the national duopoly structure. The corresponding equilibrium profits are:

$$\Pi^F_{M_o^N} = \left( \frac{1}{2} - \frac{C_F}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} - \frac{3t}{4} + \frac{C_H}{2} \right)^2 \quad (19)$$



and 
$$\Pi^{H_{M_o^N}} = \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 \quad (20)$$

Let us underline that home firms will now benefit from the foreign strategy since  $2\Pi^{H_{M_o^o}} < 2\Pi^{H_{M_o^N}}$ <sup>16</sup>: in structure  $M_o^N$  the equilibrium quantities produced by home firms and the equilibrium price are now higher than in  $M_o^o$  because of the anti-competitive effect of the formation of the foreign monopoly<sup>17</sup>. In that case the results are in line with the traditional analysis: foreign merger induces an increase of outsiders' output and home firms' profit are higher when foreign firms merge. Nevertheless, merger between foreign firms is profitable, because it gives them a monopoly on their own market.

An important result is that this asymmetric market structure which leads to a triopoly market in home country (with a monopoly in foreign and only a one way trade) occurs even when the trade cost is completely nullified, for difference between marginal costs large enough (see Fig.3): in such a case Home does not make any profit by trade liberalization.

➤ When  $t$  decreases to the left of the straight line  $t_N$ , home firms are now able to export if there is a monopoly in foreign. Foreign firms have two opposite incentives: adopting a national duopoly structure in order to avoid home exports and stay in autarky in their own market or choosing the national monopoly structure in order to get a higher price in their own market knowing that this structure allows home firms' competition. For trade cost high enough, home firms' competition in the structure  $M_o^N$  is weak. It follows that there exists a limit level of trade costs such that the monopoly structure remains the more attractive for foreign firms because the gains from merging overbalance the loss from home firms' increasing competition. The heavy boundary  $t''t_N$  gives the  $(t, C_H)$  pairs for which the foreign firms are indifferent between choosing  $M_o^F$  (avoiding home firms' competition)

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<sup>16</sup> For  $t_N < t < \bar{t}_o$ ,  $\Pi^{H_{M_o^o}} = \left( \frac{1}{5} - \frac{3C_H}{5} + \frac{2C_F}{5} + \frac{2t}{5} \right)^2$ .

<sup>17</sup> See appendix 2.

or  $M_N^F$  (leading to home firms' competition on their national market)<sup>18</sup>. Above this boundary, foreign firms choose  $M_N$  and the non-cooperative game leads again to an asymmetric market structure.

**Proposition 3**

(i) For low values of the trade cost and/or low values of the difference between marginal costs, the non-cooperative Cournot game equilibrium results in a duopoly in both countries.

(ii) However, for  $0 < t < t^o$ , the firms have an incentive to collude and choose together the national monopoly structure.

➤ Under the boundary  $t > t_N$ , competition is strong because the anti-competitive effect of the trade cost is low and/or production costs are close and the foreign firms' best response is now to choose the national duopoly structure. While merging, the gains from concentration should not be sufficient to balance the loss from the home firms' competition. It follows that foreign merger is no more profitable and the equilibrium market structure is  $M_o^o$ . It remains to check whether firms have an incentive to collude and deviate from the Nash equilibrium. As long as  $t$  is higher than  $t^o$ , foreign firms have a comparative advantage in exporting (while home firms cannot export in this market structure) and no collusion is possible.

A further decrease in  $t$  under the light line  $t^o$  leads to a two way trade: both countries are able to export whatever the foreign market structure. It follows that firms have an incentive to protect themselves from the other country's exports by choosing the more competitive national market structure and that  $M_o^i$  ( $i=H, F$ ) is, in a non cooperative game, the firms' best

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<sup>18</sup> On the boundary  $t = t_N$ ,  $\Pi_{M_N^F}^F = 2\Pi_{M_o^o}^F$  where now

$$\Pi_{M_N^F}^F = \left(\frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} + \frac{t}{2}\right)^2 + \left(\frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} - \frac{3t}{4}\right)^2 \text{ and } \Pi_{M_o^o}^F = \left(\frac{1}{3} - \frac{C_F}{3}\right)^2 + \left(\frac{1}{5} - \frac{3C_F}{5} - \frac{3t}{5} + \frac{2C_H}{5}\right)^2.$$

response in both countries. However, relation (11) is now true<sup>19</sup> and it is evident that, in a collusive strategy, firms gain if they merge nationally. If one country's firms are assured that the other country's firms will not try to gain market share by choosing the duopoly structure, then their best choice is also the monopoly structure. The threat of reversal to the more competitive structure when one country deviates from the collusive agreement may ensure mergers' stability. Let us underline that, in this case, the equilibrium resulting from the non cooperative game is not the profit-maximizing choice of market structure<sup>20</sup>.

We are now able to summarize our results and derive some predictions about the future market structures after trade liberalization between different cost countries, when international mergers are forbidden.

If the trade cost remains high ( $t' < t \leq 1$ ) despite of the removing of tariffs<sup>21</sup>, a structure with one monopoly in each country is the more probable one. At the opposite, if the post-agreement trade cost is low ( $t$  under  $t'' t_N$ ) the non-cooperative game involves more competition and leads to the fully decentralized structure  $M_o^o = \{1,2,3,4\}$ . Nevertheless, in such a case the competition authorities must be watchful because collusion may be profitable for  $t < t_o$ . These two only symmetric market structures are possible when firms have identical production costs. In our model another market structure is possible: intermediate values of trade cost lead, whatever the difference between production costs, to a stable asymmetric structure with a national duopoly in the higher cost country and a national monopoly in the lower cost country. This asymmetric structure occurs also even if the trade cost is completely removed when the difference between production costs is large enough. This is a new result: a preferential agreement between countries with different

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<sup>19</sup> See Appendix 3.

<sup>20</sup> Horstmann and Markusen (1992) shows a similar result.

<sup>21</sup> For example when the transport cost is high between countries.

production costs may not induce the lower cost country to more competition and trade liberalization may not at all benefit to the higher cost country which is unable to export.

#### 4. International mergers

In addition to the two market structures considered in the precedent sections, firms are now allowed to choose to merge, in the first stage of the game, with a foreign firm<sup>22</sup>.

In models where firms face identical production costs, it is assumed that trade cost can be avoided through such mergers. In our model with different production costs, international mergers give now rise to cost savings but merging firms have two possible ways to generate efficiencies: either they avoid trade cost by forming an international duopoly, each firm in each country producing at his own production cost for his own market or they choose to produce only in the lower cost country, utilizing assets from both countries, and compete on the other country market. In that last case, trade cost is not avoided.

In both cases, firms will choose the structure leading in the second stage to the higher combined profit. Nevertheless, in case of international merger, the profit is no more equally distributed among merged firms which now are not similar. We don't specify how the combined profit is shared, the only constraint being that each firm participating to the international merger earns a higher individual profit than in other possible market structures.

In the trade cost savings case (TCS), the symmetric structure  $M_I^I = \{13,24\}$ <sup>23</sup> leads to an autarkic duopoly in each country. Whatever the level of trade cost, the combined international firms' profits are given by<sup>24</sup>:

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<sup>22</sup> We assume that neither a monopolized structure  $\{1234\}$  nor an asymmetric structure where three assets are merged (for example  $\{123,4\}$ ) are permitted by competition authorities. This assumption is justified by the relevance of the dominance concept, particularly in the EU merger control, even if it is not a dominant position itself that raises concerns but an abusive conduct which is penalized (see Seabright, 2000).

<sup>23</sup> Or the similar structure  $M_I^I = \{14,23\}$ .

$$\Pi^{13}_{M_{TCS}^I} = \Pi^{24}_{M_{TCS}^I} = \left(\frac{1}{3} - \frac{C_H}{3}\right)^2 + \left(\frac{1}{3} - \frac{C_F}{3}\right)^2 \quad (21)$$

In the marginal cost saving case (MCS), internationally merged firms are also in a duopoly structure on both countries' markets and their profits are:

$$\Pi^{13}_{M_{MCS}^I} = \Pi^{24}_{M_{MCS}^I} = \left(\frac{1}{3} - \frac{C_F}{3}\right)^2 + \left(\frac{1}{3} - \frac{C_F}{3} - \frac{t}{3}\right)^2 \quad (22)$$

It follows from (21) and (22) that firms will prefer the trade cost saving structure for high values of the trade cost such that  $t > t^*$  with  $t^* = C_H - C_F$ <sup>25</sup>. This result conforms with the literature on foreign direct investment and multinational enterprises' location choice: merged firms decide to remove their production from the higher cost country if the difference between production costs is higher than the trade cost.

#### Proposition 4

(i) *The duopoly structure with two international mergers  $M_1^I$  is dominated as long as the  $(t, C_H)$  pairs are such that the low cost country's firms are able to maintain an autarkic national monopoly on their own market. It follows that  $M_1^I$  is dominated by:*

- ✓ *the monopoly structure  $M_N^N$  with two national mergers for values of  $t$  such that  $t' < t < 1$ .*
- ✓ *The triopoly structure  $M_o^N$  with a national merger in Foreign for values of  $t$  such that  $t_N < t < t'$ .*

(ii) *The international structure  $M_1^I$  dominates the other structures when the low cost country's firms are no more protected by the trade cost and cannot stay in autarky on their*

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<sup>24</sup> It is easy to check that the combined profits are the same, for  $t > \bar{t}^o$ , in the triopoly structure with only one international merger  $\{1,2,3,4\}$  or  $\{1,3,2,4\}$  etc.

<sup>25</sup> It follows that we have to consider only the trade cost saving combined profit when  $\bar{t}_o < t < 1$ , because in that range of trade costs,  $t > t^*$  whatever  $C_H < 1$  (see fig.4).

*national market when they choose to merge nationally ( $0 \leq t < t_N$ ). Whether the firms choose the trade cost saving or the marginal cost saving depends on the difference between production costs.*

The above results are in contrast with the tariff-jumping argument, like in the symmetric production costs models. Our result suggests that the tariff-jumping argument is ruled out in models where firms' merger decisions are endogenous.

We give now qualifications to our results (see figure 4). When international mergers are allowed, foreign firms are the decisive owners because of their comparative advantage: they will agree with an international merger only when this comparative advantage is softened to such an extent that, while merging nationally, they cannot stay in autarky on their own market.

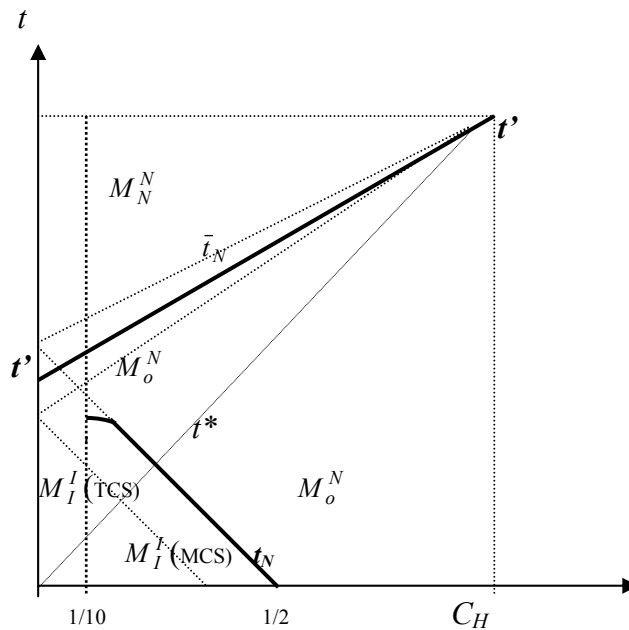


Fig.4 International mergers

➤ When  $\bar{t}_N < t < 1$ , by comparing (14), (15) and (21), it is not surprising to see that the combined profits in the international duopoly structure are lower than in the more concentrated structure resulting from national mergers<sup>26</sup>.

➤ When  $t$  decreases, this result still holds<sup>27</sup>, and the market structures  $M_N^N$  (when  $t' < \bar{t}_N$ ) or  $M_o^N$  (when  $t_N < t' < 1$ ) lead to the higher combined profits.

Let us give an intuitive explanation for these results. There are two opposite impacts of the trade cost on firms' profits: on the one hand,  $t$  limits the exported quantities and the profit earned on the other market. It follows that firms have an incentive to avoid  $t$  in order to get a larger share of the other market. This is the tariff-jumping argument. On the other hand, trade cost is a protection for the domestic market and, in models where market structure are endogenous, high values of  $t$  allow the lower cost firms to choose a national monopoly structure leading always to a higher profit than an international duopoly structure.

Remember that in this range of trade costs home firms are unable to export: they have no incentive to avoid the trade cost since their profit increases with  $t$ . Foreign firms have a comparative advantage: they export and a part of their profit is affected by the trade cost, but the larger component of their profit is their own market where they are a monopolist. As long as they are protected by high values of  $t$  ( $t_N < t < 1$ ), their anti-competitive incentive to form a national monopoly is larger than their incentive to jump the trade cost by choosing an international duopoly structure.

When  $t$  reaches lower values ( $t < t_N$ ), foreign firms are not protected by the trade cost if they merge nationally. They must share their own market with home firms. In each country, there is a triopoly market structure  $M_o^N = \{1,2,3,4\}$ . Moreover, remember that when  $t$  reaches  $t''$ ,

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<sup>26</sup> The relation  $\frac{1}{2} \left[ \left( \frac{1 - C_H}{2} \right)^2 + \left( \frac{1 - C_F}{2} \right)^2 \right] > \left( \frac{1 - C_H}{3} \right)^2 + \left( \frac{1 - C_F}{3} \right)^2$  is always true.

<sup>27</sup> See appendix 4.

foreign firms want to protect their market because the anti-competitive effect of the trade barrier is no more sufficient and their choice leads to the less concentrated structure  $M_o^o = \{1,2,3,4\}$ . It follows that for  $0 \leq t < t_N$  the incentive to internationally merge is stronger<sup>28</sup>. The main reason of this choice is to get a more concentrated structure (a duopoly rather than a triopoly in  $M_o^N$  or a quadriopoly in  $M_o^o$ ), not to avoid the trade cost. Moreover, remember that, for  $(t, C_H)$  pairs under the line  $t_o$  (that means for low values of the trade cost and /or production costs) firms could nationally merge if they collude. In this region of the parameter space, an international duopoly leads, as national mergers, to a duopoly in each country and does not correspond to an increase in firms' market power. Nevertheless, firms will prefer the international merger which creates efficiencies while the national merger does not.

However, the interesting result is that, most of the time, the firms' incentives are not founded on the trade cost-jumping argument. Indeed, when  $t$  is low ( $t < t^*$ ), merger synergies are higher in the marginal cost savings model which is chosen: production occurs only in the lower cost country. These results suggest that the presumption that international mergers occur with high trade costs -“the tariff-jumping argument”- is robust only to the extent that firms have no alternative market structure and/or no other motives to merge. In our model, firms internationally merge only if this structure leads to an increase in their market power (it is the case for  $t_o < t < t_N$ ) or, for a same market power, leads to efficiencies (it is the case for  $0 < t < t_o$  when firms collude).

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<sup>28</sup> Excepted in the northern space of this area: in this little parameter space, the foreign national monopoly is protected by trade cost and home firms' competition is weak. This result strengthens our conclusions about the irrelevance of the tariff-jumping argument.



## 5. Conclusion

Our purpose in this paper was to provide some predictions about mergers formation following trade liberalization between countries with different marginal costs.

Our analysis highlights several main points which contrast with the traditional results and may help to evaluate regional agreements schemes between asymmetric countries. One result is that a regional agreement between different countries, so that a comparative-advantage basis for trade exists, may lead to a stable asymmetric market structure with more competition in the higher cost country but does not induce a more competitive market structure in the lower cost country. This result contrasts with the idea that a more open economy should systematically provide more domestic competition. Moreover, we obtain a discontinuity in trade flows which are not linear in the decrease in trade cost and we show that for high enough differences between marginal costs, the higher cost country may never export even if the trade cost is nullified. Both results contrast with the idea that a greater decrease in trade cost should systematically induce more trade. We show also the likelihood of collusion between countries for low values of the trade cost or/and low difference between production costs. Another result is that it seems that the tariff-jumping argument must be reconsidered when market structures are endogenous. Trade cost has no determinate direct impact on the firms' decision to merge internationally. Firms prefer to merge nationally, even if international mergers are allowed, when they are protected by high trade costs. Moreover, in our model, when firms merge internationally, their aim may be not to avoid trade cost but to produce at a lower cost. This result contrasts with the idea that firms want to merge internationally in order to avoid trade cost. This idea is disrupted when firms may choose another more concentrated market structure.

The principal shortcoming of our analysis is the absence of welfare considerations. For example, a crucial question is whether regional trade agreements will be welfare improving.

The EU merger control suggests the application of a consumer welfare standard<sup>29</sup> by answering the following question: do consumers gain sufficiently from merger efficiencies in order to offset the anti-competitive effects of an increase in market power? To answer this question, it is necessary to consider the motives for the merger: in our model, with high trade costs, national mergers' dominant motive is to increase market power and such mergers have a negative impact on consumers welfare. With low trade costs, the justification for international mergers is a mix of motives: the increase in market power and the search for efficiencies, most of the time through marginal cost savings. It follows that international mergers may lead to lower prices and enhance consumer welfare despite an increased market power. Anyhow, welfare evaluations of mergers make necessary to specify how the combined profits are shared. Moreover, in the EU enlargement context, it is not clear if the application of a consumer welfare standard would take into account the aggregate EU welfare and identify conditions under which Pareto gains are achieved or compare welfare evolutions in new and old EU members. In this way, further research could extend our analysis.

### **Appendix 1**

In autarky, the profit maximization in home, when the market structure is a duopoly leads to the equilibrium autarky price:

$$P_A^H = \frac{1}{3} + \frac{2}{3}C_H$$

And in a merged structure :

$$P_A^H = \frac{1}{2} + \frac{1}{2}C_H$$

The corresponding autarky prices in foreign are:

$$P_A^F = \frac{1}{3} + \frac{2}{3}C_F \quad \text{and} \quad P_A^F = \frac{1}{2} + \frac{1}{2}C_F$$

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<sup>29</sup> On this topic, see De la Mano, 2002.

Using (1) and (2), it is straightforward to obtain equations (3) to (6).

## Appendix 2

In structures  $M_o^o = \{1,2,3,4\}$  or  $M_o^N = \{1,2,3,4\}$ , if  $t_N \langle t \bar{t}_o$ , foreign firms export, whatever the market structure in home.

At the non-cooperative equilibrium, quantities produced by each home firms are

$$q^{H_{M_o^o}} = \left( \frac{1}{5} - \frac{3C_H}{5} + \frac{2C_F}{5} + \frac{2t}{5} \right) \text{ or } q^{H_{M_o^N}} = \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right) \text{ and the equilibrium price is given}$$

$$\text{by } P^{H_{M_o^o}} = \left( \frac{1}{5} + \frac{2C_H}{5} + \frac{2C_F}{5} + \frac{2t}{5} \right) \text{ or } P^{H_{M_o^N}} = \left( \frac{1}{4} + \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right).$$

Remember that  $\bar{t}_o = \frac{1}{3} + \frac{2C_H}{3} - C_F$ , it is easy to check that  $q^{H_{M_o^N}} \rangle q^{H_{M_o^o}}$  and  $P^{H_{M_o^N}} \rangle P^{H_{M_o^o}}$  if

$$t \langle \frac{1}{3} + \frac{2C_H}{3} - C_F.$$

## Appendix 3

Under the line  $t_o$ , when both countries choose the duopoly structure, firms' profits are given by

$$\Pi^i_{M_o^o} = \left( \frac{1}{5} - \frac{3C_i}{5} + \frac{2C_{j \neq i}}{5} + \frac{2t}{5} \right)^2 + \left( \frac{1}{5} - \frac{3C_i}{5} + \frac{2C_{j \neq i}}{5} - \frac{3t}{5} \right)^2$$

and when they both choose to merge

$$\Pi^i_{M_o^N} = \left( \frac{1}{3} - \frac{2C_i}{3} + \frac{C_{j \neq i}}{3} + \frac{t}{3} \right)^2 + \left( \frac{1}{3} - \frac{2C_i}{3} + \frac{C_{j \neq i}}{3} - \frac{2t}{3} \right)^2.$$

It follows that, in this range of trade costs,  $2\Pi^F_{M_o^o} \langle \Pi^F_{M_o^N}$  and  $2\Pi^H_{M_o^o} \langle \Pi^H_{M_o^N}$ .

## Appendix 4

For  $t' < t(\bar{t}_N)$ , we have to compare the combined profits given by (17),(18) and (21).

Simulations show that , whatever the values of  $C_F$  and  $C_H$  ,

$$\frac{1}{2} \left[ \left( \frac{1-C_F}{2} \right)^2 + \left( \frac{1}{3} - \frac{2C_F}{3} + \frac{C_H}{3} - \frac{2t}{3} \right)^2 + \left( \frac{1}{3} - \frac{2C_H}{3} + \frac{C_F}{3} + \frac{t}{3} \right)^2 \right] > \left( \frac{1-C_H}{3} \right)^2 + \left( \frac{1-C_F}{3} \right)^2 .$$

When  $\bar{t}_o < t' < t$ , both countries are in autarky because home firms have chosen the less concentrated structure and foreign firms cannot export. The international structure is dominated since (see (12) and (15)), for all values of  $C_F < 1$ :

$$\frac{1}{2} \left( \frac{1-C_F}{2} \right)^2 + \left( \frac{1-C_H}{3} \right)^2 > \left( \frac{1-C_H}{3} \right)^2 + \left( \frac{1-C_F}{3} \right)^2 .$$

For  $t_N < t(\bar{t}_o)$ , whether the trade cost savings or the marginal cost savings model is chosen depends now on the difference  $C_H - C_F$ .

When  $C_H < \frac{1}{4} + \frac{3C_F}{4}$ , then  $t > t^*$  and the TCS is chosen if firms internationally merge. The comparison of the combined profits shows (see (19), (20), (21)) that the international structure is dominated:

$$\left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 + \frac{1}{2} \left[ \left( \frac{1-C_F}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} - \frac{3t}{4} + \frac{C_H}{2} \right)^2 \right] > \left( \frac{1-C_H}{3} \right)^2 + \left( \frac{1-C_F}{3} \right)^2 . \quad (23)$$

If  $C_H > \frac{1}{4} + \frac{3C_F}{4}$ , then the MCS is more profitable but the international structure<sup>30</sup> is still dominated:

$$\left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 + \frac{1}{2} \left[ \left( \frac{1-C_F}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} - \frac{3t}{4} + \frac{C_H}{2} \right)^2 \right] > \left( \frac{1-C_F}{3} \right)^2 + \left( \frac{1}{3} - \frac{C_F}{3} - \frac{t}{3} \right)^2 . \quad (24)$$

<sup>30</sup> Any international triopoly structure is also dominated. Results are available upon request from the author.

For lower values of the  $(t, C_H)$  pairs such that  $t < t_N$ , firms are in structure  $M_o^N$  when international mergers are forbidden but now, in this structure, there is a two-way trade and the combined profits of firms 1 and 3 (for example) are now given by:

$$\frac{1}{2} \left[ \left( \frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} + \frac{t}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} - \frac{3t}{4} \right)^2 \right] + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} - \frac{t}{2} \right)^2 \quad (25)$$

These combined profits are lower in (25) than those given by the LHS in (24) because the foreign country's market structure is now a triopoly while it is a monopoly in (24). On the other hand, the combined international profits given by the RHS in relations (24) and (26) increase when  $t$  decreases. In the same way, it is easy to check that the combined international profits increase in the RHS of relation (23) for lower values of  $C_H$ . It follows that firms have an incentive to merge internationally when the trade cost falls under  $t_N$ . All simulations show that, for  $t < t^*$ :

$$\begin{aligned} \frac{1}{2} \left( \left( \frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} + \frac{t}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} - \frac{3t}{4} + \frac{C_H}{2} \right)^2 \right) + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} - \frac{t}{2} \right)^2 \\ < \left( \frac{1}{3} - \frac{C_F}{3} \right)^2 + \left( \frac{1}{3} - \frac{C_F}{3} - \frac{t}{3} \right)^2 \end{aligned} \quad (26)$$

and that, for  $t > t^*$

$$\begin{aligned} \frac{1}{2} \left( \left( \frac{1}{4} - \frac{3C_F}{4} + \frac{C_H}{2} + \frac{t}{2} \right)^2 + \left( \frac{1}{4} - \frac{3C_F}{4} - \frac{3t}{4} + \frac{C_H}{2} \right)^2 \right) + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} + \frac{t}{4} \right)^2 + \left( \frac{1}{4} - \frac{C_H}{2} + \frac{C_F}{4} - \frac{t}{2} \right)^2 \\ < \left( \frac{1}{3} - \frac{C_H}{3} \right)^2 + \left( \frac{1}{3} - \frac{C_F}{3} \right)^2 \end{aligned} \text{ excepted for the highest few values of } t \text{ in the northern area.}$$

It is not surprising that this result holds for  $t < t^*$  since, in this range of trade costs, when international mergers are forbidden, either firms are in the more competitive structure or they collude and nationally merge, but without merger efficiencies. In both cases, firms will prefer to internationally merge, if it is allowed.

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