Endogenous mergers, trade and industrial policy

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ISBN 952-458-396-8
ISSN 1458-686X
no 11

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ABSTRACT

Two firms produce differentiated goods in different countries. The owners negotiate over a merger. The standard result is that the owners of a firm obtain their initial profit plus half of the merger surplus. Introducing subsidies/taxes adds a new element because profit shares affect policies and policies affect profit shares. In addition to the disagreement effect, the bargaining solution is determined by how much a firm contributes relatively to the merger profit. Besides, the reversal of policies may make anti-competitive mergers unfeasible.

JEL classification: F12, F13, G34

Keywords: endogenous mergers, international mergers, strategic trade policy

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1. INTRODUCTION

This paper analyses a situation where two firms producing differentiated goods in different countries under Cournot competition bargain over a horizontal merger and the equity shares of it, that is, over the division of its combined profit. If there were no post- merger strategic trade policies, the solution is familiar: Each obtains its initial pre-merger profit (where optimal pre-merger policy may be taken into consideration) plus half on the merger surplus. Introducing post-merger production subsidies/taxes complicates the solution because policies affect shares and shares affect policies. Besides the influence of the disagreement points (or inside options), there are additional effects from differing post-merger policies caused by asymmetries. To give an example, if the only asymmetry is in post-merger synergy advantages, with no policies both negotiators divide the merger profit. In the presence of policies, the owners of the firm deriving more synergy advantages obtain a larger share of the merged enterprise. In general, the endogeneity yields intuitively appealing solutions. The more a procuder contributes to the merger profit, the larger is his/her share of it.

Besides, with policies mergers may become unfeasible because optimal policies reverse from pre-merger subsidies to post-merger taxes in most cases. To put this in a context, the well-known result in Brander and Spencer (1985) is that in a Cournot duopoly with national firms in different countries production subsidy is an optimal policy when considering one country or both countries. This was subsequently modified in several ways. Eaton and Grossman (1986) showed that in a Bertrand-duopoly production tax is optimal in both countries if all production is exported to a third country. Dixit (1984) showed that if there are several Cournot-competitive firms in the policy country tax may well be optimal because a subsidy to one domestic firm is, in itself, harmful to other domestic firms. In all of these, the firms were owned by nationals. A modification concerns cross-ownership of the imperfectly competitive firms. Lee (1990) and Dick (1993) showed that if these firms are partially owned by foreigners subsidy recommendation may reverse to tax because a part of the benefit caused by a subsidy goes to foreigners. In their papers, the firms continue to make independent production decisions from which ownership is separated and the cross- ownership shares are modelled as exogenous. A further extension concerns subsidizing/taxing research and development (R&D) instead of final goods. As shown by Brander and Spencer (1983), subsidizing is still optimal. However, as presented by Qiu and Tao (1998), if there are considerable exogenous spillovers from the R&D activity to foreign firms, subsidy recommendation may be reversed. Zhou et al. (2001) discuss investment taxes and subsidies in a duopoly situation of a low product quality country (firm) and a high quality country (firm), both exporting to a third country. They found out that under Cournot competition tax is optimal in the low- quality country while subsidy is optimal in the high- quality country. Joint welfare is increased by taxes in both countries.

Section 2 presents the basic model and derives optimal policies. Section 3 analyses the merger game which is formulated as a Nash bargaining game which may be seen as a limiting case of a game of alternating offers (see Binmore et al. (1986)). Firms' owners know what the goverments' (optimal) policies would be after merger while a government knows the effects of its policy on production and prices. Asymmetries in country sizes, production costs and synergy advantages are discussed in Section 4. In Sections 2-4 the policies are determined non- cooperatively. However, as will be shown in Section 5, joint welfare would be increased by subsidies in both countries. Concluding remarks are presented in Section 6.

2.THE MODEL

There are two countries, denoted by the letters h (h-country) and f (f-country). Each country has similar endowments of a single factor of production. This factor is used in two production sectors in both countries. The first is a competitive sector, denoted by subscript 0, where a homogenous good is produced in both countries. The second sector is imperfectly competitive, producing two symmetric, differentiated goods, good 1 in h-country and good 2 in f- country. In the production of these goods, marginal costs are constant, denoted by c_1 for good 1 and c_2 for good 2. The governments' policy instruments are production tax or subsidy, denoted by s_1 for a per unit subsidy in h- country if $s_1 > 0$ and tax if $s_1 < 0$. The corresponding denotation for f-country is s_2. There are no trading costs and the markets are integrated. Arbitrage ensures that the government must subsidize or tax all domestic production of a good instead of exports (or domestic consumption) only.

A representative consumer in either country has a quasilinear utility function $U(q_0,q_1,q_2) = u(q_1,q_2) + q_0$ where q_i denotes consumption of the respective good. As in Dixit (1988), the subutility function has a quadratic form $u(q_1,q_2)= A\cdot(q_1+ q_2) - (1/2)(q_1^2+q_2^2+2ßq_1q_2)$. When maximising this with the budget constraint, we arrive at inverted demands:

$$p_i = A - q_i - ßq_j \qquad (1)$$

where i,j =1,2, i≠ j, refer to goods and p_i are the respective prices. It is assumed that 0 < ß < 1, that is, the goods are imperfect substitutes.

In the initial situation of national firms, in h- country firm 1, which is owned by h-country residents, produces good 1 and in f-country firm 2 owned by f-country residents produces good 2. As can be shown, it is optimal for both governments to pay subsidies. These are equal in a symmetric situation (equal unit costs and equal country sizes). If h-country is larger than f-country, optimal subsidy is larger because of a larger consumer surplus. This leads to a larger profit of firm 1. As was shown by Neary (1994) for homogenous goods and as could be shown for heterogenous goods, if the unit cost of firm 1 is smaller than that of firm 2, h-country's subsidy is larger and, naturally, the profit of firm 1.

Let us now turn to a situation where firms 1 and 2 merge. Good 1 is still produced in h-country only in plant 1 of the merged enterprise and good 2 in f-country only in plant 2. The inflexibility of production sites may be justified, e.g., by assuming sunk costs. The merger situation is formulated as a joint maximization of the combined profit where (potential) synergy advantages are taken into account:

$$\max_{q_1,q_2} (\pi_1+ \pi_2) = (A-q_1-ßq_2+s_1-c_1+a_1)q_1 + (A-q_2-ßq_1+s_2-c_2+a_2)q_2 + S \qquad (2)$$

where S denotes such synergy advantages which do not depend on production quantities. If they do, I formulate these advantages as constant unit cost savings, denoted by a_i. I will call the former fixed and the latter variable advantages. (For modelling horizontal mergers, see Farrell and Shapiro (1990)). The plants use separate accounting so that the government may tax or subsidize the production of the domestic plants. The first order conditions combined with Eq. (1) are:

$$p_i = A - q_i - ßq_j = q_i + ßq_j - s_i + c_i - a_i \qquad (3)$$

From Eq. (3) the Nash- Cournot equilibrium quantities are:

$$q_i = [A\ (2-2ß)\ -2(c_i-a_i)+\ 2ß(c_j-a_j) + 2s_i - 2ßs_j\ ] / D_M \qquad (4)$$

where $D_M = 4-4ß^2$. Let z denote the share of the merged enterprise and of its profit going to h-country residents. The governments take z as exogenous. As explained by Markusen and Venables (1988), optimal subsidy/tax for h- country, s_1^*, is obtained by maximizing the indirect utility function $v^h(p_1,p_2,\ z(\pi_1+\pi_2)-s_1q_1)$ with respect to s_1. This yields[1)]

$$s_1^* = -2(1-z - \Omega/2)(1-ß^2)q_1 \qquad (5a)$$

where Ω describes the relative size of h-country, $0 < \Omega < 1$. Correspondingly, optimal policy in f-country is

$$s_2^* = -2(z - ø/2)(1-ß^2)q_2 \qquad (5b)$$

where $ø = 1-\Omega$ is the relative size of f-country. Based on these, it can be shown that in the merger case, irrespective of division of equities, tax is optimal at least in one of the two countries[2)]. For a wide range of cases it is optimal in both countries, for example, if all production is exported to a third country or if $1/4 < z < 3/4$ with equal country sizes. A part of this is explainable by the arguments in cross-ownership literature since owning the shares of the merged enterprise resembles cross- ownership of the two national firms. A tax in the domestic country hurts the domestic plant but a part of this loss goes abroad while at the same time it benefits the foreign plant and a part of this benefit comes back to the domestic country. However, the tax recommendation is stronger here because a subsidy in one country would lead to an extra large increase in the production of the subsidized good as noted above. This increases subsidy costs and implies an excessively low price for this good making subsidization less lucrative.

The connection between subsidies/taxes and the ownership shares is central to the following analysis. Differentiating Eq.(5a) implicitly with respect to s_1, Eq.(5b) with respect to s_2, using Eq. (4) and applying the derivation rule for inverse functions yields

$$\partial s_1^*/\partial z = 2(1-ß^2)q_1/\ [1+ (1-z - \Omega/2)] = -\ \partial s_1^*/\partial(1-z) \qquad > 0 \qquad (6a)$$

$$\partial s_2^*/\partial z \;=\; -\;2(1-ß^2)q_2/\;[1+ z - ø/2)] \;=\; -\;\partial s_2^*/\partial(1-z) \;<\; 0 \qquad (6b)$$

That is, an increase in domestic ownership of the merged enterprise leads to an increase (a decrease) in optimal subsidy (tax) of the domestic good.

3. THE MERGER GAME

The merger is bargained between the native owners of the two national firms. The variables in the national firms' case are denoted by the letters N and in the merger case by M. The bargaining concerns the division of the combined profit of the plants $\pi_1^M + \pi_2^M$, denoted by π_{12}^M. The governments know how the firms react and, in addition, the owners know what the governments will do, that is, implement optimal policy. Consequently, we may write $\pi_{12}^M = \pi_{12}^M (s_1^{*M}, s_2^{*M})$. For simplicity, we assume that the marginal utility of income is equal to unity in both countries. As could be shown, this does not affect the conclusions. Note that this assumption is implicitly included when we were discussing optimal policies. The bargaining solution is obtained by maximizing the following Nash product with respect to ownership shares

$$\max_{z} \;\; [z\pi_{12}^M - \pi_1^N)][(1-z)\pi_{12}^M - \pi_2^N] \qquad (7)$$

with the usual feasibility requirements. The first order condition may be written as :

$$\frac{\partial(z\pi_{12}^M)/\partial z}{z\pi_{12}^M - \pi_1^N} = \frac{\partial[(1-z)\pi_{12}^M]/\partial(1-z)}{(1-z)\pi_{12}^M - \pi_2^N} \qquad (8a)$$

where , from Eqs.(4), (6a) and (6b),

$$\partial(z\pi_{12}^M)/\partial z = \pi_{12}^M \qquad (8b)$$

$$+ \ 2z(q_1^M)^2(1-ß^2)/\ [1+ (1-z - \Omega/2)] - \ 2z(q_2^M)^2(1-ß^2)/\ [1+ z - ø/2)]$$

$$\partial[(1-z)\pi_{12}^M]/\partial(1-z) = \pi_{12}^M \qquad (8c)$$

$$- 2(1- z)(q_1^M)^2(1-ß^2)/[1+ (1-z - \Omega/2)] + 2(1-z)(q_2^M)^2(1-ß^2)/[1+z - ø/2)]$$

At least for $ß \geq 1/2$, (8b) and (8c) are both positive3). Note that relative production quantities unambiguously reflect the relative plant- specific profits, for example if $q_1^M > q_2^M$ from Eq. (3) $\pi_1^M = (q_1^M+ßq_2^M)q_1^M > (q_2^M+ßq_1^M)q_2^M = \pi_2^M$. Eqs.(8a)-(8c) show the following:

Proposition. With strategic trade policies, the division of the equities of the merged enterprise depends (i) on the initial national firms' situation and (ii) on how much these national firms may contribute to the profit of the merged enterprise.

(i) is a standard effect of the disagreement point or inside option, described in the denominators of Eq. (8a), while the endogeneity of the merger comes entirely from (ii). This can be seen by considering a situation where no trade policies are available. In this situation, the numerators of Eq. (8a) are the same, equal to π_{12}^M, and we obtain the well-known and widely applied split-the-difference solution (see, e.g., Holmström and Roberts (1998)). The residents of a country obtain the profit of the respective national firm plus half of the difference between the merger profit and the profits of both national firms, that is, from Eqs. (8a)- (8c),

$$z\pi_{12}^M = \pi_1^N + (1/2)(\pi_{12}^M - \pi_1^N - \pi_2^N) \text{ and}$$

$$(1-z)\pi_{12}^M = \pi_2^N + (1/2)(\pi_{12}^M - \pi_1^N - \pi_2^N).$$

In a situation with policies, the solution becomes more complicated because of the endogeneity in Eqs. (8b) and (8c). The general case is presented in Figure 1 where, applying Osborne and Rubinstein (1990), the left-hand side of Eq. (8a) concerning firm/plant 1 in h-country and right-hand side concerning firm/plant 2 in f-country are drawn separately as functions of z. I will call the former the h-curve and the latter the f-curve. A sufficient (but by no means necessary) condition for h-curve to be decreasing is to assume that $\partial^2(z\pi_{12}^M)/\partial z^2 < 0$, that is, the profit amount is not increasingly increasing with respect to profit share. Correspondingly, f-curve increases with respect to z. The equilibrium is where these curves cross.

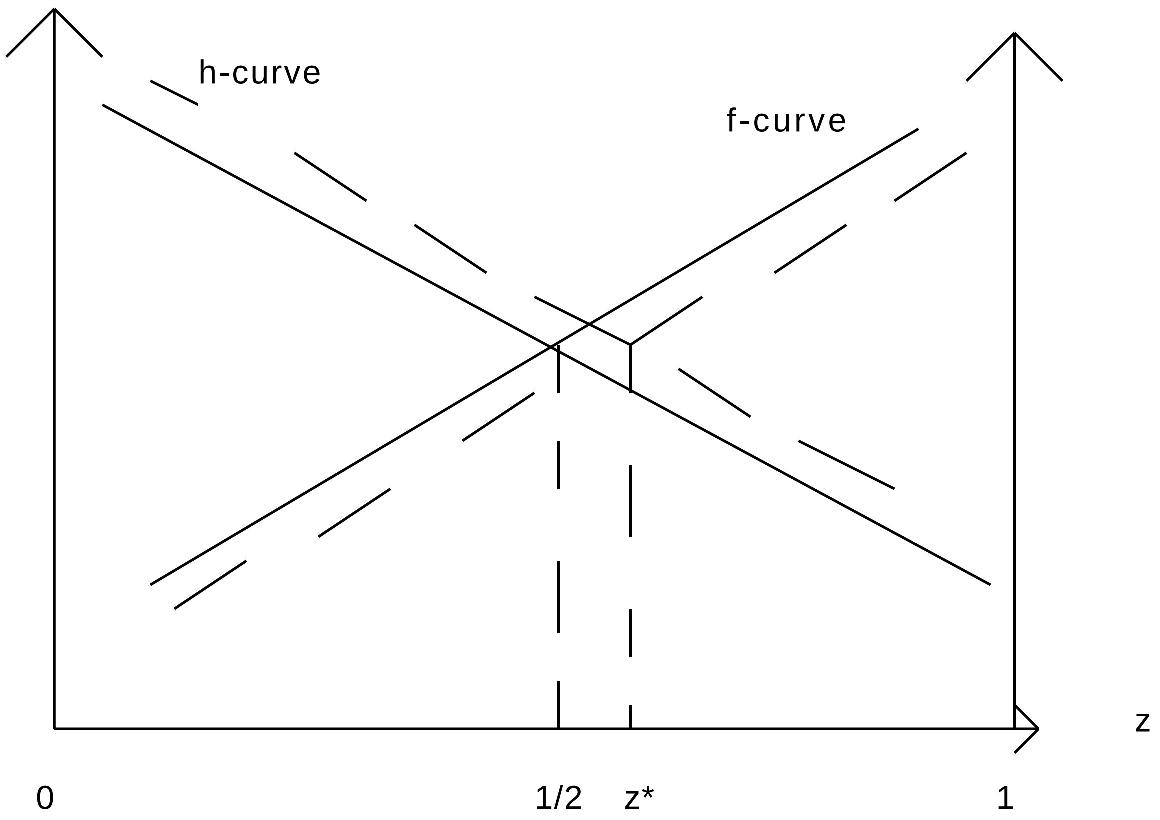

Figure 1. Eq. (8a) presented geometrically. Solid lines depict the perfectly symmetric case. Broken lines depict three situations:
(i) h-country's unit cost is smaller than f-country's cost
(ii) h-country is larger than f-country
(iii) h-country plant derives more synergies than f-country plant

The solid lines depict the symmetric situation, that is, country sizes, unit production costs and synergy advantages are equal. The unique solution is z = (1-z) = 1/2 because in the merger situation the plant-specific profits and production quantities are equal, as they are in the national firms' case. Accordingly, in this equilibrium the necessary condition for the feasibility of the merger is that half of the profit of the merged enterprise is larger than the disagreement profit, that is, $(1/2)\pi^{M}{}_{12} - \pi_i^N > 0$. This may be problematic if the governments pay the national firms optimal subsidies and if the bargaining owners suppose that the goverments will levy optimal noncooperative production taxes after the merger. As an illustration, Table 1a shows the profits in a symmetric case without any synergies for a sample of values of substitution. As may be inferred, there will be no merger unless there are sufficient synergy advantages. Note, however, that optimal policies may also prevent mergers with synergy advantages, if these are not large enough. In Table 1b corresponding figures are presented in a situation where all production is exported to a third country. As we can see, purely anticompetitive mergers are possible only if the substitutability is very high.

	$\pi_i^N(s_i^*)$	$\pi_{12}^M/2$
ß = 0.5	$(A-c)^2/3.28$	$(A-c)^2/7.6$
ß = 0.8	$(A-c)^2/3.80$	$(A-c)^2/7.94$
ß = 0.9	$(A-c)^2/3.90$	$(A-c)^2/7.98$
ß=0.999	$(A-c)^2/4$	$(A-c)^2/8$

Table 1a. Perfectly symmetric two-countries situation. First column: the profit of a national firm with optimal subsidies. Second column: the merger profit going to each country with optimal taxes and no synergy advantages.

	$\pi_i^N(s_i^*)$	$\pi_{12}^M/2$
ß = 0.9	$(A-c)^2/10.05$	$(A-c)^2/10.155$
ß=0.999	$(A-c)^2/10.56$	$(A-c)^2/10.125$

Table 1b. Perfectly symmetric situation when all production is exported to a third country. First colum: the profit of a national firm if there are optimal subsidies. Second colum: the merger profit going to each country with optimal taxes and no synergy advantages.

4. ASYMMETRIES IN COSTS, SYNERGIES AND COUNTRY SIZES

Three asymmetries are discussed in the following. Each of them is analysed separately while assuming the others absent. Let us first consider a situation where the unit production costs in different countries are not similar. Assume that h-country's cost c_1 is smaller than f-country's cost c_2. Consider a hypothetical situation where the production cost is $(c_1 + c_2)/2$ in both countries corresponding to the solid curves in Figure 1. Let h-country's cost decrease and f-country's cost increase from this average. Intuitively, one might suggest that h-country residents obtain a larger share for the two reasons discussed in Section 3. (i) Their disagreement point is higher. This is obvious. (ii) Their more cost-effective firm would contribute more to the merger profit. This is not so self-evident because a cost difference causes changes in taxes. For any given z, by inserting s_1^* and s_2^* from Eqs.(5a) and (5b) into Eq.(4), differentiating with respect to c_1 and doing the same with respect to c_2 we arrive at:

$$\partial q_1^{M*}/\partial c_1\ ,\ \partial q_2^{M*}/\partial c_2\ <\ 0 \text{ and } \partial q_2^{M*}/\partial c_1\ ,\ \partial q_1^{M*}/\partial c_2\ >\ 0 \quad (9)$$

Because of this, the terms $2z(q_1^M)^2(1-ß^2)/\ [1+ (1-z - \Omega/2)]$ and $-2z(q_2^M)^2(1-ß^2)/\ (1+ z - ø/2)$ in h-curve increase which contributes to its upwards shift. Corresponding terms contribute to f-curve's downward shift. What remains is the merger profit π_{12}^M, which is present both in the denominator and numerator of both curves. Additionally, its change is the result of two opposing forces. For these reasons, we may suppose that its change does not affect the curves very much compared with the two other elements mentioned above. Furthermore, in the national firms' situation the disagreement point, that is, the profit of h-country firm, π_1^N, is larger than that of f-country firm, π_2^N, which as itself leads to a decrease in the denominator of h-curve and increase in that of f-curve. Accordingly, h-curve shifts upwards, f-curve shifts downwards, as shown in Figure 1, and h-country's merger share z increases. The only conceivable situation for a reverse result would be such where the cost advantage is taxed away post-merger. However, even if the lower cost country would tax its production more than the higher cost country, the tax difference must be smaller than the cost difference. This can be seen by subtracting in Eq. (4), which yields, when taking Eq. (9) into account,

$$q_1^{M*} - q_2^{M*} = [(2-2ß)(c_2 - c_1) + (2-2ß)(s_1^{M*} - s_2^{M*})]/D_M > 0 \qquad (10)$$

In conclusion, if unit production costs differ, the owners of the lower cost firm obtain a larger share of the merged enterprise both because of the higher inside option and because they contribute more to the merger profit.

In the case of dissimilar country sizes, let the relative size of h-country be larger than that of f-country. Consider a hypothetical situation where relative country sizes are equal, corresponding to the solid curves in Figure 1. Let h- country size Ω grow and f- country size $1-\Omega$ fall from this average. For any given z, inserting optimal policies s_1^* and s_2^* from Eqs.(5a)-(5b) into Eq.(4) and differentiating with respect to Ω we arrive at:

$$\partial q_1^{M*}/\partial\Omega,\ \partial q_2^{M*}/\partial(1-\Omega) \geq 0 \text{ and } \partial q_2^{M*}/\partial\Omega,\ \partial q_1^{M*}/\partial(1-\Omega) \leq 0 \qquad (11)$$

In Eq. (11) the equality signs refer to a case where all production is exported to a third country. Otherwise, an increase in h-country's relative size leads to a larger output of its good and to a smaller output of f-country's good. The reason is that the post-merger tax in h-country becomes smaller than in f-country, as may be seen by subtracting in Eq. (4):

$$q_1^{M*} - q_2^{M*} = (2-2ß)(s_1^{M*} - s_2^{M*})/D_M \qquad (12)$$

The explanation is that in a larger country the consumer surplus items are larger and a smaller tax on one good lowers the prices of both goods. In Eqs. (8a)-(8c) in the numerator of h-curve a higher Ω leads to a larger term $2z(q_1^M)^2(1-ß^2)/ [1+ (1-z - \Omega/2)]$ and a lower $1-\Omega$ to a larger term $-2z(q_2^M)^2(1-ß^2)/ (1+ z - (1-\Omega)/2)$ for any given z. In addition, the profit of the national firm in the larger country is higher because of a higher subsidy, that is, $\pi_1^N > \pi_2^N$. This decreases the value of the denominator of h-curve. All these factors contribute to an upwards shift of h-curve. By similar arguments, corresponding terms in the f-curve contribute to its shift downwards. Again, what remains is the term π_{12}^M. As before, we may suppose that the effect of the two opposite changes on the merger profit are relatively small. Accordingly, h-curve shifts upwards and f-curve downwards, as shown in Figure 1. In conclusion, the owners in the larger country obtain a larger share both because of a higher pre-merger subsidy and because of a lower post-merger tax.

Note that even if I have been speaking about taxes when analysing asymmetries in the merger case, a subsidy is possible in the lower cost country and/or in the larger country. Finally, note that both asymmetries affect the feasibility conditions of the merger game. If h- country has a lower production cost or is relatively larger than f- country, in the feasibility condition $z\pi_{12}{}^{M} > \pi_1{}^{N}$ both sides increase while in the condition $(1\text{-}z)\pi_{12}{}^{M} > \pi_2{}^{N}$ both sides decrease as compared with a perfectly symmetric situation. More specific forms could be derived but I leave it at this remark.

The third asymmetry concerns the post-merger situation only. Variable synergy advantages were modelled as unit cost savings. If they are asymmetric, we may proceed as with asymmetric costs. Eq. (9) becomes

$$\partial q_1{}^{M*}/\partial a_1\ ,\ \partial q_2{}^{M*}/\partial a_2 > 0 \text{ and } \partial q_2{}^{M*}/\partial a_1\ ,\ \partial q_1{}^{M*}/\partial a_2 < 0 \quad (13)$$

Starting from a hypothetical situation of equal synergies and analysing Eqs. (8a)-(8c), we can infer that if, for example, the production of h-country's good derives more technological advantages from the merger than the production of f-country's good, $a_1 > a_2$, h-curve shifts upwards and f-curve downwards. Eq.(4) may be rewritten as

$$q_1{}^{M*} - q_2{}^{M*} = [(2-2ß)(a_1 - a_2) + (2-2ß)(s_1{}^{M*} - s_2{}^{M*})]/D_M \qquad (14)$$

which shows, when applying Eq. (13), that all the synergy advantage is not taxed away. In conclusion, h-country owners obtain a larger share for post-merger reasons only. Similar conclusions apply to asymmetric fixed advantages. If the term S in Eq.(2) can be divided to two parts, one accruing to plant 1 only, S_1, and the other to plant 2 only, S_2, and if $S_1 > S_2$, h-curve shifts upwards and f-curve downwards. It should be emphasized that, in the absence of policies, the merger profit would be shared equally irrespective of asymmetric synergies. But now, with policies, those owners whose firm derives more advantages receive a larger share. The explanation is that the increase in the share lowers the tax of the good which benefits more from the merger. For the other group of owners the amount of its income may well be larger than what it would obtain with a larger share. In other words, a lower tax on the more benefiting good leads to a so much larger merger profit that even the owners of the smaller share receive more.

5. GOVERNMENTS' COOPERATION

Above, such situations have been discussed where the governments did not cooperate with each other. Brander and Spencer (1985) showed for homogenous goods duopoly with national firms that in a cooperative situation it is optimal to pay lower subsidies than in a non- cooperative situation. In particular, if both countries export all their production to a third country optimal policy reverses to tax. As could be shown, this result also holds for the heteregenous goods duopoly if the goods are relatively good substitutes.

For the merger case, nearly opposite results ensue. Maximizing joint welfare with respect to s_i yields[4)]

$$s_i^{M*} = [-q_i(\partial p_i/\partial s_i) - q_j(\partial p_j/\partial s_i)] / [\partial q_i/\partial s_i] = (1-ß^2)q_i \geq 0 \qquad (15)$$

As can be seen from Eq. (15), if there is no domestic consumption in either country, laissez faire is optimal. In other situations, joint welfare would be increased by subsidies in both countries. For the wide range of cases where tax is optimal in both countries, this directly implies that the outcome is exactly opposite compared with the national firms' case, that is, cooperative subsidies are higher than non-cooperative ones. In general, the same applies to one of the countries at least. Notice that with cooperative policies, the feasibility conditions of the merger become less demanding.

6. CONCLUDING REMARKS

A very simple duopoly model was applied. Its limitations are obvious, e.g., constant costs and quadratic utilities. A further constraining assumption was that when deciding on optimal policy, a government did not take into account the effects of its policy on the sharing of the equities of the merged enterprise. In principle, we could include this into the model but this would complicate it considerably [5)]. It may be conjectured that if a government does this way, it would lead to a lower tax or even a subsidy because, from a firm's point of view, a decrease in tax is like a decrease in production cost increasing its share. However, if both governments do this, the end result may well be that there are no changes in shares but lower taxes in both countries.

Finally, let us consider some alternative frameworks discussed in Introduction. First, as could be shown, if the firm(s) would adjust prices (Bertrand competition) instead of quantities, for the merger case it can be shown that similar conclusions would be obtained as for Cournot competition. Second, if there were more firms in the Cournot- competitive sector, the policy recommendation tends to reverse, in a national firm's case, to tax. This, in itself, would make the feasibility condition less stringent. At the same time, however, the merger game becomes more complicated (see Horn and Persson (2001)). What can be shown is that, in a situation of two firms in one country, one firm in the other and a merger of a domestic and a foreign firm, tax is optimal for a wide range of equity shares.

NOTES:

[1] From Eq. (4) $\partial q_i/\partial s_i$ = 2/(4-4ß^2) and $\partial q_j/\partial s_i$ = -2ß/(4-4ß^2). From Eq. (3) $\partial p_i/\partial s_i = \partial q_i/\partial s_i + ß\partial q_j/\partial s_i - 1 = -1/2$ and $\partial p_i/\partial s_j = 0$. The plant-specific profits are, from Eq. (3), $\pi_i = (q_i+ßq_j)q_1$. Differentiating their sum yields $\partial(\pi_1+\pi_2)/\partial s_i = q_i$. The first order condition for maximizing the indirect utility function with respect to s_1 is $\partial v^h/ds_1 = -q_1{}^h(\partial p_1/\partial s_1)-q_2{}^h(\partial p_2/\partial s_1)+ z[\partial(\pi_1+\pi_2)/\partial s_1]-q_1-s_1(\partial q_1/\partial s_1)=0$

[2] Assume that subsidy is optimal policy in h-country, that is, $1 - z -\Omega/2 < 0$. From this, $1/2 < z - 1/2 + \Omega/2 = z - ø/2$, that is, tax is optimal in f-country Correspondingly, if subsidy is optimal in f-country $z - ø/2 = z- 1/2+\Omega/2 < 0$ from which $1-z - \Omega/2 > 1/2$, that is, tax is optimal in h-country. If all production is exported to a third country, the outcome is obtained by setting $\Omega = ø = 0$ into Eqs. (9a) and (9b).

[3] If $ß \geq 1/2$, the right hand side of Eq. (12b)

$$> (q_2{}^M)^2 - 2z(q_2{}^M)^2(1-ß^2)/ [1+ z - ø/2)]$$

$$> (q_2{}^M)^2 - 2z(q_2{}^M)^2(3/4)/ [1+ z - 1/2)]$$

$$= (q_2{}^M)^2[1/2 + z - (3/2)z]/[1/2+ z] > (q_2{}^M)^2(1-z)/(1+2z) > 0$$

[4] The condition for joint welfare maximization with respect to s_i is $\partial v^h/\partial s_i + \partial v^f/\partial s_i = -q_i(\partial p_i/\partial s_i)- q_j(\partial p_j/\partial s_i)+ \partial\pi_{12}{}^M/\partial s_i -q_i- s_i(\partial q_i/\partial s_i) = 0$

[5] Eq. (5a) would become $s_1{}^M = -2(1-z - \Omega/2)(1-ß^2)q_1 + (\partial z/\partial s_1)\pi_{12}{}^M$

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