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International Trade and the Incentive for Merger*

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Abstract

This paper examines the profitability of horizontal merger in an open economy with Cournot competition. We find that duopoly is a necessary, but not sufficient, condition for domestic merger to be profitable. A cross-border merger, however, can be profitable from any market structure.

JEL classification: L4, F2
Keywords: merger, international trade, oligopoly.

1 Introduction

In an important contribution to the literature on incentives for firms to merge, Salant, Switzer and Reynolds (1983) establish that a bilateral merger from an initial Cournot equilibrium with linear demand is unprofitable, except in the case of duopoly. One strand of subsequent research has explored conditions that might augment the profitability of merger, such as the existence of cost savings (Perry and Porter, 1985), product differentiation advantages (Deneckere and Davidson, 1985) or more complex (non-linear) demand functions (Cheung, 1992 and Faulí-Oller, 1997). In this paper we revert to Salant, Switzer and Reynolds's constant cost, homogeneous product, linear demand framework to examine the profitability of merger in an open economy. More specifically, we ask: for what configurations of market structure and trade costs, if any, will merger be profitable? Using a two-country model, we consider both within-country ("domestic") and cross-border ("international") mergers. We find that, under trade conditions, duopoly is a necessary, but no longer sufficient, condition

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for profitable domestic merger, but international merger can be profitable from any market structure.[1]

2 The Model

We consider a homogeneous product which can be produced and consumed in either, or both, of two countries, $i, j = 1, 2, i \neq j$. We suppose that each country has an identical linear inverse demand function

$$P_i = a - Q_i. \tag{1}$$

Production costs comprise a constant marginal cost which is the same for all firms and, for simplicity, set to zero. In addition, exports are subject to a trade cost, t, per unit of output. We let n_i and n_j denote the number of firms located in countries i and j respectively. We assume that the outcome of competition between firms is a Cournot equilibrium in quantities and that there is no arbitrage. This implies that the price prevailing in country i can differ from that in country j by more than t. Profits for a representative firm based in country i are given by

$$\Pi_i = P_i y_i + (P_j - t)x_i, \tag{2}$$

where y_i denotes the sales of a firm in country i to its home market and x_i its exports to country j.

The problem of a representative firm in country i is to maximise (2), holding outputs of rival firms fixed and subject to non-negativity constraints on x_i and y_i. We assume, henceforth, that domestic output is strictly positive in equilibrium. The first order conditions, using an asterisk to denote Cournot equilibrium values, for this problem are

$$P_i^* - y_i^* \quad = \quad 0 \tag{3}$$

and

$$\left.\begin{array}{lcl} P_j^* - t - x_i^* & \leq & 0 \\ x_i^* & \geq & 0 \end{array}\right\}, \tag{4}$$

where a right hand brace indicates a pair of complementary inequalities, one of which must hold with equality.

Noting that P_i^* is a function of y_i^* and x_j^* alone, whilst P_j^* is a function of y_j^* and x_i^* alone, conditions (3) and (4) can be solved simultaneously to yield

$$x_i^*(n_i, n_j) = \max\left[0, \frac{a - (n_j + 1)t}{n_i + n_j + 1}\right] \tag{5}$$

and

[1] A related, but different, issue is the *change* in the profitability of merger that would result from a *change* in trade cost or unilateral tariff. This question has been examined by Long and Vousden (1995), Falvey (1998) and Gaudet and Kanouni (2004).

$$\begin{array}{rclr} y_i^*(n_i, n_j) & = & (a + n_j t)/(n_i + n_j + 1), & x_j^*(n_i,n_j) > 0, \\ y_i^*(n_i, n_j) & = & a/(n_i + 1), & x_j^*(n_i,n_j) = 0. \end{array} \tag{6}$$

In the case where exports from both countries are zero, (5) - (6) reduce to the standard conditions for Cournot equilibrium in each country in which firms make profits of

$$\Pi_i^A(n_i) = \left(\frac{a}{n_i + 1}\right)^2. \tag{7}$$

By inspection of (5), the maximum trade cost compatible with international trade taking place (i.e. $x_i^*, x_j^* > 0$) is given by

$$t < \max\left[\frac{a}{n_i + 1}, \frac{a}{n_j + 1}\right] \equiv t^* \tag{8}$$

and for the symmetric case where $n_i = n_j = n$ this threshold level of trade cost is

$$t^* = \frac{a}{n + 1}. \tag{9}$$

For an equilibrium involving trade, substitution from (5) and (6) into (1) and (2), after some rearrangement, yields:

$$\Pi_i^*(n_i, n_j, t) = \frac{\left[2a^2 + 2n_j^2 t^2 - 2an_j t^2 + t^2\right]}{n_i + n_j + 1}. \tag{10}$$

It is convenient to decompose this profit into the elements deriving from the home and overseas markets. For a firm located in country i, we denote these profits as $\pi_i^i(n_i, n_j, t)$ and $\pi_i^j(n_i, n_j, t)$ respectively and note that $\Pi_i(n_i, n_j, t) \equiv \pi_i^i(n_i, n_j, t) + \pi_i^j(n_i, n_j, t)$. Substitution from (5) and (6) into (1) yields

$$\pi_i^i(n_i, n_j, t) = \left(\frac{a + n_j t}{n_i + n_j + 1}\right)^2 \tag{11}$$

and

$$\pi_i^j(n_i, n_j, t) = \left(\frac{a - (n_j + 1)t}{n_i + n_j + 1}\right)^2. \tag{12}$$

Similarly for a firm in country j, $\Pi_j(n_i, n_j, t) \equiv \pi_j^j(n_i, n_j, t) + \pi_j^i(n_i, n_j, t)$, where

$$\pi_j^j(n_i, n_j, t) = \left(\frac{a + n_i t}{n_i + n_j + 1}\right)^2 \tag{13}$$

and

$$\pi_j^i(n_i, n_j, t) = \left(\frac{a - (n_i + 1)t}{n_i + n_j + 1}\right)^2. \tag{14}$$

2.1 Merger under Trade

We consider first an initial equilibrium with trade taking place and consider two possible forms of merger. In what we term a *domestic merger* two firms in country i form a single firm and in what we term an *international merger* one firm in country i joins with one firm in country j.

With a domestic merger two firms forgo their individual profits $\Pi_i(n_i, n_j, t)$ but take a share of profits that are enhanced through the reduction in domestic competition. Thus, the gain to a domestic merger in a trade equilibrium in which $n_i = n_j = n$, can be written as

$$G^D(n,t) = \pi_i^i(n_i-1, n_j, t)+\pi_i^j(n_i-1, n_j, t)-2\pi_i^i(n_i, n_j, t)-2\pi_i^j(n_i, n_j, t). \quad (15)$$

With an international merger, we need to consider three types of firms. Following such a merger there will be $n-1$ firms located wholly in country i, $n-1$ firms located in country j and one newly merged firm which has a production base in each country. The newly merged firm is not the same as existing firms in that it can supply either market from a domestic production unit. Therefore, in setting its output in each country it can act like a domestic firm in that country; there is no incentive for it to produce for export because by producing domestically it can save trade costs. The multinational firm's impact on total production can therefore be deduced by analogy with a Cournot equilibrium in which domestic output in country i is determined as if there are n domestic Cournot competitors and $n-1$ overseas competitors, whilst output for export from country i is determined as if there are $n-1$ firms competing over exports facing n overseas competitors. The position in country j is symmetric to this. International merger, therefore, has the effect of reducing by one the number of exporters serving each market but leaving the number of domestic producers unchanged. Thus, the gain to an international merger in a trade equilibrium in which $n_i = n_j = n$, can be written as

$$G^I(n,t) = \pi_i^i(n_i, n_j-1, t)+\pi_j^j(n_i-1, n_j, t)-\Pi_i(n_i, n_j, t)-\Pi_j(n_i, n_j, t). \quad (16)$$

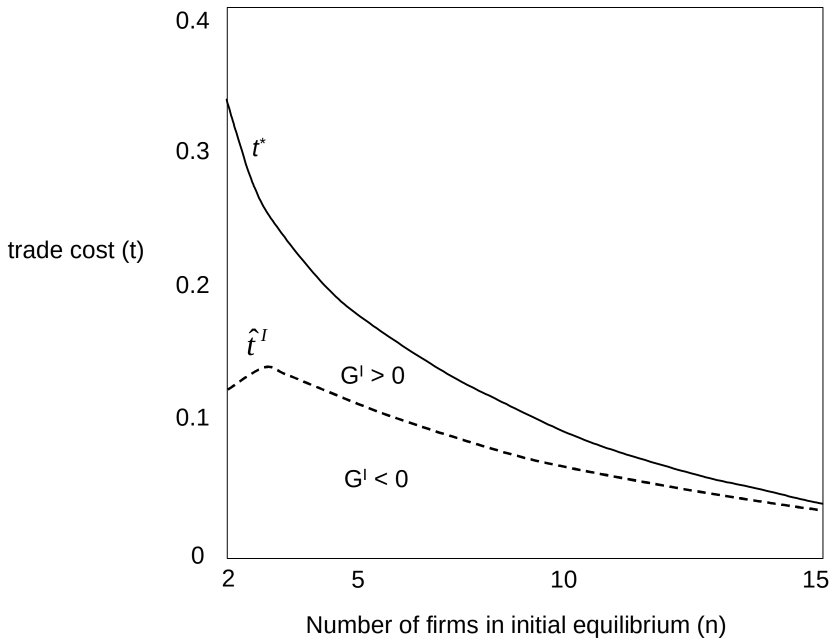
In their autarky setting, Salant, Switzer and Reynolds (1983) demonstrate that a merger is profitable only if there are two firms in the initial Cournot equilibrium. Does this result hold under trade? A first thought might be that merger would clearly be unprofitable since the number of competitors is doubled relative to the Salant, Switzer and Reynolds setting. However, the situation under trade is complicated by the fact that merger generates an asymmetry between the merged and unmerged entities. Proposition 1 addresses the question in regard to domestic and international merger.

Proposition 1 *For domestic merger, $G^D(n,t) < 0$ for all n and $0 \le t < t^*$ whilst for international merger there exists a threshold level of trade costs, $\widehat{t^I}(n)$ such that $G^I(n,t) < 0$ when $t < \widehat{t^I}(n)$, but $G^I(n,t) > 0$ when $\widehat{t^I}(n) < t < t^*$*

Proof. Setting $n_i = n_j = n$, substituting from (11) and (12) into $G^D(n,t)$ and differentiating with resect to t the resulting first order condition implies that $G^D(n,t)$ is maximised at a trade cost of $\bar{t}(n) = \frac{a}{2n^2+2n+1}$. Substitution of this value of t into $G^D(n,t)$ shows that the latter is negative for $n \geq 2$ thus establishing the result for domestic merger. After setting $n_i = n_j = n$, substituting from (11) and (12) into $G^I(n,t)$ and equating to zero, the critical (zero-gain) value of trade cost can be solved for as $\widehat{t}^I(n) = \frac{8an^3-10an-2a}{2(4n^4+12n^3+7n^2-2n-1)}$. For all $n \geq 2$, $\widehat{t}^I(n)$ lies in the range $(0, t^*)$. Since, as can readily be confirmed, $G^I(n,t)$ is negative at $t = 0$, concave and approaches zero from above as t approaches t^* it follows that $\widehat{t}^I(n)$ constitutes a threshold such that $G^I(n,t) < 0$ when $t < \widehat{t}^I(n)$, but $G^1(n,t) > 0$ when $\widehat{t}^I(n) < t < t^*$, thus confirming the result for international merger. ■

The Proposition establishes that from an initial equilibrium in which there is international trade then, whatever the market structure, there is no incentive for domestic merger. However, with an international merger the situation is somewhat different. Specifically, Proposition 1 admits the possibility that mergers from even relatively competitive markets may be profitable provided that trade costs are of an appropriate magnitude. The intuition for this difference can be explained in terms of the impact of merger on cost and revenue. For $t = 0$, domestic and international mergers are equivalent; neither generates a saving in trade cost whilst both lead to a fall in market share and revenue (the standard Salant, Switzer and Reynolds result). Now consider the effect of raising t. Both domestic and international mergers will generate a saving in trade costs, but the reduction will be greater in the latter case since both markets will be served from a domestic plant. For both types of merger the relationship between t and the trade cost saving is non-monotonic, falling to zero as t approaches t^*, the point at which trade ceases. The impact of t on the consequences of merger for revenue is markedly different in the two cases: for a domestic merger the loss of revenue increases with t whilst for an international merger there is an inverse relationship. This difference can be understood by considering the situation as t approaches t^*. In the case of domestic merger the effect becomes concentrated on the home market to the point where, when $t = t^*$, the impact of the merger is simply to reduce the number of domestic competitors from n to $n-1$, with the associated loss of market share for the merging entities. With an international merger, by contrast, there is no loss of market share at $t = t^*$ since the number of competitors remains at n in both markets. The net result is that for an international merger the cost saving will outweigh the loss of revenue if t is sufficiently high, whilst a domestic merger is always unprofitable.

The following figure (in which $a = 1$) shows how the profitability of an international merger is related to trade cost and initial market concentration; an international merger is profitable between the locus t^* and the locus $\widehat{t}^I$.



2.2 Merger Initiating Trade

When a merger takes place from autarky (i.e. $t > t^*$) the resulting change in market structure may initiate trade. To understand this effect, let X_i^* and X_j^* denote the total volume of exports from i to j and j to i respectively. Using (5) for the representative firm in i, and an equivalent expression for that in j, these are given by

$$X_i^*(n_i, n_j, t) = \frac{n_i(a - t(n_j + 1))}{n_i + n_j + 1} \tag{17}$$

and

$$X_j^*(n_i, n_j, t) = \frac{n_j(a - t(n_i + 1))}{n_i + n_j + 1}. \tag{18}$$

With a symmetric initial structure with n firms in each country, the flows of exports from i to j and j to i following a domestic merger in country i are, respectively,

$$X_i^D(n, t) = \max\left[0, \frac{(a - t(n+1))(n-1)}{2n}\right] \tag{19}$$

and

$$X_j^D(n,t) = \max\left[0, \frac{a-nt}{2}\right]. \tag{20}$$

Inspection of (19) and (20) reveals that the former is positive for $t < t^*$ whilst the latter is positive for $t < t^A$ where

$$t^A \equiv \frac{a}{n}. \tag{21}$$

Thus, if t lies in the range $t^* < t < t^A$ a domestic merger in country i will initiate a one-way flow of trade from j to i.

Consider now an international merger. As explained above, this has the effect of reducing by one the number of exporters serving each market but leaving the number of domestic producers unchanged. Assuming a symmetric initial structure with n firms in each country and using, (17) and (18), we can write the post-merger trade flows as

$$X_i^I(n,t) = \max\left[0, \frac{(a-t(n+1))(n-1)}{2n}\right] \tag{22}$$

and

$$X_j^I(n,t) = \max\left[0, \frac{(a-t(n+1))(n-1)}{2n}\right]. \tag{23}$$

For either of these flows to be positive requires $t < t^*$, which is the same condition that pertained pre-merger. An international merger will thus neither initiate, nor cause the cessation of, trading.

We may thus consider whether from a position of autarky, but where $t < t^A$, a domestic merger is profitable. The gain from such a merger is

$$G^{DA}(n,t) = \pi_i^i(n_i - 1, n_j, t) - 2\Pi^A(n_i) \tag{24}$$

and, in rather special circumstances, this may be positive as the following Proposition establishes.

Proposition 2 *For $n = 2$ there exists a threshold level of trade costs, $\widehat{t}^D$, such that $G^{DA}(n,t) > 0$ when $\widehat{t}^D < t < t^A(n)$. In all other circumstances, $G^{DA}(n,t) < 0$.*

Proof.

After setting $n_i = n_j = n$, substituting from (11) and (7) into $G^{DA}(n,t)$ reveals directly that this is negative for $n > 2$. Setting $n = 2$ and solving $G^{DA}(n,t) = 0$ for t yields a critical (zero-gain) value for trade cost of $\widehat{t}^D = \frac{a(4\sqrt{2}-3)}{6}$. Since $G^{DA}(n,t)$ is increasing in t it follows that for $\widehat{t}^D < t < t^A(n)$ it is positive, thus establishing the claim. ■

The Proposition demonstrates that for trade costs in the range where a domestic merger would initiate trade, duopoly in the home market is a necessary but not sufficient condition for the merger to be profitable. This contrasts to the position under autarky where, as established by Salant Switzer and Reynolds, a bilateral merger from duopoly is *always* profitable.

3 Conclusions

In an autarky setting, Salant, Switzer and Reynolds (1983) demonstrated that a merger would be profitable if there were two firms in the initial Cournot equilibrium, but not if there were three or more firms. Using a two-country model, we show that in an open economy with international trade, the condition for a merger between two firms in the same country to be profitable is more restrictive. Specifically, duopoly is no longer sufficient for a merger to be profitable; an additional requirement is that trade costs exceed a threshold level. An international merger, by contrast, can be profitable from any market structure, provided that trade costs lie in a certain range. For simplicity, it has been assumed that both market size and initial market structure are the same in both countries, and one direction for further research is to consider an asymmetric setting.

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