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and the Incentive to Merge

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Abstract

In this paper we consider whether a movement towards freer international trade generates incentives for firms to merge and if so what forms of merger are most profitable. In a linear Cournot framework we show that a reduction in trade costs may, but will not necessarily, encourage mergers. Both market structure and the level to which trade costs fall are shown to play a decisive role. Domestic mergers will be encouraged only if the product market is not highly concentrated and trade costs fall below a threshold level. International mergers can be encouraged in any market structure, and are generally more profitable than domestic mergers.

JEL classification: L4, F2

Keywords: merger, international trade, oligopoly.

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1 Introduction

In the second half of the 1980s the European Union (EU) experienced an upsurge in merger activity. Between 1985 and 1990 the annual number of mergers involving the top 1000 EU and 500 foreign firms grew steadily from 150 to almost 500.[1] What is the explanation for this merger wave? A widely held view is that firms were restructuring in preparation for the Single European Market in 1992. For example, Jacquemin, Buigues and Ilkovitz (1989), in a report to the European Commission, argued that high levels of both EU and international mergers could be explained by the incentives to specialise and extend the geographic sphere of operations that arose from integration.[2] Davies and Lyons (1996) point to an apparent acceleration in activity following ratification of the Single European Act in 1987, and to the fact that almost all of the growth in merger activity after 1987 is accounted for by an increase in cross border mergers - either between firms in different EU countries or between EU and foreign firms.[3] A number of authors draw parallels with the merger wave of the 1960's, arguing that once again the explanation lies with international competition - see, for example, Bishop and Kay (1993) and Cosh and Hughes (1996).[4] Outside Europe, Long and Vousden (1995) point to the increase in merger activity in Canada following the Canada-US free-trade agreement. The view that mergers in general, and cross-border mergers in particular, can be initiated by closer integration begs two questions. Is there a basis in economic theory for expecting that a reduction in trade barriers will provide firms with an incentive to merge? If so, is there reason to suppose that cross-border mergers will be favoured over within-border ones? In

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[1] Data from CEC competition reports, Compiled by Davies and Lyons (1996).

[2] See also Jacquemin (1990).

[3] Figures prior to 1987 were collected from a more restricted search and so may underestimate mergers.

[4] According to a report in the *Financial Times* of 14th October 1997 firms were once again restructuring themselves through international mergers - this time in preparation for the first wave of monetary union in 1999.

this paper we address these questions using a two-country Cournot model.

A number of previous papers have examined the incentive to merge under oligopoly. In a seminal contribution, Salant, Switzer and Reynolds (1983), using a Cournot model with linear demand, demonstrated that whilst a merger will raise industry profits, individual firms will generally not have an incentive to merge. The explanation lies in the existence of an externality. A merger leads to a contraction in the output of the merging firms, and an expansion by their rivals. As a result, the merging firms experience a decline in profit. One strand of subsequent research has sought to identify conditions under which a merger would be profitable. Perry and Porter (1985) argue that a merged firm has access to the combined productive capacity of both constituent firms, and hence may have lower marginal costs and higher equilibrium output than its un-merged rivals. This dampens the output reduction predicted by Salant, Switzer and Reynolds, and thereby increases the likelihood of a profitable merger. Similarly, Deneckere and Davidson (1985) show that the existence of product differentiation can lead to a gain from merger when the merged firm continues to sell all of the products of its constituent firms. More recently, Cheung (1992) and Faulí-Oller (1997) examine the sensitivity of the Salant, Switzer and Reynolds (1983) result to a relaxation of the linear demand assumption. All of these papers assume a closed economy. The incentive to merge in an open economy has been analysed by Long and Vousden (1995), Falvey (1998) and Gaudet and Kanouni (2004).[5] Falvey (1998) uses a Cournot framework with firms of differing efficiencies to examine the effect on merger profitability of a marginal change in the tariff imposed by the home country in a two-country model. The model suggests that the effect of a tariff reduction can be to increase or decrease the profitability of merger, depending on the extent of the cost differential and locations of the merging entities. Gaudet and Ka-

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[5] A related strand of literature considers the welfare implications of mergers in an open economy and associated policy issues. See, for example, Ross (1988), Barros and Cabral (1994), Head and Ries (1997), Richardson (1999) and Collie (2003).

nouni (2004) consider the implications of the abolition of a home-country tariff in a three-firm Cournot model and find that the profitability of a domestic merger in the home country depends upon the level of the tariff — only the abolition of a tariff which is prohibitive to imports, both pre- and post-merger, unambiguously increases the profitability of merger.[6] The present paper is most closely related to Long and Vousden (1995) in that it examines the implications of bilateral as well as unilateral tariff reductions. With regard to the former, Long and Vousden (1995) show that the effect of a marginal reduction in the tariff on the profitability of merger (evaluated in the neighbourhood of free trade) in general depends upon the type of merger and the extent of any saving in marginal cost. However, for the special case of zero cost saving the profitability of both domestic and international mergers is reduced by a fall in tariffs. The key distinguishing feature of the analysis presented below is that it examines non-marginal reductions in trade barriers. In certain situations — which include EU integration and the Canada-US free-trade agreement — this is a more accurate characterisation of events and, as we shall see, the implications for merger can be quite different.

Two specific questions are addressed in the present paper. First, will trade liberalisation affect the incentive to merge? More specifically, will a reduction in trade costs from a level consistent with autarky to one that supports trade, increase the profitability of mergers, both domestic and international? Second, within a trade setting, how does the profitability of domestic merger compare with that of international merger? Salant, Switzer and Reynolds (1983) find that, in a closed economy, two-firm mergers are profitable only from a position of duopoly. Mergers from less concentrated markets can be explained within the Salant, Switzer and Reynolds framework if the possibility of fixed cost savings is introduced to the model. Our interest, however,

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[6]Where a tariff does not deter imports either pre- or post-merger the profitability of merger is reduced by abolition, whereas for intermediate tariffs such that imports are deterred pre- but not post-merger, the effect of abolition on merger profitability can go either way.

lies with the implications of trade for merger and thus we leave the possibility of a fixed cost saving (or any other non trade-related factor affecting the profitability of merger) in the background. We find that, in contrast to Long and Vousden (1995), reductions in trade costs can encourage merger even in the absence of marginal cost asymmetries. Both market structure and the level to which trade costs fall are shown to play a decisive role. Thus domestic mergers will not be encouraged by reductions in trade costs if product market concentration is high, but in less concentrated markets they will be encouraged if trade costs fall to a sufficiently low level. International mergers are always more profitable than domestic mergers, except in the special case of zero trade costs. This is reflected in the fact that an international merger *may* be encouraged by a fall in trade costs in concentrated markets but will *always* be encouraged in less concentrated markets. In contrast with the case of domestic merger, when the level of trade costs is decisive for international merger the requirement is that these costs lie *above* a certain threshold.

The remainder of the paper is organised as follows. Section 2 presents the model and determines the conditions under with trade will occur. The implications of a reduction in trade costs for the profitability of domestic and international mergers are examined in Section 3 and then a brief concluding section completes the paper.

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 question we are interested in is whether trade costs affect the profitability of merger. Specifically, for a given initial market structure, does the incentive to merge when trade costs are at a level that support international trade differ from the incentive that exists under autarky?

The gain to merger is the difference between the post-merger profit of the merged entity and the sum of the pre-merger profits of its constituent firms. Under autarky the gain from a merger between two firms located in country i, $G^A(n_i)$, is

$$G^A(n_i) = \Pi_i^A(n_i - 1) - 2\Pi_i^A(n_i), \tag{3}$$

where $\Pi^A(n_i)$ denotes the autarky Cournot profit for a representative firm. In our linear model, this Cournot profit is given by

$$\Pi_i^A(n_i) = \left(\frac{a}{n_i + 1}\right)^2 \tag{4}$$

and thus the gain to merger is

$$G^A(n_i) = \left(\frac{a}{n_i}\right)^2 - \frac{2a^2}{(n_i+1)^2}. \tag{5}$$

Under conditions of trade, there are two distinct types of merger to consider: a *domestic merger* (a merger between two firms located in the same country) and an *international merger* (a merger between two firms in different countries). To evaluate the effect of trade costs on the incentive to merge - either domestically or internationally - the first task is to establish the conditions under which trade would take place. For simplicity, we assume a symmetric pre-merger equilibrium in which the number of firms is the same in each country: $n_i = n_j = n$.

In the Appendix we show, first, that in the pre-merger equilibrium, trading will take place if and only if the trade cost is below a threshold level, t^*, given by

$$t^* = \frac{a}{n+1}. \tag{6}$$

Second, in the case of a domestic merger there will be post-merger trade if and only if $t < t^A$ where

$$t^A = \frac{a}{n}. \tag{7}$$

Thus a domestic merger will never lead to a cessation of trading but can induce trade to commence. More specifically, the effect of a merger when trade costs lie in the range $t^* \leq t < t^A$ is to initiate one-way trade: imports are sucked into i, but the firms located in i sell only to their home market. Finally we show that an international merger, by contrast, will neither induce nor lead to the cessation of trade. In the case of international mergers, therefore, the condition for trading to occur post-merger, as well as pre-merger, is given by $t < t^*$.

To understand these conditions, a key observation is that there are no links —

either on the demand or cost side — between the two markets. Firms can therefore assess the profitability of production for the home and overseas markets independently. Consider the flow of trade from j to i. Exports will cease when the associated profits fall to zero; i.e. when $P_i = t$. In this situation, P_i is determined solely by the market structure in country i. An international merger has no effect on the number of producers located in i and thus the zero trade condition remains unchanged. A domestic merger in country i, by contrast, reduces the number of producers in i and thus, via an increase in P_i, is capable of initiating exports from producers located in j. On the other hand, a domestic merger in country i will not induce exports to j; from a zero profit position only a change in the market structure in j, or a fall in t, could initiate a trade flow from i to j.

Having established the conditions under which trade will take place, we now turn to the implications for the incentive to merge.

3 Analysis and results

3.1 Domestic merger

In the previous section we established that (i) if trade costs exceed a threshold, t^A, given by (7), then there will be no trade either pre- or post-merger, (ii) if t lies in the range $t^* \leq t < t^A$, where t^* is given by (6), then there is no pre-merger trade but a domestic merger would initiate a (one-way) trade flow and (iii) if t lies below t^* then trading takes place in both the pre-merger and post-merger equilibria. To establish the implications of trade for domestic merger, there are thus two subcases to consider:

3.1.1 Subcase 1 $t^* \leq t < t^A$

For t in the range $t^* \leq t < t^A$, there is no trade in the pre-merger equilibrium. A representative firm's profit is therefore given by (4). Suppose a merger takes place in country i. As noted above, the effect of a such a merger is to generate a flow of imports into i. In the ensuing one-way trade equilibrium, a representative firm in i makes a profit of (see Appendix)

$$\widetilde{\Pi}(n_i, n_j, t) = \left(\frac{a + n_j t}{n_i + n_j + 1} \right)^2.$$

(8)

The gain from a domestic merger, G^{D1}, can be written as

$$G^{D1}(n_i, n_j, t) = \widetilde{\Pi}(n_i - 1, n_j, t) - 2\Pi^A(n_i).$$

(9)

Define $\Delta G^{D1} \equiv G^{D1} - G^A$. If ΔG^{D1} is positive then trade, relative to autarky, is conducive to merger in this subcase; otherwise it is not. From a symmetric initial configuration with n firms in each country, the difference in gains to merger can, using (3) and (9) be written as

$$\Delta G^{D1}(n, t) = \widetilde{\Pi}(n - 1, n, t) - \Pi^A(n - 1)$$

(10)

and using (4), (8) and (10) we obtain

$$\Delta G^{D1}(n, t) = \frac{nt(nt + 2a) - 3a^2}{4n^2}.$$

(11)

Proposition 1 *For t in the range $t^* \leq t < t^A$: $\Delta G^{D1}(n, t) < 0, \forall n$.*

Proof. By inspection of (11).

This proposition addresses the case where trade costs fall to a level such that, whilst there is no pre-merger trade, trading would take place following a domestic

merger and reveals that such a fall would not be conducive to merger in that, whatever the initial market structure, the gain to merger is less than the gain under autarky. The intuition is straightforward; when trade costs lie in the range $t^* \leq t < t^A$, a domestic merger in, say, country i induces one-way trade with imports flowing into i from j and this reduces the profit of the merged entity in i relative to the level that would have pertained under autarky.

3.1.2 Subcase 2 $t < t^*$

In a trade equilibrium, firms earn profit from their home market and the overseas market. For a firm located in country i, we denote these profits as $\pi_i^i(n_i, n_j, t)$ and $\pi_j^j(n_i, n_j, t)$ respectively. The firm's total profit is then

$$\Pi_i(n_i, n_j, t) = \pi_i^i(n_i, n_j, t) + \pi_i^j(n_i, n_j, t). \tag{12}$$

In the Appendix we show that

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

and

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

The gain to a domestic merger in a trade equilibrium, G^{D2}, can then be written as

$$G^{D2}(n_i, n_j, t) = \pi_i^i(n_i - 1, n_j, t) + \pi_i^j(n_i - 1, n_j, t) - 2\pi_i^i(n_i, n_j, t) - 2\pi_i^j(n_i, n_j, t). \tag{15}$$

We now define $\Delta G^{D2} \equiv G^{D2} - G^A$ and in the Appendix show that, for a symmetric initial configuration with n firms in each country, this difference in the gain to merger

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is given by

$$\Delta G^{D2}(n,t) = \left[\frac{1+4n-4n^2}{4n^2(2n+1)^2}\right]\left[2a(a-t)+(2n^2+2n+1)t^2\right] - a^2\left(\frac{1}{n^2} - \frac{2}{(n+1)^2}\right).$$

(16)

Proposition 2 *For $t < t^*$:*

(a) *If $n \leq 4, \Delta G^{D2}(n,t) < 0$*

(b) *If $n \geq 5, \exists$ a threshold level of trade costs, $t^D(n)$, such that $\Delta G^{D2}(n,t) < 0$ if $t > t^D(n)$, but $\Delta G^{D2}(n,t) > 0$ if $0 \leq t < t^D(n)$*

Proof. See Appendix.

Proposition 2 provides support for the view that freer international trade can encourage merger activity. Furthermore, it indicates a decisive role for both the initial market structure and the level to which trade costs fall. If there are fewer than five firms in each country then trade will not encourage merger, no matter how far trade costs fall. On the other hand, if there are five or more firms in the market then merger will be encouraged if trade costs fall below a threshold level.

To understand these results, notice first that trade doubles the size of the market and this effect taken alone will reduce the incentive to merge. However, trade also increases the number of firms competing in the market from n to $2n$. The effect of this depends on the starting point. An initial market with just two firms is a special case in that it is the only structure from which merger under autarky is profitable. Thus doubling the number of firms will reduce the incentive to merger and thus reinforce the market size effect.[7] For $n \geq 3$, on the other hand, doubling the number of competitors serves to reduce the loss from merger and, furthermore, the loss is

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[7]In the linear Cournot framework, the loss due to merger under autarky is maximised when $n = 4$.

inversely related to n. For $n = 3$ and $n = 4$ this effect is insufficient to outweigh the market size effect and thus trade is not conducive to merger ($\Delta G^{D2} < 0$), but for $n \geq 5$ trade can encourage merger ($\Delta G^{D2} > 0$) provided trade costs are sufficiently low. The impact of a reduction in trade costs is also quite complex in that there are two opposing effects on profits (both pre- and post-merger). A reduction in trade costs lowers the marginal cost of exported goods and hence, other things being equal, raises profit. However, a second effect is to increase the intensity of competition in the home market and, hence, cause a reduction in prices and profit. The relationship between trade cost and ΔG^{D2} is not monotonic but nevertheless there is, for $n \geq 5$, a threshold level, $t^D(n)$, below which $\Delta G^{D2} > 0$.

Propositions 1 and 2 together reveal that a reduction in trade barriers can, but need not, induce domestic merger activity and also indicate a key role for market structure. If the initial number of firms in each country is less than five, then a fall in trade costs - to whatever level - will not increase the incentive to merge relative to autarky. With five or more firms, the outcome depends on the interplay of t and n. This interplay is depicted in Figure 1 (in which the demand parameter, a, is set at unity).

The region above and to the right of the line labelled t^A comprises combinations of n and t such that there is no trade in either the initial equilibrium or following a domestic merger. The profitability of merger in this region is given by the autarky expression, G^A, which constitutes the benchmark against which we assess the implications of trade. If the trade cost were to fall into the region bounded by and t^A and t^* then a domestic merger would initiate a one-way trade flow, but Proposition 1 reveals that this would not be conducive to merger ($\Delta G^{D1} < 0$). A fall in trade cost to a level below t^* would lead to trade in the pre-merger as well as post-merger equilibrium. Proposition 2 then reveals that, provided trade costs fall far enough ($t < t^D$), and the initial market structure is not too concentrated, trade is conducive
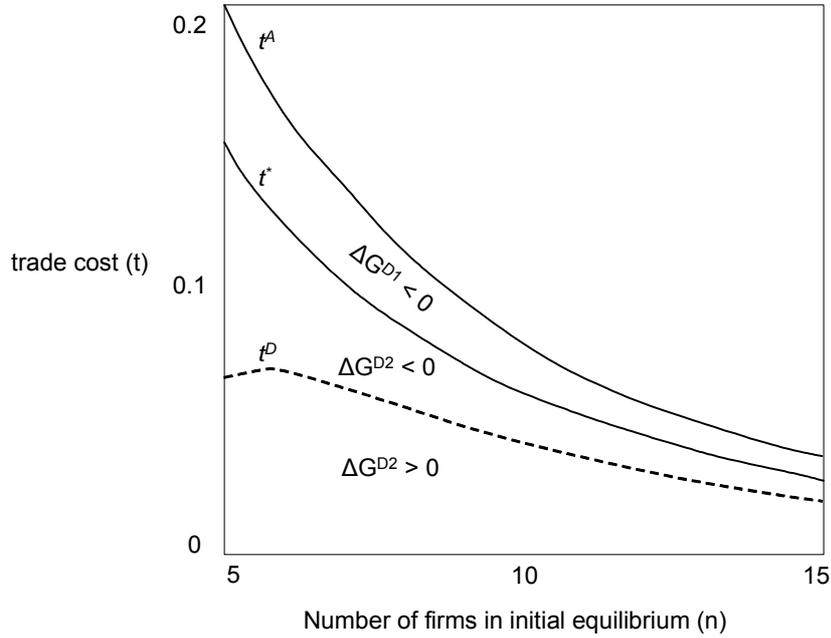
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Figure 1:

to merger. Figure 1 further reveals that this threshold is highest at an intermediate value of n. The model thus suggests a sense in which, in a trade setting, intermediate market concentration is most conducive to domestic merger.

3.2   International merger

International mergers are qualitatively different from domestic mergers. A merger within a country preserves the symmetry between firms within each country but, from an initial situation in which $n_i = n_j = n$, introduces an asymmetry across countries (unless $t = 0$ in which case there is no distinction between countries and we have a single market).

With an international merger, in which one firm from each of the two countries merge, we have to consider three types of firm. Following merger the world market

will be comprised of $n - 1$ 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.

In a pre-merger trade equilibrium the firms earn profit from their home market and the overseas market. 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. The firm's total profit is then

$$\Pi_i(n_i, n_j, t) = \pi_i^i(n_i, n_j, t) + \pi_i^j(n_i, n_j, t), \tag{17}$$

where $\pi_i^i(n_i, n_j, t)$ and $\pi_i^j(n_i, n_j, t)$ are given by (13) and (14) respectively. Similarly, for a representative firm in country j we have

$$\Pi_j(n_i, n_j, t) = \pi_j^j(n_i, n_j, t) + \pi_j^j(n_i, n_j, t), \tag{18}$$

$$\pi_j^j(n_i, n_j, t) = \left(\frac{a + n_i t}{n_i + n_j + 1} \right)^2, \tag{19}$$

$$\pi_j^i(n_i, n_j, t) = \left(\frac{a - (n_i + 1)t}{n_i + n_j + 1} \right)^2. \tag{20}$$

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The gain to an international merger can then be written as

$$G^I(n_i, n_j, t) = \pi_i^i(n, n_j - 1, t) + \pi_j^j(n_i - 1, n_j, t) - \Pi_i(n_i, n_j, t) - \Pi_j(n_i, n_j, t). \quad (21)$$

Our interest lies with G^I relative to the gains to merger in the absence of trade. Since, within our framework, an international merger has no implications for firm behaviour under autarky, the natural benchmark is the gain to a domestic merger, G^A. If G^I exceeds G^A then trade is deemed to be conducive to international merger, otherwise it is not. We define $\Delta G^I \equiv G^I - G^A$. For the symmetric initial configuration with n firms in each country, this difference (see Appendix) is

$$\Delta G^I(n, t) = \left[\frac{(a + nt - t)^2}{2n^2} \right] - 2\frac{[(a + nt)^2 + (a - nt - t)^2]}{(2n + 1)^2} - a^2 \left(\frac{1}{n^2} - \frac{2}{(n + 1)^2} \right). \quad (22)$$

As pointed out earlier, an international merger, in contrast with a domestic merger, will never initiate trade and thus our attention is restricted to situations in which trade characterises both the pre-merger and post-merger equilibria ($t < t^*$).

Proposition 3 *For $t < t^*$:*

(a) *If $n = 2, \Delta G^I(n, t) < 0$*

(b) *If $n = 3, 4, \exists$ a threshold level of trade costs, $t^I(n)$, such that $\Delta G^I(n, t) < 0$ if $0 \le t < t^I(n)$, but $\Delta G^I(n, t) > 0$ if $t > t^I(n)$*

(c) *If $n \ge 5, \Delta G^I(n, t) > 0$*

Proof. See Appendix.

Proposition 3 reveals that, as with domestic mergers, a reduction in trade barriers can, but need not, encourage international merger activity.

An internationally merged firm is at an advantage relative to its competitors as it can supply either market from a local plant and thus avoid trade costs. This suggests that it will typically make higher profits than its rivals, but this does not imply that a merger is profitable. The role of market structure reflects the pattern found for domestic merger in that ΔG^I is negative when n is low but can be positive for higher n. However, trade is more conducive to international than domestic mergers in the sense that ΔG^I may be positive in markets with fewer than five firms and is always positive when there are five or more firms. Underlying the effect of market structure on ΔG^I is the fact that there is a positive relationship between the gain to merger (domestic or international) and n over the whole range of n, whereas under autarky this positive relationship exists only beyond $n = 4$. Proposition 3 indicates that the relationship between ΔG^I and t is quite different to the domestic merger case. For an international merger it is high trade costs that encourage merger in the sense that, for $n = 3$ or 4, there is a threshold level, $t^I(n)$, *above* which ΔG^I is positive.[8] The intuition here can be explained in terms of the effect of the merger on revenue and costs. An international merger, just like a domestic merger, results in a loss of revenue, but this loss declines as t increases, approaching zero as t approaches t^* (at t^* there is no trade and an international merger has no implications for competition). Offsetting the decline in revenue is a saving in trade costs (the multinational firm serves both markets from domestic plants) and for high levels of t this cost saving more than compensates for the loss in revenue. We now turn to the relative attractiveness of domestic and international merger.

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[8]The relationship between ΔG^I (or G^I) and t is not monotonic, but ΔG^I (and G^I) is at a minimum when $t = 0$. The relationship between the gain to domestic merger and t is similarly non-monotonic. Moreover, the relationship between the gain to domestic merger and n is also complex. For $n \leq 4$, the gain is maximised at high t whist for $n \geq 5$ it is maximised at low t. This difference reflects the existence of the two regimes ($t^* \leq t < t^A$) and ($t < t^*$). For all n, the gain to domestic merger is minimised at $t = t^*$.

3.3 The relative profitability of domestic and international mergers

Proposition 4 *The relative profitability of domestic and international mergers is determined by trade costs as follows.*

For (a) $t^* \leq t < t^A$, $G^{D1} < G^I$, whilst for

(b) $0 < t < t^*$, $G^{D2} < G^I$ and for

(c) $t = 0$, $G^{D2} = G^I$.

Proof. Part (a) follows from Proposition 1 together with the fact that an international merger has no implications for behaviour in the absence of trade ($t \geq t^*$). For part (b), see Appendix. Part (c) is proved by substituting $t = 0$ into (45) and (51).

Proposition 4 reveals an international merger is more profitable than a domestic merger except for the special case $t = 0$ (in which case the gains are the same). To understand this result, note first that when $t = 0$ location is irrelevant in this model and thus domestic and international mergers are formally identical. Merger is unprofitable in this case due to the adverse effect on market share and revenue. As t rises above zero, the loss of revenue increases for a domestic merger, but declines for an international merger. In addition, the saving in trade costs when $t > 0$ is greater for an international than domestic merger.

4 Conclusions

In this paper we have used a Cournot framework to examine the possibility that merger activity might arise as a strategic response to falling trade barriers. We find that reductions in trade costs can, but will not necessarily, encourage mergers. For both domestic and international mergers, the outcome depends upon both the initial market structure and the extent of the fall in trade costs. In the case of domestic

merger, a reduction in trade costs will not increase the incentive to merge if the product market is highly concentrated. In less concentrated markets mergers may be encouraged, but only if trade costs fall below a threshold level. We have shown that this threshold depends on the initial market structure. International mergers were found to be more profitable than domestic merger within our framework. This is reflected in the fact that freer trade will encourage international merger over a wider set of circumstances than was the case for domestic merger. Provided that the market is not too concentrated, international merger will be encouraged by a fall in trade costs to any level that supports trade. In concentrated markets, however, the level must exceed a threshold, except for the case of duopoly — where merger will not be encouraged whatever the level of trade costs.

Our analysis complements a number of existing papers in the merger literature, in particular those of Long and Vousden (1995) who examine the impact of marginal changes in trade costs on the incentive to merge and Gaudet and Kanouni (2004) who are concerned with non-marginal, but unilateral, tariff reductions. We have shown that the combination of non-marginal and symmetric reductions in trade costs, of the kind that are consistent with broad movements towards freer trade such as EU integration and the Canada-US free trade agreement, can have substantially different implications for the incentives to merge domestically and internationally.

5 Appendix

Pre-merger trade equilibrium

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:

$$P_i^* - y_i^* \;=\; 0, \tag{23}$$

$$\left.\begin{array}{rcl} P_j^* - t - x_i^* & \leq & 0 \\[2mm] x_i^* & \geq & 0 \end{array}\right\}, \tag{24}$$

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 (23) and (24) can be solved simultaneously to yield

$$x_i^*(n_i, n_j) = \max\left[0, \frac{a - (n_j + 1)t}{n_i + n_j + 1}\right], \tag{25}$$

$$y_i^*(n_i, n_j) = \begin{array}{l} (a + n_j t)/(n_i + n_j + 1) \quad \text{if } x_j^*(n_i, n_j) > 0 \\[2mm] a/(n_i + 1) \qquad\qquad \text{otherwise} \end{array}. \tag{26}$$

It can readily be confirmed that, in the case where exports from both countries are zero, (25) - (26) reduce to the standard conditions for Cournot equilibrium in each country. The maximum trade cost compatible with international trade taking place is given by

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

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

$$t^* = \frac{a}{n + 1}. \tag{27}$$

For an equilibrium involving trade, substitution from (25) and (26) into (1) and

(2) after some rearrangement yields:

$$\Pi_i^*(n_i, n_j, t) = \frac{\left[2a^2 + 2n_j^2 t^2 - 2an_j t^2 + t^2\right]}{n_i + n_j + 1}. \tag{28}$$

Effect of merger on conditions for trade

Let X_i^* and X_j^* denote the total volume of exports from i to j and j to i respectively. Using (25) for the representative firm in i and an equivalent expression for that in j, these are given by

$$X_i^*(n_i, n_j, t) = \frac{n_i(a - t(n_j + 1))}{n_i + n_j + 1}, \tag{29}$$

$$X_j^*(n_i, n_j, t) = \frac{n_j(a - t(n_i + 1))}{n_i + n_j + 1}. \tag{30}$$

Assume a symmetric initial structure with n firms in each country, and consider a domestic merger in country i. The post-merger flows of exports from i to j and j to i are, respectively,

$$X_i^D(n, t) = \max\left[0, \frac{(a - t(n + 1))(n - 1)}{2n}\right], \tag{31}$$

$$X_j^D(n, t) = \max\left[0, \frac{a - nt}{2}\right]. \tag{32}$$

Inspection of (31) and (32) reveals that the former is positive for $t < t^*$ whilst the latter is positive for $t < t^A$ where

$$t^A \equiv \frac{a}{n}. \tag{33}$$

Thus if t lies in the range $t^* < t < t^A$ a domestic merger in country i will initiate

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a one-way flow of trade from j to i.

Consider now an international merger. As explained in Section 3, 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, (29) and (30), we can write the post-merger trade flows as

$$X_i^I(n,t) = \max\left[0, \frac{(a - t(n+1))(n-1)}{2n}\right],$$ (34)

$$X_j^I(n,t) = \max\left[0, \frac{(a - t(n+1))(n-1)}{2n}\right].$$ (35)

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.

Profit in one-way trade equilibrium

Consider the equilibrium described above in which trade flows from j to i but not in the reverse direction. A firm in i will only supply its home market and thus earn profit of

$$\widetilde{\Pi}(n_i, n_j, t) = \frac{(a - (Y_i^* + X_j^*))Y_i^*}{n_i},$$ (36)

where Y_i^* denotes the total volume of production for the home market in i and X_j^* the total exports from j to i. Using (26) we obtain

$$Y_i^*(n_i, n_j, t) = \frac{n_i(a + n_j t)}{n_i + n_j + 1},$$

whilst X_j^* is given by (30). above. These output expressions can then be substituted into (36) to obtain

$$\widetilde{\Pi}(n_i, n_j, t) = \left(\frac{a + n_j t}{n_i + n_j + 1}\right)^2.$$

Domestic merger with two-way trade

Let Y_i^* and Y_j^* denote the total volume of production for the home market in i and j respectively. In a trade equilibrium, these are, using (26) and an equivalent expression for a representative firm in j

$$Y_i^*(n_i, n_j, t) = \frac{n_i(a + n_j t)}{n_i + n_j + 1}, \tag{37}$$

$$Y_j^*(n_i, n_j, t) = \frac{n_j(a + n_i t)}{n_i + n_j + 1}. \tag{38}$$

In a trade equilibrium, firms earn profit from their home market and the overseas market. 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. The firm's total profit is then

$$\Pi_i(n_i, n_j, t) = \pi_i^i(n_i, n_j, t) + \pi_i^j(n_i, n_j, t). \tag{39}$$

The profit from sales in its home market is given by $P_i y_i^*$ which, using (1), (37) and (30) can be written as

$$\pi_i^i(n_i, n_j, t) = \frac{(a + n_j t)^2}{(n_i + n_j + 1)^2} \tag{40}$$

Profit from the overseas market is $(P_j - t)x_i^*$ which, using (1), (38) and (29) can be written as

$$\pi_i^j(n_i, n_j, t) = \frac{(a - (n_j + 1)t)^2}{(n_i + n_j + 1)^2}. \tag{41}$$

Consider a domestic merger between two producers in country i. Using (39), (40) and (41) the combined pre-merger profit of the constituent firms is

$$2\Pi_i(n_i, n_j, t) = 2\frac{[(a + n_j t)^2 + (a - (n_j + 1)t)^2]}{(n_i + n_j + 1)^2} \tag{42}$$

and the post-merger profit is

$$\Pi_i(n_i - 1, n_j, t) = \frac{(a + n_j t)^2 + (a - (n_j + 1)t)^2}{(n_i + n_j)^2}. \tag{43}$$

In the symmetric case the gain to merger is then

$$G^{D2}(n, t) = \frac{(a + nt)^2 + (a - nt - t)^2}{4n^2} - 2\left[\frac{(a + nt)^2 + (a - nt - t)^2}{(2n + 1)^2}\right], \tag{44}$$

which can, after some simplification, be written as

$$G^{D2}(n, t) = \left[\frac{1 + 4n - 4n^2}{4n^2(2n + 1)^2}\right]\left[2a(a - t) + (2n^2 + 2n + 1)t^2\right]. \tag{45}$$

Proof of Proposition 2

$\Delta G^{D2} \equiv G^{D2} - G^A$ and using (45) and (5) this can be written as

$$\Delta G^{D2}(n, t) = \left[\frac{1 + 4n - 4n^2}{4n^2(2n + 1)^2}\right]\left[2a(a - t) + (2n^2 + 2n + 1)t^2\right] - a^2\left(\frac{1}{n^2} - \frac{2}{(n + 1)^2}\right). \tag{46}$$

This expression is maximised when the trade cost takes the value $\bar{t}$ given by

$$\bar{t}(n) = \frac{a}{2n^2 + 2n + 1}. \tag{47}$$

Straightforward calculations reveal that $\Delta G^{D2}(n,t)$ is negative at $\bar{t}(n)$ for $n = 2, 3$ and 4. This establishes part (a) of the proposition.

To establish part (b) of the Proposition, we (i) obtain an expression for t such that $\Delta G^{D2}(n,t) = 0$, then show that (ii) $\Delta G^{D2}(n,t)$ is positive at $t = 0$, (iii) $\frac{\partial \Delta G^{D2}(n,t)}{\partial t}$ is positive when evaluated at $t = 0$, (iv) $\frac{\partial^2 \Delta G^{D2}(n,t)}{\partial t^2}$ is negative and (v) $\Delta G^{D2}(n,t)$ is negative for t close to t^*.

(i) Using (46) it can be shown that $\Delta G^{D2}(n,t) = 0$ when the trade cost is $t^D(n)$ given by

$$t^D(n) = \frac{a \left[4n^3\lambda - 5n\lambda - \lambda + 4n^2\theta + 4n\theta + \theta \right]}{(8n^4 - 6n^2 - 6n - 1)(n+1)\lambda}, \tag{48}$$

where $\lambda \equiv \sqrt{2n+1}$ and $\theta \equiv \sqrt{8n^5 - 36n^4 + 10n^3 + 11n^2 + 16n + 3}$.

(ii) Setting t to zero in (46) yields

$$\Delta G^{D2}(n,0) = a^2 \left[\frac{1 + 4n - 4n^2}{4n^2(2n+1)^2} + \frac{2}{((n+1)^2} - \frac{1}{n^2} \right].$$

This can be rearranged as

$$a^2 \left[\frac{4n^4 - 12n^3 - 17n^2 - 6n - 1}{2n^2(2n+1)^2(n+1)^2} \right].$$

This expression is positive for $n \geq 5$.

(iii) Differentiation of $\Delta G^{D2}(n,t)$ with respect to t yields

$$\frac{\partial \Delta G^{D2}(n,t)}{\partial t} = \frac{1 + 4n - 4n^2}{2n^2(2n+1)^2} \left[2n^2 t + 2nt + t - a \right],$$

which evaluated at $t = 0$ gives

$$\frac{\partial \Delta G^{D2}(n,0)}{\partial t} = a \left[\frac{4n^2 - 4n - 1}{2n^2(2n+1)^2} \right] > 0.$$

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(iv) Differentiating again with respect to t yields

$$\frac{\partial^2 \Delta G^{D2}(n,t)}{\partial t^2} = \frac{1 + 4n - 4n^2}{2n^2(2n+1)^2}(2n^2 + 2n + 1) < 0.$$

(v) As t rises to t^*, pre-merger trade falls to zero. Post-merger exports from i to j also fall to zero, but post-merger exports from j to i remain strictly positive. The impact of trade on the gains from domestic merger at this point, denoted $\Delta G^{D1}(n,t)$, is negative from Proposition 1. ∎

Proof of Proposition 3

In Section 3 we expressed the gain to international merger as

$$G^I(n_i, n_j, t) = \pi_i^i(n, n_j - 1, t) + \pi_j^j(n_i - 1, n_j, t) - \Pi_i(n_i, n_j, t) - \Pi_j(n_i, n_j, t). \quad (21)$$

The sum of the first two terms constitutes the post-merger profit of the merged entity. For the symmetric case this is, using (13) and (19)

$$\Pi^I(n,t) = \frac{(a + nt - t)^2}{2n^2}. \quad (49a)$$

The sum of the latter two terms in (21) represents the combined pre-merger profits of the merged entity. For the symmetric case, this is the same as the pre-merger profits for a domestic merger in a trade equilibrium and so we can use (42) to obtain

$$2\Pi(n,t) = 2\frac{[(a + nt)^2 + (a - nt - t)^2]}{(2n+1)^2}. \quad (50)$$

Combining, (49a) and (50) then yields

$$G^I(n,t) = \frac{(a + nt - t)^2}{2n^2} - 2\left[\frac{(a + nt)^2 + (a - nt - t)^2}{(2n+1)^2}\right]. \quad (51)$$

We define $\Delta G^I \equiv G^I - G^A$. Combining (51) and (5) yields

$$\Delta G^I(n,t) = \left[\frac{(a+nt-t)^2}{2n^2}\right] - 2\frac{[(a+nt)^2 + (a-nt-t)^2]}{(2n+1)^2} - a^2\left(\frac{1}{n^2} - \frac{2}{(n+1)^2}\right),$$

(22)

which, after some manipulation, can be written as

$$\Delta G^I(n,t) = \frac{\alpha + \beta + \gamma}{(2n^2)(2n+1)^2(n+1)^2},$$

(52)

where $\alpha = a^2(4n^4 - 12n^3 - 17n^2 - 6n - 1), \beta = at(8n^3 + 8n^2 - 6n - 2)(n+1)^2$

and $\gamma = -t^2(4n^4 + 12n^3 + 7n^2 - 2n - 1)(n+1)^2$.

Part (a): Substituting $n = 2$ into this expression and simplifying gives

$$\Delta G^I(2,t) = \frac{-113}{1800}(a^2) + \frac{41}{100}(at) - \frac{183}{200}t^2.$$

This is maximised when $t = \frac{41a}{183} \equiv t'$ which yields

$$\Delta G^I(2,t') = \frac{-37}{2196}(a^2) < 0.$$

Part (b): Substituting $n = 3$ into (52) and simplifying gives

$$\Delta G^I(3,t) = \frac{-43}{3528}(a^2) + \frac{134}{441}(at) - \frac{352}{441}t^2.$$

This is zero when $t = \frac{67a - 7\sqrt{53a}}{352}$, negative for $0 \le t < \frac{67a - 7\sqrt{53a}}{352}$, and positive for
$\frac{67a - 7\sqrt{53a}}{352} < t < t^*$.

Substituting $n = 4$ into (52) and simplifying gives

$$\Delta G^I(4,t) = \frac{-41}{64800}(a^2) + \frac{307}{1296}(at) - \frac{1895}{2592}t^2.$$

This zero when $t = \frac{307a}{1895} - \frac{9\sqrt{28130a}}{9475}$, negative for $0 \le t < \frac{307a}{1895} - \frac{9\sqrt{28130a}}{9475}$, and positive for $\frac{307a}{1895} - \frac{9\sqrt{28130a}}{9475} < t < t^*$.

Part (c): Substituting $n = 5$ into (52) and simplifying gives

$$\Delta G^I(5,t) = \frac{68}{27225}(a^2) + \frac{584}{3025}(at) - \frac{2082}{3025}t^2.$$

This is positive for $0 \le t < t^*$. To establish that ΔG^I is positive for $n > 5$ when t is in the relevant range $(0 \le t < t^*)$, we evaluate ΔG^I at $t = 0$ and $t = t^*$. Using (52) and (6),we have

$$\Delta G^I(n,0) = \frac{a^2(4n^4 - 12n^3 - 17n^2 - 6n - 1)}{(2n^2)(2n + 1)^2(n + 1)^2}, \tag{53}$$

$$\Delta G^I(n,t^*) = \frac{a^2(n^2 - 2n - 1)}{n^2(n + 1)^2}. \tag{54}$$

It is then straightforward to show that $\frac{d\Delta G^I}{dn}$ is positive for $n \ge 5$ when evaluated at both $t = 0$ and $t = t^*$. ∎

Proof of Proposition 4(b)

Let $\Delta G^{ID}(n,t)$ denote the difference between the gain from international and domestic merger in a symmetric trade equilibrium. That is, $\Delta G^{ID}(n,t) \equiv G^I(n,t) - G^{D2}(n,t)$. Using (51) and (44) we obtain

$$\Delta G^{ID}(n,t) = \frac{2a(2n - 1)t - (6n - 1)t^2}{4n^2}.$$

This is concave in t and zero when $t = 0$. For $t = t^*$ we obtain, using (6):

$$\Delta G^{ID}(n,t^*) = \frac{a^2(4n^2 - 4n - 1)}{4n^2(n + 1)^2}.$$

This is positive for all $n \ge 2$. Thus $G^I > G^{D2}$ for all t in the range $0 < t < t^*$. ∎

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