Quotas and Endogenous Mergers among Heterogeneous Firms

by

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Abstract

In this paper we analyse the effects of quantitative restrictions on trade on the incentives for national and international mergers in a segmented oligopolistic market of Cournot-competing firms.

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I Introduction

The links between trade, trade policy and competition policy have received increased attention from trade economists in recent years[1]. As foreign trade and investment policies are liberalised, other policies take on an even more significant role in regulating the international environment in which firms compete. One important influence will be the effects of trade liberalisation on the incentives for existing firms to merge, and a small literature has developed investigating the implications of tariff liberalisation for merger profitability. But one important feature of the recent liberalisation process undertaken as an outcome of the Uruguay Round, is that it is not confined to tariffs. It also encompasses Voluntary Export Restraints (VERs) and other "grey area" measures of a more quantitative character. The implications of the existence and liberalisation of quantitative trade restrictions for merger profitability remain to be investigated.

A common approach to examining the interactions between competition policy and trade policy in the literature has been to model the former as the direct choice of the number of identical domestic firms, and to see how the "optimal" number of these firms changes when constraints are imposed on trade policy choices[2]. More detailed analyses of firms' decisions to merge have employed a range of models reflecting those available in the general merger literature. Salant, Switzer and Reynolds (1983) have shown that identical Cournot-competing firms with constant marginal costs have no incentive to merge in a closed market, unless the participants collectively have a large share of the market pre-merger, or the merger saves on fixed costs[3]. But small trade interventions will have rather a limited impact where the incentive to merge is avoiding fixed costs[4], and so the natural focus in this paper is on heterogeneous firms that differ in their marginal costs.

Perry and Porter (1985) introduce an explicit link between marginal cost and firm size through a tangible asset, assumed to be in fixed supply to the industry, whose quantity in the hands of a firm determines its unit costs. Then the merged firm has more of the asset than any of the individual participants and therefore lower

[1] See Horn and Levinsohn (2001) and WTO Annual Report 1997 for reviews of the relevant literature.
[2] See Collie (1997) and the references therein.
[3] This analysis has been extended to non-Cournot behaviour and non-linear demand. See, for example, Deneckere and Davidson (1985), Kwoka (1989) and Fauli-Oller (1997).
[4] Gaudet and Kanomi (2000) consider the incentive that different levels of a tariff provide for a fixed-cost saving domestic merger. The main impact arises when the tariff is large enough to influence the number of foreign competitors in the market.

costs[5]. A somewhat simpler way to introduce inter-firm size differences is to suppose that they indicate different firm technologies, reflected in different (constant) marginal costs. Open economy models of mergers using this assumption are found in Long and Vousden (1995), Falvey (1998, 2003) and Neary (2003). In most of this literature, only a few of the potential mergers are considered, and they tend to be chosen exogenously. More recently some consideration has been devoted to examining the full constellation of merger possibilities, in order to predict which mergers are likely to be proposed in which circumstances. Horn and Persson (2001) discuss the relative merits of the various approaches to endogenising mergers and establish some general results on "endogenous mergers" under both fixed cost saving and variable cost rationalisation motives. We draw on the latter below. Specifically we adapt the approach of Barros (1998), who considers a market with three potential participants and shows that merger outcomes depend on technology differences[6]. Assuming that merger to monopoly is precluded, he finds that if the technology difference is small there are no mergers. For intermediate technology differences the least and most efficient firms merge. For large technology differences, the two most efficient firms merge[7]. We retain the assumption of three firms, as this allows the full range of outcomes of interest[8], but we allow variable technology differences, and hence generate a wider range of outcomes.

Using this model we consider the implications of quantitative restraints on some (or all) firms for the likelihood of mergers among them. We are interested in two questions. First, whether the presence of the quota makes merger activity more or less likely. Second, where more than one merger is profitable, how the presence of the quota affects which merger will be preferred. Quotas affect the likelihood of any merger through two channels; the post-merger profitability of the merged firm and the pre-merger profitability of the participants. That quotas will tend to encourage merger activity through the first channel is clear. A major factor reducing the potential

[5] This approach has also been extended to a multi-country context by Horn and Levinsohn (2001). Kabiraj and Chaudhuri (1999) compare the relative profitability and welfare effects of national and cross-border mergers, and show that there exists a range of merger efficiency gains for which a cross-border merger would lead to higher domestic welfare than a national merger.

[6] Which are assumed to be constant in his case. The marginal cost of firm j is $c_1 + [j-1]\Delta$, where c_1 is the marginal cost of the most efficient firm, and Δ is the technology difference.

[7] This outcome is generalised in Corollary 3 in Horn and Persson (2001).

[8] And may not even be that limiting in view of Proposition 2 in Horn and Persson (2001) which establishes, under not particularly restrictive conditions, that a duopoly is the equilibrium ownership structure when monopoly is precluded.

profitability of mergers in quantity-setting games is the expansion of output by non-participating firms in the post-merger equilibrium. As we show below, merger profitability will be enhanced unambiguously if outsiders are quota constrained. Further, in a market where sales are restricted, a firm's quota entitlement may itself provide an additional inducement to potential merger partners. The influence of the quota through the second channel is less clear, however, since the pre-merger profits of quota-constrained firms may rise or fall relative to free trade depending, inter alia, on the restrictiveness of the quota.

We find that mergers are encouraged by quantitative restrictions, which raises the question of the sense in which these restrictions are able to "protect" import-competing firms. The output and profits of import-competing firms are increased by the quota in the absence of a merger, and, since mergers are a voluntary activity, firms will only participate if their owners gain. Outside firms are made better off, leading to a presumption that the profits of import-competing firms are protected by the quota, even when mergers occur. But the change in total import-competing output is unclear, a priori, since a merger reduces the output of the less-efficient partner. Can a quota imposed to "protect" the output of import-competing firms in fact induce their closure through merger?

It has long been established that some forms of trade restriction can affect the strategic interaction between import-competing and exporting firms under some oligopolistic market structures. This outcome arises if quantitative restrictions are imposed in a market where firms sell differentiated products and are Bertrand price competitors in particular[9]. By assuming Cournot quantity competition among producers of a homogeneous product, we limit the impact that policy choice has on the strategic interactions between firms, so that the complexities of the potential trade policy outcomes do not obscure their implications for merger activity that are the primary focus of this paper. We also assume demand is linear and firms have constant marginal costs. This structure allows for relatively simple solutions, where the effects of discrete changes in the both number (via mergers) and the sales (via quotas) of firms can be considered.

[9] Harris (1985) and Krishna (1989) investigate VERs, while Greaney (1996) considers "voluntary import expansions".

The remainder of the paper is as follows. Section II sets up the model and determines the factors influencing the profitability of mergers in free trade. The following Section looks at the quota. The final section presents our conclusions.

II Free Trade

Consider a world economy in which there are three (potential) producers of a homogeneous product. Each firm (j) has constant unit costs (c_j) and no fixed costs. Unit costs differ across firms, and firms are ordered so that k > j implies $c_k > c_j$. Competition in this market is assumed to be Cournot. There are two countries (home and foreign) but markets are segmented. Demand in the home market is

$$D = A - p \tag{1}$$

where A is a positive constant, and p is price. In this section we assume free trade and no transport costs. Each producing firm j therefore chooses its output (x_j) to $\max \ \pi_j = [p - c_j]x_j$, taking $dp/dx_j = -1$. Solving the first order conditions for optimal firm output, summing these to obtain total output (X), and then substituting in (1), gives the equilibrium values:

$$\overline{p} = \frac{A+C}{n+1}; \overline{x}_j = \overline{p} - c_j; \pi_j = [\overline{p} - c_j]^2 = \overline{x}_j^2 \tag{2}$$

where $C = \sum_{j \in N} c_j$, and n is the number and N the set of producing firms.

We assume that mergers are market specific. When two firms in this market (k and j) "merge", they become a single decision making unit. Given that the merger itself is has no effect on the technology of the participants, cost minimisation by the new merged firm implies the abandonment of firm k's (relatively inefficient) technology, and the new market equilibrium is simply that which obtains with the closure of firm k[10]. Total output falls, the market price rises, the profits of the remaining firms rise and consumer surplus falls[11]. Consumers lose from the merger,

[10] Note that by assuming a fixed number of firms we intend to preclude the divisionalisation process whereby firms may gain by splitting into separate identical production decision making units. Were divisionalisation possible, the merged firm might then increase its total profits by operating as two or more units, particularly if all had access to the technology of the more efficient partner. See Baye et al (1996) and Ziss (2001). In common with much of the literature in this area, we take the initial number of firms and their technologies as given. Such would be the case, for example, if the technology in this industry was patentable, the existing firms held all the patents and there was little prospect of any firm inventing a viable new technology.

[11] Farrell and Shapiro (1990) provide the conditions for output to fall under more general assumptions.

and outside firms gain. The incentive to merge is the additional profits that may accrue to the merged firm as a result of the higher price.

When two firms merge in a three firm market the shift to the new post-merger equilibrium (where Δy denotes the change in variable y as a consequence of the merger) has

$$\Delta\bar{p} = \frac{\bar{x}_k}{3}; \quad \Delta x_h = \frac{\bar{x}_k}{3}, h \neq k; \quad \Delta\bar{D} = \Delta\bar{X} = -\frac{\bar{x}_k}{3} \tag{4}$$

The closure of firm k results in an increase in the output of each of the remaining firms. Given our assumptions of linearity and constant marginal costs, their outputs rise by the same absolute amount, which is one third of the closing firm's original output. Since only 2 firms remain, total output falls (by $\bar{x}_k/3$), and price rises (by $\bar{x}_k/3$). The change in profits of continuing firm h is the increased profits on its original output plus the profits from its increased output. From (4) this becomes

$$\Delta\pi_h = \frac{\bar{x}_k}{3}[2\bar{x}_h + \frac{\bar{x}_k}{3}] > 0 \tag{5}$$

This merger will have been profitable for the participants only if the increase in profits to firm j exceed the lost profits of the closed firm. Substituting from (5), this *Gain* is

$$G(j,k) = \Delta\pi_j - \pi_k = \frac{\bar{x}_k}{9}[6\bar{x}_j - 8\bar{x}_k] \tag{6}$$

Equation (6) provides a condition on relative firm sizes (or relative shares of output) for a profitable merger. Given $\bar{x}_k$, and the number of firms, the larger the initial output of the continuing partner the more likely the merger is to yield a net gain.

In his analysis of endogenous mergers in this type of market, Barros (1998) notes that there are two general conditions that the distribution of profits of the merged firm must satisfy in equilibrium. First, there are *participation constraints* that limit the possible payoffs to the two partners. Consider again merger {j,k}. Let π^{jk} denote the total profits of the merged firm, and π_j^{jk} denote the "payoff" to partner j (so that $\pi^{jk} = \pi_j^{jk} + \pi_k^{jk}$). Then the participation constraint for this merger requires that

$$\pi^{jk} - \pi_k \geq \pi_j^{jk} \geq \pi_j \tag{7}$$

The left side of this inequality indicates the largest payoff that can be made to partner j (i.e. the remainder after partner k is paid exactly what it would receive if their were no merger), while the right side indicates the minimum payoff to partner j (i.e. what it would receive if there were no merger). Satisfying these participation constraints requires that the merger be profitable (i.e. $\pi^{jk} \geq \pi_j + \pi_k$). Second, there are the *stability constraints*, which recognise that each merger partner may have the option of merging with the outside firm (h). These conditions require

$$\pi_j^{jk} \geq \pi^{jh} - \pi_h^{jk} \equiv o_j^{jh} \qquad \text{and} \qquad \pi_k^{jk} \geq \pi^{kh} - \pi_h^{jk} \equiv o_k^{kh} \qquad (8)$$

that is the payoffs to each partner be no less than the maximum offer that the outside firm h would be willing to make to that partner for their participation in the alternative merger[12].

We can now use these constraints to determine the conditions under which different mergers may occur. With three firms there are, in principle, three possible mergers. When more than one merger is profitable, we determine that which will be preferred on the basis of the outside offers. Suppose for example that mergers {1,2} and {1,3} are both profitable. In this case firms 2 and 3 are "bidding" over a possible merger with firm 1 and the maximum outside offer each of the smaller firms will make to 1 are, respectively

$$o_1^{12} = \pi^{12} - \pi_2^{13} > 0 \quad \text{and} \quad o_1^{13} = \pi^{13} - \pi_3^{12} > 0$$

Which of these is the greater depends on relative outputs, but since

$$o_1^{12} - o_1^{13} = \pi^{12} - \pi^{13} - \frac{8}{18}[(\bar{x}_2)^2 - (\bar{x}_3)^2] = \frac{[\bar{x}_2 - \bar{x}_3]}{18}\{6\bar{x}_1 - 7[\bar{x}_2 + \bar{x}_3]\} \qquad (9)$$

there will be cases where firm 3 makes the larger outside offer to 1, even though merger {1,3} is not the most profitable (i.e. $\pi^{12} > \pi^{13}$)[13]. Unfortunately, when {1,3} and {2,3} are both profitable both outside offers are zero. In each case firm 3 exits the

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[12] Note that the stability condition uses $\pi_h^{jk} > \pi_h$ reflecting that the outside firm is always better off from a merger.

[13] This is equivalent to Barros' criteria that the merger with the highest internal gain (taking account of the gains from being the outside firm) will be preferred, since $o_1^{12} - o_1^{13} = [\pi^{12} - (\pi_1 + \pi_2^{13})] - [\pi^{13} - (\pi_1 + \pi_3^{12})] = [\pi^{12} + \pi_3^{12}] - [\pi^{13} + \pi_2^{13}]$. This outcome also follows from Proposition 2 in Horn and Persson (2001) which establishes, in this case, that the producing firms in equilibrium will be those that maximise total industry profits. One can readily show that total profits when only firms 1 and 2 produce are equal to total profits when only firms 1 and 3 produce if initially $6\bar{x}_1 = 7[\bar{x}_2 + \bar{x}_3]$.

market, and the only difference between these mergers is the identity of the firm which compensates firm 3. Since $\pi^{13} = \pi_1^{23}$ and $\pi^{23} = \pi_2^{13}$ each of the larger firms would prefer to be the outsider[14]. In this case we assume that a merger will occur, but that it could be either.

The profitability conditions can be obtained from equation (6). Merger {j,k} is profitable if $6\bar{x}_j \geq 8\bar{x}_k$. If merger {1,2} is profitable so is {1,3}. Consideration of the participation and stability constraints then leads to the following outcomes depending on the distribution of firm sizes:

(1) If $6\bar{x}_1 \leq 8\bar{x}_3$, then no merger is profitable and all three firms produce;

(2) If $6\bar{x}_2 < 8\bar{x}_3 < 6\bar{x}_1 \leq 8\bar{x}_2$, then {1,3} is the only profitable merger;

(3) If $8\bar{x}_3 < 6\bar{x}_2 < 6\bar{x}_1 \leq 8\bar{x}_2$, then {1,3} and {2,3} are both profitable and either may occur;

(4) If $6\bar{x}_2 < 8\bar{x}_3 < 8\bar{x}_2 \leq 6\bar{x}_1$ then both {1,3} and {1,2} are profitable and which occurs depends on the stability conditions;

(a) if $6\bar{x}_1 < 7[\bar{x}_2 + \bar{x}_3]$, then merger {1,3} occurs; while

(b) if $6\bar{x}_1 > 7[\bar{x}_2 + \bar{x}_3]$, then merger {1,2} is occurs.

(5) If $8\bar{x}_3 < 6\bar{x}_2 < 8\bar{x}_2 \leq 6\bar{x}_1$ then all mergers are profitable and either {1,3} or {2,3} occurs if (a) is satisfied, and {1,2} occurs if (b) is satisfied.

Corresponding to each of these cases will be a distribution of the profits of any merged firm between the partners (i.e. specific values of π_j^{jk} etc). This distribution should reflect the outside opportunities of the partners, but is otherwise indeterminate.

These outcomes are illustrated in Figure 1. Given the size of the largest firm (x_1), the requirement that $x_1 \geq x_2 \geq x_3$ constrains the range of feasible outputs for the other firms to the triangle shown. The combinations of relative outputs (reflecting relative costs) that give rise to each of the cases are shown by the labelled areas. For example, if all outputs are sufficiently similar no merger will occur; while if firm 1 is much larger than the others all mergers will be profitable, but merger {1,2} will occur. For later comparisons we shade the range of relative output sizes for which firm 3 discontinues production as a result of merger.

[14] This is the "after you" syndrome. See Neary (2003).

III Quota

Suppose that the home country imposes import quotas on foreign produced goods. Excluding the rare cases where quota rights are auctioned, the "revenue" from the restriction will be captured by those fortunate enough to be allocated the rights to import. In the context of this oligopolistic market structure, it seems sensible to assume that any entity through which imports are undertaken in free trade is fully integrated with the foreign producer[15]. The foreign producers then capture the rents, no matter whether the quota licences are allocated to "domestic" importers or to "foreign" exporters (as under a VER, for example).

An immediate problem in dealing with quantitative restrictions in oligopolistic markets is to determine how the import rights are to be allocated among the exporting firms. The GATT/WTO obligations with respect to the administration of quotas are provided in GATT Article XIII. While these obligations refer to allocations to countries (since the "contracting parties" to the GATT were countries), they provide a strong indication of what would constitute an acceptable allocation to any group[16]. Briefly, Article XIII requires that all exporters be covered by the restriction (paragraph 1), and that the distribution of trade aim at approaching as closely as possible the shares that might be expected to obtain in the absence of the restriction (paragraph 2). The actual allocation of trade shares can be by agreement with all parties having a "substantial interest" in supplying the product concerned or, "where this method is not reasonably practicable", in proportion to the shares during a "previous representative period" (paragraph 2 (d)). While the ambiguity of many of these terms has proved fertile ground for disputes, in practice a three year period, during which trade was unrestricted, has generally been taken to be "representative".

Given the wide application of the "previous representative period" formula, here we assume that the quota allocation across foreign firms is in proportion to their exports in free trade. The domestic and foreign firm profit maximisation problems then become, respectively,

$$\underset{h_j}{Max}(p-c_j)h_j \qquad \text{and} \qquad \underset{x_k}{Max}(p-c_k)x_k \quad \text{s.t.} \quad x_k \le q\bar{x}_k$$

[15] This avoids the inefficiencies that would arise if a second independent profit maximising entity intervened between home consumers/retailers and the foreign producer.
[16] Alternatively we could assume that our foreign firms are each based in a different country.

where q is the quota rate, $0 \leq q \leq 1$, and p, h_j and x_j denote, respectively, the domestic price, the sales of import-competing firm j and the sales of exporting firm k under the quota regime. Because the optimal response of an unconstrained firm is to increase its own sales in the face of a reduction in its competitors' sales (i.e. sales are strategic substitutes), and the permitted sales by exporting firms in the home market are proportional to their optimal free trade sales, the quota constraint is binding for all exporting firms. Equilibrium sales under the quota regime are then:

$$\tilde{h}_j = \tilde{p} - c_j; \; \tilde{x}_k = q\bar{x}_k$$

Which gives an equilibrium home market quota-induced price of

$$\tilde{p} = \bar{p} + \frac{[1-q]\bar{M}}{n+1}$$

where n is the number of import-competing firms and $\bar{M}$ is free trade equilibrium imports. The effects of a change in the quota regime can then be derived:

$$\frac{d\tilde{p}}{dq} = -\frac{\bar{M}}{n+1} < 0; \frac{d\tilde{h}_j}{dq} = \frac{d\tilde{p}}{dq} < 0; \frac{d\tilde{x}_k}{dq} = \bar{x}_k > 0; \frac{d\tilde{\pi}_j}{dq} = 2\tilde{h}_j \frac{d\tilde{p}}{dq} < 0;$$

$$\frac{d\tilde{\pi}_k}{dq} = [\tilde{p} - c_k]\tilde{x}_k + q\bar{x}_k \frac{d\tilde{p}}{dq}$$

Tightening the quota (reducing q) raises the domestic price, increases domestic firms' sales and reduces imports. The profits of import-competing firms rise, and, significantly the profits of some exporting firms may increase as a result of the quota, which can shift output towards the collusive outcome. This depends on the relative numbers of import-competing and exporting firms, however, since only the latter are subject to the quota, and the former will increase their outputs. For each exporting firm k, one can determine a profit-maximising quota (q_k^o), with

$$q_k^o = \frac{1}{2} + \frac{n+1}{2}.\frac{\bar{x}_k}{\bar{M}} \qquad (10)^{17}$$

Equation (10) also indicates that a larger foreign firm prefers a less restrictive quota.

The influence of a quota on merger profitability and stability depends on the identity of the firms constrained and the restrictiveness of the constraint. In what

[17] Note that if there are no domestic firms, and all foreign firms are identical, then $q^0 = [n^*+1]/2n^*$, which is the collusive outcome. The existence of unconstrained domestic firms tends to raise this profit maximising quota. Again, if all foreign firms are identical, $q^o = [n+n^*+1]/2n^*$, with no restriction being profit maximising once $n \geq n^* - 1$.

follows we consider three cases which seem to cover the relevant spectrum of possibilities. It will be convenient to refer to the quota-constrained firms as "foreign" and "exporters" and the unconstrained firms as "domestic" and "import-competing". But note that the analysis below also covers the case where the quota is applied discriminatorily, constraining only some exporters. Since we are primarily interested in the effects of "protection", in each case we assume that the largest and most profitable firm is a quota-constrained exporter in the pre-merger equilibrium.

Three other points are worth observing before we move on to the individual cases. First, it is straightforward to show that any merger is profitable if the sales of the outside firm(s) cannot increase[18]. Thus any merger is profitable if all the outside firms are quota constrained. Since we are dealing with three firms at least one of which will be quota constrained, there will always be a profitable merger. Second, if not all firms are quota constrained, firm efficiency and firm size need no longer coincide for tight quotas as they do in free trade. This raises the question of whether the quota can be sufficiently restrictive that the less efficient merger partner continues to operate if it is unconstrained by the quota. Finally, recall that we are not considering cases where a quota restricted firm is able to transfer its technology to an existing domestic firm via acquisition or merger, or a new domestic firm through Greenfield investment [19]

Case [A] All firms are quota restricted.

While one might imagine that the imposition of an import quota when there is no domestic industry to protect is likely to be uncommon, quotas have been imposed on a wide range of imports on Balance of Payments and other grounds in the past. Examining this case has the benefit of illustrating the effects of the quota regime when *all* firms are similarly constrained. It also indicates the incentives for merger

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[18] Suppose firms j and k merge, but that other outputs are held constant. Then $p_m^{jk} = p + x_k/2$, $\pi^{jk} = (x_j + \frac{x_k}{2})^2$ and $G(j,k) = x_k[x_j - \frac{3x_k}{4}] > 0$. Indeed this merger is profitable even when the output of the continuing partner does not increase, as then $p^{jk} = p + x_k, \pi^{jk} = [x_j + x_k]x_j$ and $G(j,k) = x_k[x_j - x_k]$.

[19] This removes the tariff- or quota-jumping motive for mergers. Levinsohn (1989) establishes the equivalence of tariffs and quotas when foreign direct investment is an alternative to exporting. Ryan (2001) explores mergers as a form of tariff and quota jumping.

among the members of an export cartel, although this is not an aspect that is developed in detail here [20].

Since the outside firm is unable to expand its output due to the quota, all mergers are profitable in this case. Two types of post-merger equilibria can be distinguished, however, depending on whether the quota is sufficiently restrictive that it also constrains the merged firm. If the merged firm is so constrained then the merger has no effect on total sales and price, and the gains from the merger arise solely from the reallocation of quota from the less to the more efficient partner. So if i and j merge, the gain is

$$\tilde{G}(i,j) = [c_j - c_i]q\bar{x}_j = [\bar{x}_i - \bar{x}_j]q\bar{x}_j > 0 \qquad \text{and} \qquad \tilde{\pi}_k^{ij} = \tilde{\pi}_k$$

Clearly this gain falls as the quota is tightened.

If all three potential mergers are quota constrained, then that which will occur depends on the relevant outside offers. We can show that {1,3} will dominate {2,3}, since firm 1 can make a larger offer than firm 2 to firm 3 at all values of q in the relevant range – i.e.

$$o_3^{13} - o_3^{23} = [\tilde{\pi}^{13} - \tilde{\pi}_1] - [\tilde{\pi}^{23} - \tilde{\pi}_2] = [\bar{x}_1 - \bar{x}_2]q\bar{x}_3 > 0 \qquad (11)$$

The same quota is transferred in each case, and the more efficient firm makes the larger profit from the transfer. But whether {1,3} or {1,2} is preferred depends on relative outputs since

$$o_1^{13} - o_1^{12} = [\tilde{\pi}^{13} - \tilde{\pi}_3] - [\tilde{\pi}^{12} - \tilde{\pi}_2] = q[\bar{x}_2 - \bar{x}_3][\bar{X} - 2\bar{x}_1] \qquad (12)$$

While {1,3} has the larger cost saving per unit of quota transferred, {1,2} transfers the larger quota. Only where the largest firm has more than half the market in free trade (i.e. $\bar{x}_1 > \bar{X}/2$), will the merger of the two largest firms be preferred.

If the merged firm is not to be quota-constrained, then its post-merger profit maximising output must be no greater than the combined quotas of the participants[21]. We know these mergers must be profitable, because the outsider cannot increase its output and in each case the participants have the option of simply reallocating the quota to the more efficient partner, which would lead to a positive gain as above.

[20] Cave and Salant (1995) discuss the determination of cartel quotas in a more general setting.
[21] Note that the merged firm may also be constrained by "use-it-or-lose-it" provisions of the quota regime, however. If these provisions apply, then failure by the merged firm to employ its quota entitlement will see those rights redistributed to other foreign firms, who can be expected to exercise them. See Bergsten et al (1987) for a discussion of the administration of quota regimes.

Where the merged firm is not quota-constrained they are able to do better than this. For a merger involving i and j, the profit-maximising sales of the merged firm are

$$x^{ij} = \overline{x}_i + \frac{[1-q]\overline{x}_k + \overline{x}j}{2}$$

where k is the outside firm. The influence of the quota, per se, is most clearly demonstrated when it is set at the free trade level (q = 1), as then $x^{ij} = \overline{x}_i + \overline{x}_j/2$ which exceeds the corresponding output in free trade of $x^{ij} = \overline{x}_i + \overline{x}_j/3$. The inability of the outside firm to increase its sales means that the merged firm sells more (by $\overline{x}_j/6$), and at a higher price than in the corresponding free trade equilibrium. Further, x^{ij} increases as the quota is tightened (i.e. q falls), until eventually the quota becomes binding on the merged firm once[22] $q < q^{ij} = \frac{\overline{x}_i + \overline{X}}{\overline{x}_i + \overline{x}_j + \overline{X}}$. There is a gain from merger {i,j} throughout this range. This gain is largest when the quota is set at the free trade level, and declines as the quota is tightened. Although tightening the quota increases the profits of the merged firm ($\tilde{\pi}^{ij} = [x^{ij}]^2$) it increases the combined pre-merger profits of the partners even more.

In comparing different mergers, we note that $q^{13} > q^{12}$ and $q^{13} > q^{23}$, but that the relative sizes of q^{12} and q^{23} depend on relative outputs[23]. As the quota is tightened, {1,3} will be the first to become quota-constrained. When the merged firm is not quota constrained, the outside firm ids better off under the merger, since it sells the same amount at a higher price. If none of the merged firms would be quota-constrained ($q > q^{13}$), comparison of the outside offers for each is relatively straightforward. Comparing {1,3} and {2,3} we can show that

$$o_3^{13} - o_3^{23} = [\tilde{\pi}^{13} - \tilde{\pi}_1^{23}] - [\tilde{\pi}^{23} - \tilde{\pi}_2^{13}] > 0.$$

Recall that for the corresponding comparison in free trade each of the larger firms preferred to be the outsider, because its profits as the outsider were the same as the profits of the merged firm if it were the continuing partner (i.e. $\pi^{13} = \pi_1^{23}$ and $\pi^{23} = \pi_2^{13}$) and it does not have to compensate the closing firm. This no longer holds

[22] Set $x^{ij} = q[\overline{x}_i + \overline{x}_j]$ and solve for q^{ij}.

under the quota regime, since the outside firm is quota-constrained while the merged firm is not. Thus, for example, even when the quota is set at the free trade level we have

$$\tilde{\pi}^{13} - \tilde{\pi}_1^{23} = \frac{\bar{x}_3}{2}\left[\bar{x}_1 + \frac{\bar{x}_3}{2}\right] > \frac{\bar{x}_3}{2}\left[\bar{x}_2 + \frac{\bar{x}_3}{2}\right] = \tilde{\pi}^{23} - \tilde{\pi}_2^{13}$$

Combining this with (11) we conclude that {1,3} will be preferred to {2,3}, whether both merged firms are quota-constrained or whether neither is quota constrained.

Whether {1,3} or {1,2} is preferred again depends on relative outputs, however, since when neither merged firm is quota constrained we have

$$o_1^{13} - o_1^{12} = q[\bar{x}_2 - \bar{x}_3][(\frac{4-q}{8-q}) > \frac{\bar{x}_1}{\bar{X}}]$$

If the pre-merger equilibrium is unchanged from free trade (i.e. q = 1), then {1,3} will be preferred if $\bar{x}_1 < [3/7]\bar{X}$, which is a tighter constraint than the corresponding free trade condition $\bar{x}_1 < [7/13]\bar{X}$. While this constraint becomes weaker as the quota is tightened, $\bar{x}_1 > [1/2]\bar{X}$ is a sufficient condition for merger {1,2} to be preferred regardless of whether the merged firm is quota constrained. We therefore conclude that {1,3} is less likely to be preferred under the quota regime.

While we have not compared cases where one merged firm is quota-constrained and the other is not, the message is clear. There will be a merger, and it is unlikely to be {2,3}. But which of {1,2} and {1,3} is chosen will depend on relative firm costs as reflected in relative free trade outputs. A comparison with the free trade case is given in Figure 2. When all firms are quota-constrained there is always a profitable merger, and hence no range of relative outputs for which no firm closes down through merger. The range of relative outputs over which firm 2 discontinues production has expanded, from the lower unshaded area to the area under the solid line. The range over which firm 3 discontinues has contracted at the lower margin and expanded at the upper, tightening the quota increases the likelihood that the smallest domestic firm will shut down.

Case [B] Only the most efficient firm is quota restricted.

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[23] One can show that $q^{12} \geq q^{23}$ if $\bar{x}_3[\bar{x}_1 + \bar{X}] \geq \bar{x}_2[\bar{x}_2 + \bar{X}]$.

We now have two import-competing firms to be protected by the quota and hence can investigate its effects on their outputs and profits, and, in particular, their incentives to merge with each other and with the foreign exporter. The quota equilibrium in this case has

$$\tilde{p} = \overline{p} + [1-q]\frac{\overline{x}_1}{3}; \tilde{\pi}_1 = \left[\frac{4-q}{3}\right] q\overline{x}_1^2 \; ; \tilde{\pi}_j = \left[\overline{h}_j + [1-q]\frac{\overline{x}_1}{3}\right]^2, \quad j \neq 1 .$$

The sales of the two import-competing firms increase by the same amount which implies that the profits of the intermediate firm increase by the larger amount (but by a smaller proportion) relative to free trade. So, absent a merger, the quota protects the domestic output and profits of the domestic firms. The exporting firm's sales and profits fall if the quota is binding.

We now consider potential mergers, beginning with those involving the exporting firm. Since the sales of the most efficient merger partner are constrained by the quota, while those of the outside firm are not, we expect these mergers to be less profitable than in free trade. Further, although it is not a priori obvious that these mergers will necessarily involve the complete closure of the less efficient partner, we can show that it does – if the merger is to be profitable. Consider merger {1,j}. If the merged firm maintains some production by firm j, then we find in the post-merger equilibrium that $p^{1j} = \overline{p} + \frac{\overline{x}_1}{3}$ and the optimum output of firm j is $h_j^{1j} = \overline{h}_j + \frac{\overline{x}_1}{3} - q\overline{x}_1$.

Thus $h_j^{1j} > 0$ requires that $\frac{3\overline{h}_j + \overline{x}_1}{3\overline{x}_1} > q$. However, when we then consider the gain from this merger we find that

$$\tilde{G}(1,j) = \tilde{\pi}^{1j} - [\tilde{\pi}_1 + \tilde{\pi}_j] = \frac{q\overline{x}_1}{9}\left\{2q\overline{x}_1 - [3\overline{h}_j + \overline{x}_1]\right\}$$

which is only positive if $q > \frac{3\overline{h}_j + x_1}{2x_1}$, which exceeds $\frac{3\overline{h}_j + x_1}{3x_1}$. We conclude that the less efficient partner will be shutdown in any profitable merger. Note that this also implies that no merger that closes out the exporting firm from this market will ever be profitable. Even under a very tight quota, the gain in profits to the continuing import-competing firm is never sufficient to compensate the (efficient) exporter for its lost profits.

This being the case, the source of the gain from the merger comes from the higher price that firm 1 receives on its quota, and the gain is

$$\tilde{G}(1,j)=\left[\frac{3\bar{h}_j+(1-q)\bar{x}_1}{18}\right]\left[(5q-2)\bar{x}_1-6\bar{h}_j\right]$$

When q = 1, {1,j} will only be profitable if $\bar{x}_1 > 2\bar{h}_j$, which is a much tighter requirement than in free trade (where $6\bar{x}_1 > 8\bar{h}_j$ suffices). Starting from the free trade quota, a tightening of the quota will increase (reduce) the gain from this merger if $\bar{x}_1 > (<) 7\bar{h}_j$. Although tightening the quota reduces the profits of the merged firm and increases the pre-merger profits of the non-continuing partner, both of which reduce the profitability of the merger, it also reduces the pre-merger profits of the continuing partner, which increases the merger profitability. If this last effect is strong enough (i.e. firm 1 is sufficiently large relative to firm j) then the profitability of the merger can increase under a more restrictive quota. But at some point the quota becomes so tight that the merger is not profitable. [24]. We conclude that mergers involving the (quota-constrained) most efficient firm are less likely to be profitable under the quota regime. But where both are still profitable ($[5q-2]\bar{x}_1 > 6\bar{h}_2$) the stability conditions for these two mergers determine which will be preferred. Noting that the non-participant would prefer to be the outside firm than that there be no merger (i.e. $\tilde{\pi}_k^{1j}=\left[\bar{h}_k+\frac{[1-q]\bar{x}_1+\bar{h}_j}{2}\right]^2 > \tilde{\pi}_k$), we can solve for the relative offers to firm 1

$$o_1^{13}-o_1^{12}=\frac{\bar{h}_2-\bar{h}_3}{4}\left[3\bar{X}-(4q+1)\bar{x}_1\right]$$

When q = 1, {1,3} is the preferred option if $\bar{x}_1 < [3/5]\bar{X}$, which is a looser requirement than in free trade (where $\bar{x}_1 < [7/13]\bar{X}$ is required). As the quota is tightened, the profits of both merged firms fall, but $\tilde{\pi}^{12}$ falls by more than $\tilde{\pi}^{13}$, and the profit of both outside firms rise, but $\tilde{\pi}_2^{13}$ more than $\tilde{\pi}_3^{12}$. The net result is that both offers fall as q is tightened, but o_1^{12} by more than o_1^{13}, making {1,3} more likely to be the preferred option.

[24] That is when $q=[6\bar{h}_j+2\bar{x}_1]/5\bar{x}_1$.

Now consider a merger of the non-constrained firms. Since the outsider is quota-constrained, this merger will always be profitable and becomes more profitable as the quota is tightened. Since firm 3 exits the market in each case, we have $p^{23} = p^{13}$ implying that $\tilde{\pi}_1^{23} = \tilde{\pi}^{13}$ and $\tilde{\pi}_2^{13} = \tilde{\pi}^{23}$. The indeterminacy of preference between these mergers when both are profitable carries over from free trade to the quota equilibrium. In each case the larger merger partner prefers to be the outsider to the other merger.

In summary, we obtain a range of outcomes depending on the relative efficiency of the firms (as captured by their relative free trade outputs) and the tightness of the quota. This time three cases can be distinguished.

(B1) If $(5q-2)\bar{x}_1 < 6\bar{h}_3$, then {2,3} is the only profitable merger;

(B2) If $6\bar{h}_3 < (5q-2)\bar{x}_1 < 6\bar{h}_2$, then {1,3} and {2,3} are both profitable and either may occur;

(B3) If $6\bar{h}_2 < (5q-2)\bar{x}_1$, then all mergers are profitable and which occurs depends on the stability conditions;

(a) if $3(\bar{h}_2 + \bar{h}_3) > (4q-2)\bar{x}_1$, then either {1,3} or {2,3} occurs; while

(b) if $3(\bar{h}_2 + \bar{h}_3) < (4q-2)\bar{x}_1$, then {1,2} occurs.

Compared with free trade, the merger involving the two import-competing firms is more likely to occur and those involving the exporter are less likely. These outcomes are illustrated in Figure 3. Again some merger is always profitable, but in this case firm 3 is much more likely to close down through merger under the quota than in free trade. Tightening the quota reduces (increases) the likelihood that firm 2 (3) discontinues production.

Does the quota protect domestic output, once its effects on mergers and their likelihood are taken into account? Given that merger {2,3} is profitable under any quota, it is not obvious that output is protected. We can show that, relative to free trade, the quota will only increase domestic output when merger {j,k} occurs if the quota is sufficiently restrictive – i.e. if $[1-q]\bar{x}_1 > \bar{h}_k$, k = 2,3. Clearly it does not if q ≈ 1. If merger {j,k} would occur in free trade then the change in domestic output is $-[2/3]\bar{h}_k$, since k is a domestic firm. The corresponding change in domestic output (relative to free trade) for the same merger under the quota regime is

$[(1-q)\bar{x}_1 - \bar{h}_k]/2$. Thus even if domestic output falls (relative to free trade output) as a result of the merger (i.e. $(1-q)\bar{x}_1 < \bar{h}_k$), the fall will be less than if the quota regime were not in place. In this sense the quota protects domestic output even allowing for mergers. Figure 3 is also useful in determining the protective effect of the quota. If relative outputs are such that no merger would occur in free trade, then firm 3 will discontinue production as the less efficient merger partner under the quota, and the change in domestic output relative to free trade is $[(1-q)\bar{x}_1 - \bar{h}_3]/2$. Only for a sufficiently tight quota (i.e. $1-q > \bar{h}_3/\bar{x}_1$)[25] will domestic output increase. If relative outputs are such that firm 3 (2) will discontinue production via a merger in both the free trade and the quota-restricted equilibria, then domestic output will be higher under the quota regime. In the range where firm 2 would discontinue production in free trade, but firm 3 discontinues production under the quota, then domestic output falls by $-2\bar{h}_2/3$ in free trade and changes by $[(1-q)\bar{x}_1 - \bar{h}_3]/2$ under the quota regime. Even if domestic output falls under the quota regime, it falls by less than it would in free trade. So overall, except where there would have been no merger in free trade, the quota protects domestic output despite ensuring that one or other domestic firm discontinues production through merger.

Case [C] Two firms are quota restricted [Incomplete]

In this case we can investigate whether the import-competing firm will be the continuing or closing partner in a merger. There are two sub-cases to be considered here depending on which of the smaller firms is subject to the quota, but we begin with some general results. Suppose firms 1 and k are exporters and firm j is import-competing. In this case the quota equilibrium has

$$\tilde{p} = \bar{p} + [1-q]\frac{\bar{x}_1 + \bar{x}_k}{2}; \tilde{\pi}_i = \left[\bar{x}_i + [1-q]\frac{\bar{x}_1 + \bar{x}_k}{2}\right]q\bar{x}_i, i \neq j; \tilde{\pi}_j = \left[\bar{h}_j + [1-q]\frac{\bar{x}_1 + \bar{x}_k}{2}\right]^2.$$

The imposition of the quota on two of the firms leaves the third with monopoly power over the residual demand. Mergers involving the import-competing firm should be profitable, given that the outside firm is quota constrained. Whether they will involve closure of this firm depends on the relative efficiencies of the firms and the

[25] Note that in this range $\bar{h}_3 \geq 3\bar{x}_1/4$, so we require $1/4 > q$, which is quite a restrictive quota, before domestic output increases.

restrictiveness of the quota. When firms 1 and j merge, the merged firm has monopoly power over the demand remaining after firm k, which is quota constrained, has sold $q\bar{x}_k$. This merged firm faces a marginal cost of c_1 up to output $q\bar{x}_1$ and marginal cost c_j thereafter. We can solve for the optimum sales of this merged firm in the latter range as

$$x^{1j} = \bar{h}_j + \frac{\bar{x}_1 + [1-q]\bar{x}_k}{2} = \tilde{h}_j + \frac{q\bar{x}_1}{2}$$

The merged firm will continue production by firm j if $x^{1j} > q\bar{x}_1$, which is always the outcome if $\bar{x}_1 < 2\bar{h}_j$ and occurs otherwise if the quota is sufficiently restrictive (i.e. if $\frac{\bar{X} + \bar{h}_j}{\bar{X} + \bar{x}_1 - \bar{h}_j} > q$)[26]. Otherwise firm j shuts down[27] and $x^{1j} = q\bar{x}_1$ So merger {1,j} is always profitable and results in a reduction in import-competing output relative to the pre-merger, quota-constrained equilibrium. Import-competing output may still be higher than in free trade, however, if the quota is sufficiently restrictive (i.e. $\frac{\bar{x}_1 + \bar{x}_k}{2\bar{x}_1 + \bar{x}_k} > q$).

The outcome in a merger involving the two restricted firms {1,k} depends on whether the merged firm would be quota constrained. For relatively large quotas (i.e. $q > \frac{3\bar{x}_1 + \bar{x}_k}{3[\bar{x}_1 + \bar{x}_k]}$), the merged firm is not quota constrained. If q = 1 the condition for a profitable merger is as in free trade. As the quota is tightened (but still not binding on the merged firm), the merger becomes more profitable, not because the profits of the merged firm change but because the sum of the pre-merger profits of the participants are reduced. Once the quota becomes binding on the merged firm, the merger is profitable yielding gains from the transfer of the quota to the more efficient partner. So if this merger is profitable in free trade it continues to be profitable under a quota,

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[26] In which case $\tilde{\pi}^{1j} = [\bar{h}_j + \frac{\bar{x}_1 + (1-q)\bar{x}_k}{2}]^2 + [\bar{x}_1 - \bar{h}_j]q\bar{x}_1$ and $\tilde{G}(1,3) = \left[\frac{q\bar{x}_1}{2}\right]^2 > 0.$

[27] Then $p^{1j} = \bar{p} + [1-q][\bar{x}_1 + \bar{x}_k] + \bar{h}_j$, which gives $\tilde{\pi}^{1j} = \{\bar{x}_1 + [1-q][\bar{x}_1 + \bar{x}_k] + \bar{h}_j\}q\bar{x}_1$ and $\tilde{G}(1, j) > 0$ in the range of quotas where this solution applies.

and even if it is not profitable under free trade, it will become profitable for some quota which still leaves the merged firm unconstrained.

Where the middle firm is import-competing, then mergers involving it should be profitable, given that the outside firm is quota constrained. There are two possibilities, {1,2} which has been considered above, and {2,3} where firm 3 will leave the market since firm 2 is not quota constrained.

In the case where the smallest firm is import-competing, we can consider which of the quota-restricted firms will make the higher offer to merge with it. If firm 3 will continue to produce in both cases, then we can show that

$$o_3^{13} - o_3^{23} = \left[\frac{q}{2}\right]^2 [\bar{x}_1^2 - \bar{x}_2^2] > 0.$$

But when firm 3 shuts down in both cases, we find $\tilde{\pi}_1^{23} = \bar{\pi}^{13}$ and $\tilde{\pi}_2^{13} = \tilde{\pi}^{23}$ and we have the usual ambiguity because each firm would prefer to be the outsider. We conclude that if one merger is preferred it is likely to be {1,3}

V Conclusions

The interactions between trade and trade policy on the one hand, and competition and competition policy on the other, have become increasingly important as the globalisation process has integrated national markets. Our aim in this paper has been to start looking at the implications of (the removal of) quantitative restrictions for the incentives for national and international mergers. We began by establishing conditions under which particular mergers would occur in free trade, assuming merger to monopoly is regulated out. If all firms are of similar efficiency (size), then no merger is profitable. If one firm is much larger than the others, there tends to be a merger of the two largest firms. For intermediate cases, the smallest firm is involved in a merger with one or other of the larger firms. If instead of free trade a quota on imports is in place, then the outputs and profits of the import-competing firms would be higher, and imports would be lower, though the profits that some foreign exporters earn in this market could increase.

In the introduction we identified several issues of interest for this analysis. The first was whether the presence of quota restrictions on some market participants made mergers among them, or among unrestricted firms or between restricted and unrestricted firms more likely. We expected quotas to encourage mergers, because the

major feature reducing the profitability of mergers among Cournot competing firms is the expansion of sales by firms outside the merger. To the extent that the latter were quota constrained, this should increase the profitability of a merger. Such proved to be the case. In addition, even where to quota-constrained firms merge and the quota is sufficiently restrictive that the merged firm itself is quota constrained, there are gains from the transfer of the quota entitlement of the less efficient partner to the more efficient partner. Where all firms were quota restricted we found that a merger involving the two largest firms was always more likely than in free trade, although it became less attractive as the quota was tightened. Where there were two import-competing firms, the quota made a merger between them more likely, and a merger involving the exporter less likely. When there was only one import-competing firm, the quota made a merger between it and one of the exporters more profitable, although the import-competing firm may still continue production even if it is the less efficient partner. Interestingly, if the quota is sufficiently restrictive it also makes a merger between the exporting firms more profitable, not by increasing its post-merger profits, but by reducing the pre-merger profits of the partners.

Given that mergers are encouraged by the quota regime, the second issue we investigated was the protective power of the quota. Absent mergers, the quota regime raises the output and profits of import-competing firms. Given that merging is a "voluntary" activity, import-competing firms would only participate if their profits were increased thereby. Hence the quota must raise the incomes of import-competing firm owners. Whether the quota regime will increase the total import-competing output once merger outcomes are taken into account is another matter. The quota regime generates profitable mergers which close down the smallest firm for firm efficiency combinations where no merger would have occurred in free trade. This raises the possibility that the quota reduces domestic import-competing output if this firm is import-competing. The outcome depends on whether the output expansion of the other import-competing firm, if there is one, is sufficient to compensate. But it does seem from the consideration of the case of two import-competing firms, that where some merger would have occurred under both the free trade and quota regimes, that the post-merger import-competing output will be higher under the quota regime.

References

Barros, P.P. (1998) "Endogenous Mergers and Size Asymmetry of Merger Participants" *Economic Letters* 60(1), 113-119.

Bergsten, C. F., K. Elliot, J. Schott and W. Takacs (1987) *Auction Quotas and United States Policy* Washington DC: Institute for International Economics.

Baye, M. R., K. J. Crocker and J. Ju (1996) "Divisionalisation, Franchising and Divestiture Incentives in Oligopoly" *American Economic Review* 86(1) 223-236.

Cave, J. and S. W. Salant (1995) "Cartel Quotas under Majority Rule" *American Economic Review* 85(1), 82-102.

Collie, D. R. (1997) "Mergers and Trade Policy under Oligopoly" *Cardiff Business School* Working Paper 98-041

Collie, D. R. (1998) "Tariffs and Subsidies Under Asymmetric Oligopoly: Ad Valorem Versus Specific Instruments" *Cardiff Business School* Discussion Paper 98-111

Deneckere, R and C. Davidson (1985) "Incentives to Form Coalitions with Bertrand Competition" *Rand Journal of Economics* 16, 473-86.

Falvey, R. E. (1998) "Mergers in Open Economies" *The World Economy* 21(8) November, 1061-76.

Falvey, R. E. (2003) "Endogenous Mergers and Tariffs in an Integrated Market" in *Trade Theory, Analytical Models and Development: Essays in Honour of Peter Lloyd, Volume I*, Sisira Jayasuriya (ed) (Edward Elgar) (forthcoming).

Fauli-Oller, R. (1997) "On Merger Profitability in a Cournot Setting" *Economics Letters* 54, 75-79.

Gaudet, G. and R. Kanouni (2000) "Trade Liberalisation and the Profitability of Domestic Mergers" mimeo, University of Montreal.

Greaney, T. M. (1996) "Import now! An analysis of market-share voluntary import expansions (VIEs)" *Journal of International Economics* 40, 149-163

Harris, R. (1985) "Why voluntary export restraints are 'voluntary'" *Canadian Journal of Economics*, 18(4) November, 799-809.

Horn, H. and J. Levinsohn (2001) "Merger Policies and Trade Liberalisation" *Economic Journal* 111 244-276.

Kabiraj, T. and M. Chaudhuri (1999) "On the Welfare Analysis of a Cross-Border Merger" *The Journal of International Trade and Economic Development* 8(2) 195-207.

Krishna, K. (1989) “Trade Restrictions as Facilitating Practices” *Journal of International Economics* 27, 251-270.

Kwoka, J. E. (1989) “The Private Profitability of Horizontal Mergers with Non-Cournot and Maverick Behaviour” *International Journal of Industrial Organisation* 7, 403-411.

Lahiri, S. and Y. Ono (1988) “Helping Minor Firms Reduces Welfare” *Economic Journal* 98, 1199-1202.

Levinsohn, J. A. (1989) “Strategic Trade Policy when Firms can Invest Abroad: When are Tariffs and Quotas Equivalent?” *Journal of International Economics* 27, 129-146.

Long, N. V. and N. Vousden (1995) “The Effects of Trade liberalisation on Cost-Reducing Horizontal Mergers” *Review of International Economics* 3(2), 141-155.

Neary, P. J. (2003) “Globalisation and Market Structure” *Journal of the European Economic Association* 1(2-3), 245-271.

Perry, M. K and R. H. Porter (1985) “Oligopoly and the Incentive for Horizontal Merger” *American Economic Review* 75(1), 219-227.

Rodrik, D. (1989) “Optimal Trade Taxes for a Large Country with non-Atomistic Firms” *Journal of International Economics* 26 157-167.

Ryan, C. (2001) “Merger Activity under Tariffs and Quotas” mimeo, University of Birmingham.

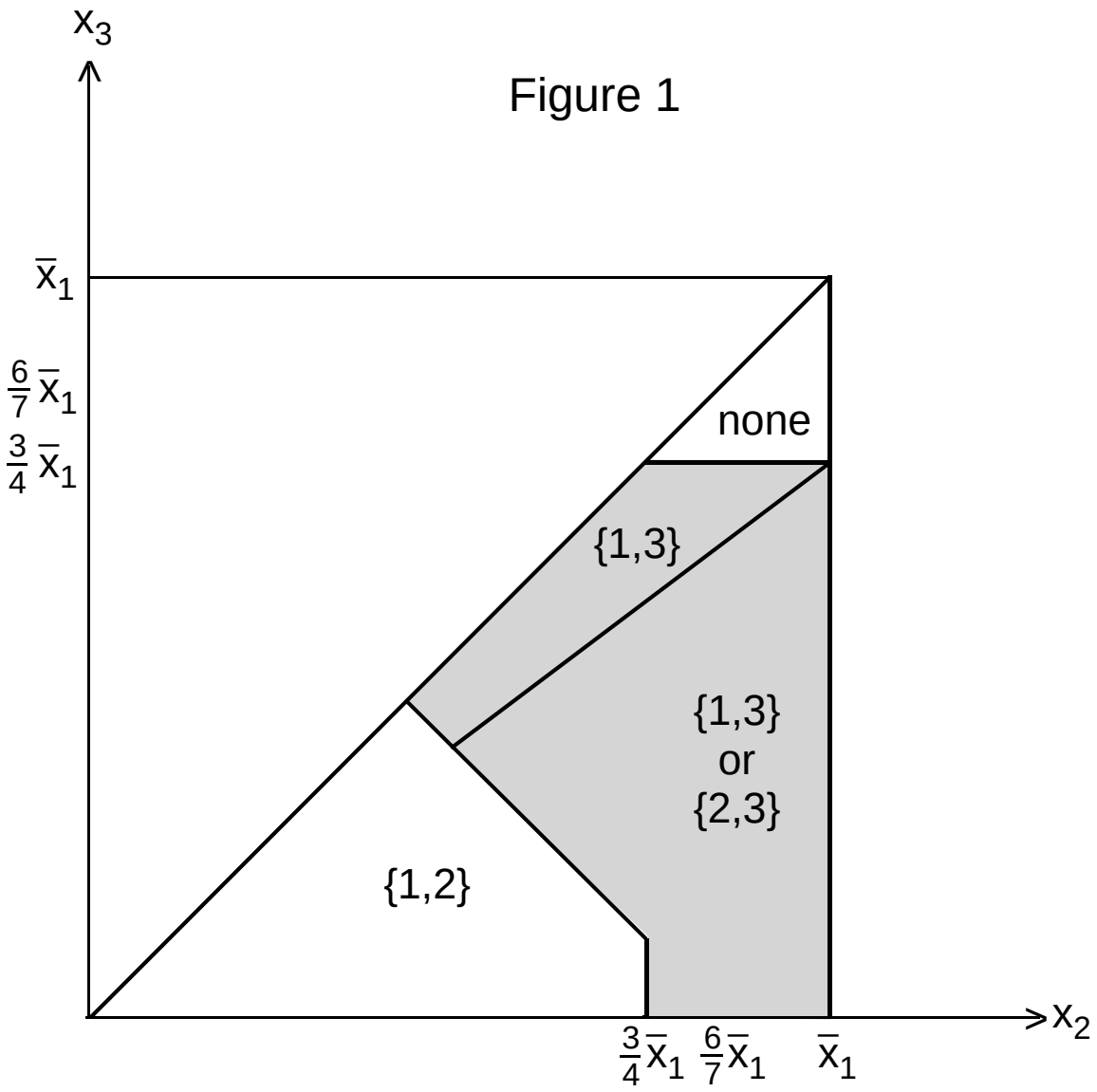
Salant, S., S. Switzer and R. Reynolds (1983) “Losses From Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium" *Quarterly Journal of Economics* 98(2), 185-199.

Takacs W. E. (1978) “The Nonequivalence of Tariffs, Import Quotas ad Voluntary Export Restraints” *Journal of International Economics* 8, 565-573.

World Trade Organisation (1997) *Annual Report*, Geneva.

Ziss, S. (2001) “Horizontal Mergers and Delegation” *International Journal of Industrial Organisation* 19, 471-492.

Figure 1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or
{2,3}
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Figure 2

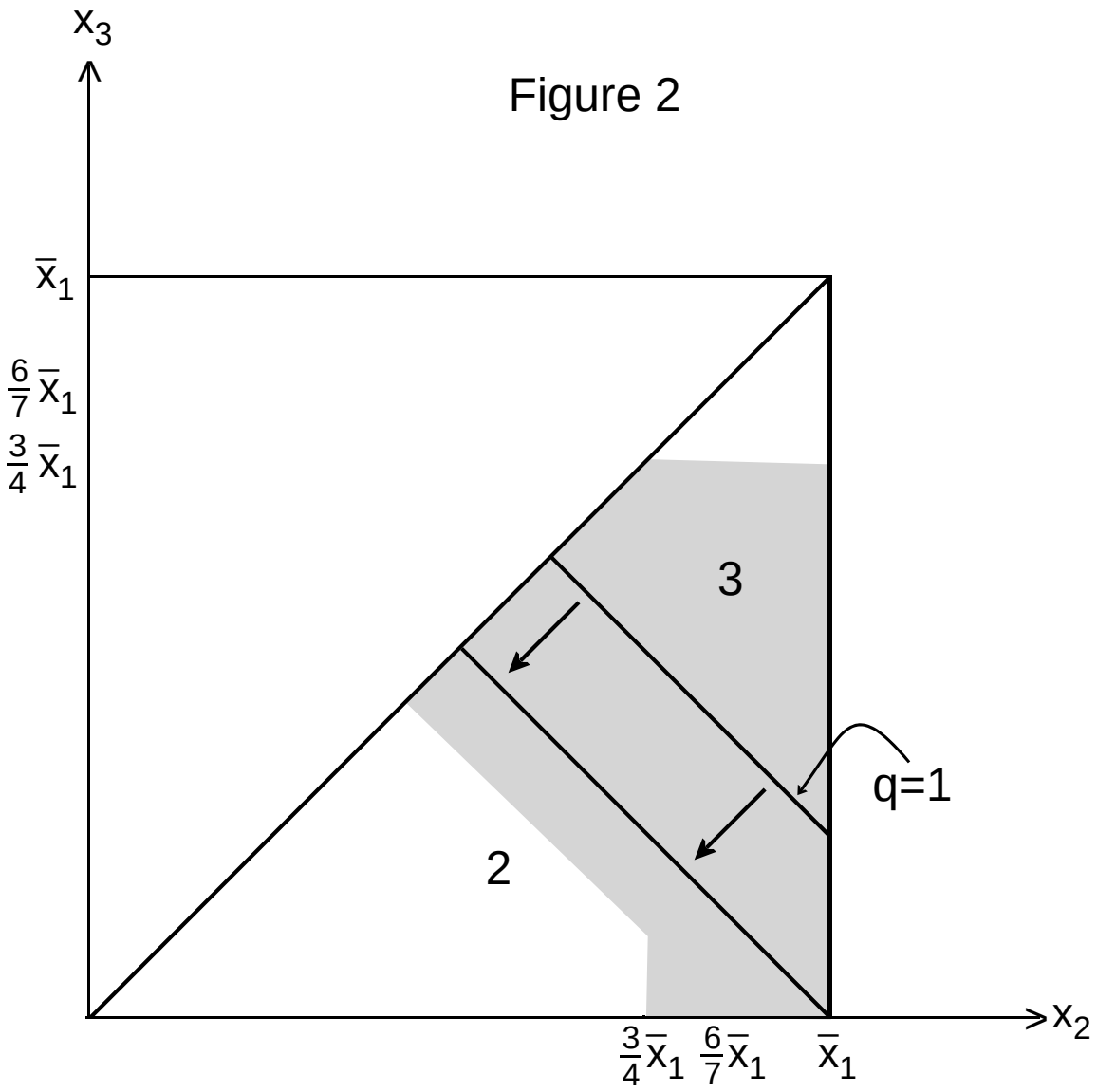
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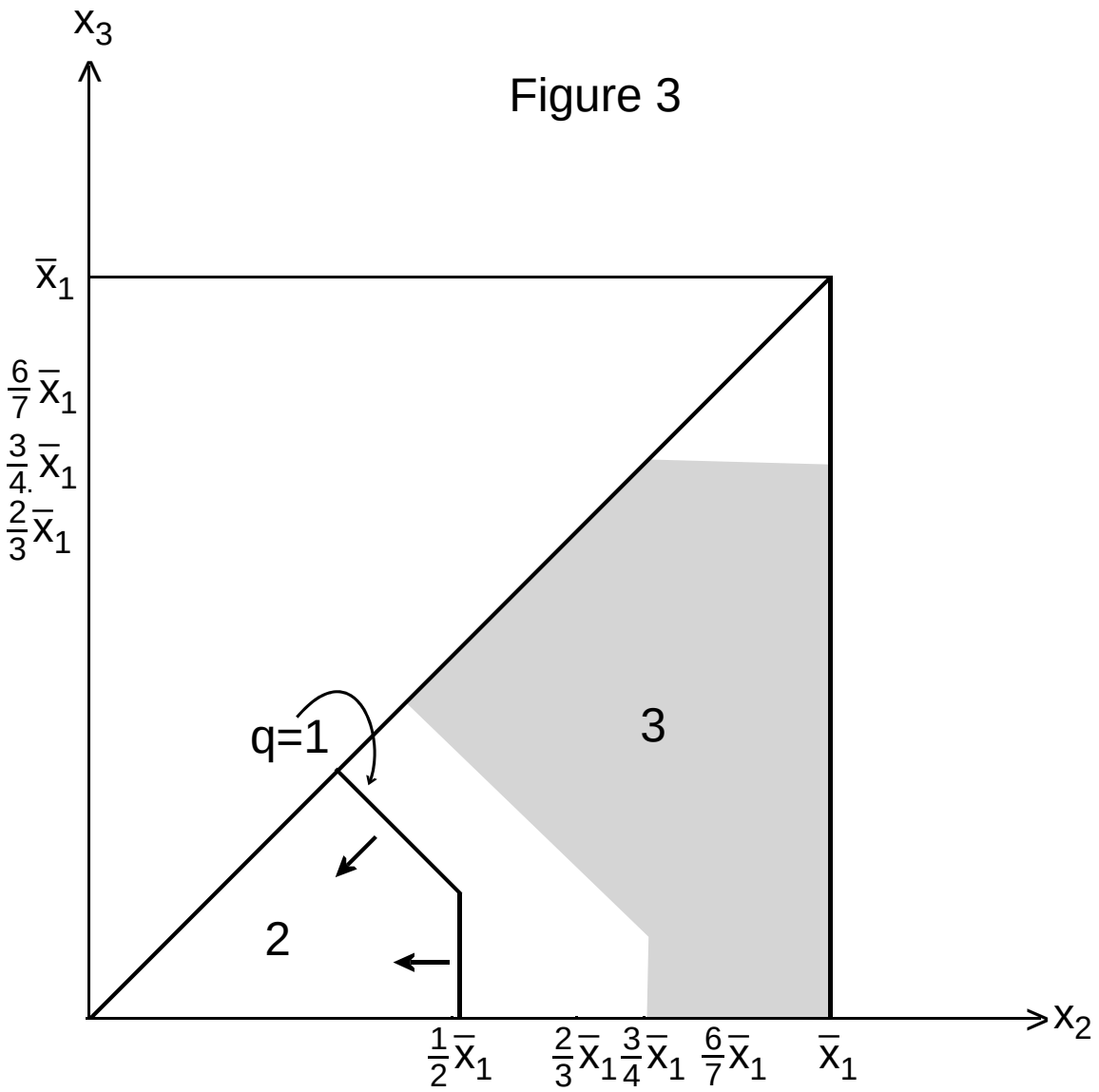
Figure 3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