Profitable Horizontal Mergers without Cost Advantages: The Role of Internal Organization, Information and Market Structure

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Merged firms are typically rather complex organizations. Accordingly, merger has a more profound effect on the structure of a market than simply reducing the number of competitors. We show that this may render horizontal mergers profitable and welfare-improving even if costs are linear. The driving force behind these results, which help to reconcile theory with various empirical findings, is the assumption that information about output decisions flows more freely within a merged firm. This induces a commitment advantage for the merged firm.

INTRODUCTION

Although merger of two firms is frequently dubbed 'fusion', this term is quite misleading. In contrast to the fusion of atoms, the new entity that results from a merger of two firms is usually a much more intricate structure than either of the two firms. Through merger firms do not just become 'bigger', they also become more complex organizations. This is empirically well documented. Prechel *et al.* (1999), for example, report that newly merged firms mostly move from the classical multi-divisional form[1] to the so-called multi-subsidiary organizational form, where the old firms are kept as still fully functional affiliates.[2]

The economics literature generally ignores such organizational issues and models a merger either as a fusion or as perfect collusion.[3] In this paper we depart from both and draw on the above findings by modelling a merged firm as a firm with separately managed subsidiaries. We analyse how this affects the market structure, profitability of firms and welfare. The main assumptions we make about mergers are very minimalistic. We do not assume any cost reductions on the production side that are known to be a possible reason why mergers can be profitable. Instead, we simply assume that within a merged firm information is exchanged more easily than between other firms.[4] More specifically, we follow the observations by Prechel *et al.* (1999) according to which merging firms become affiliates in a holding company, with each affiliate having the discretion to make independent decisions; and we assume that, owing to the many formal and informal links between these affiliates, one affiliate's production plans can be observed by the other affiliate before this information is observable for firms that do not belong to the same holding company. Moreover, we allow for some time structure in production decisions. As a consequence, an affiliate among the merged firms might be able to observe the output decision of its 'sibling' before deciding about its own output.

As innocent as this assumption may seem, it has dramatic consequences—for the two merging firms as well as for the market as a whole. In

particular, we find that merger is profitable for the involved firms, reduces profits of outsiders, and enhances welfare. All three results are in sharp contrast with the literature on mergers in markets with quantity competition that originated with Salant *et al.* (1983), and at the same time they help to reconcile theory with three stylized facts:

1. There is no clear evidence for welfare reductions as a consequence of mergers: welfare changes go in both directions (see, e.g. Pesendorfer 2003, who reports huge welfare gains for mergers in the paper industry, and, for a general appraisal, Federal Trade Commission 1999).
2. Competitors often suffer when other firms merge (see e.g. Banerjee and Eckard 1998).
3. (Bilateral) mergers are observed in all industries, even in those where costs are unlikely to be convex (see Office of Fair Trading 1999).

There is a vast body of theoretical literature on mergers and some strands of it can accommodate some of these findings. For example, Deneckere and Davidson (1985) show that bilateral merger in Bertrand markets is profitable. This can explain why we observe bilateral mergers. However, they also show that merger in these markets reduces consumer welfare and that competitors benefit if other firms merge.[5]

The literature on mergers in markets with quantity competition (Cournot markets)[6] is, however, at odds with all three observations. In Cournot markets mergers have only two consequences. First, they reduce the number of firms (or strategic players) acting in the market, as mergers are indeed modelled as fusion. Second, if costs are nonlinear, they may change the cost function of the newly merged firm. This has a number of important implications.

- Mergers are welfare-improving only if firms are asymmetric and output is shifted from less to more efficient firms (Farrell and Shapiro 1990).
- Competitors benefit if other firms merge (Salant *et al.* 1983).
- Bilateral mergers are profitable only if costs are sufficiently convex (Perry and Porter 1985).

A corollary to this is that bilateral mergers in *linear* markets are never profitable and always welfare-reducing (Salant *et al.* 1983). Consequently, one should expect to observe mergers only if the cost savings are sufficiently large, which seems to be in conflict with the third observation above—that there is merger activity in all industries regardless of specific production technologies. Cost effects are very hard to observe and measure. Accordingly, it is difficult or impossible to test this theory. In order to eliminate possible production cost effects from our consideration, we will consider the case with linear cost.[7] We propose a different reasoning, which resolves the puzzle but is based on assumptions that can be tested more easily. As we shall show, the puzzle can be resolved by taking into consideration the fact that merger is not a process that transforms two firms into one firm of the same type, essentially eliminating one of the firms, but rather leads to a different organization: merged firms are kept as intact decision units within a more complex entity.

Our analysis is in two parts. In the first, we assume that the merged firm has joint headquarters that can govern its affiliates. In particular, we assume that the HQ can enforce the *sequence* in which its two affiliates decide about their

output. For example, the HQ can force one affiliate to decide before the other (which then, because information flows freely between the two affiliates, will be informed about the quantity of its sibling when making its own decision). This has an important consequence for the market as a whole, because the market will no longer be a simple Cournot market: rather, it will have the flavour of a Stackelberg market, as the affiliate that decides first becomes some sort of Stackelberg leader. Of course, this leadership is only partial, as the outsiders will not be able to observe what the second-moving affiliate can observe.

Accounting for this pattern, we will introduce the following terminology. We shall call the first-moving affiliate of the merged firm a 'partial Stackelberg leader' and the second moving affiliate a 'partial Stackelberg follower' (or the 'informed firm'). All the other firms we shall refer to as 'Cournot firms' (or the 'uninformed firms'). Analysing this market, we arrive at the above mentioned main conclusions: that mergers can be profitable and welfare-improving even if all firms have the same linear cost functions. At the same time, competitors' profits are reduced. We shall refer to such a merger as *merger with commitment by governance*.

In the second part of our analysis we will relax the assumption about the all-powerful joint headquarters.[8] In fact, we shall completely abandon it (which might even more closely resemble a multi-*subsidiary* form), and we will show that even in the absence of a headquarters the same timing of decisions that the headquarters would enforce will evolve endogenously. Consequently, the same Stackelberg commitment power will result endogenously, and hence the same market outcome. Thus, even if the merged firm does not benefit from 'commitment by governance', it will increase its joint profit as it benefits from 'endogenous commitment'. Accordingly, we shall refer to this type of merger as *merger with endogenous commitment*.

The model we employ in the second part of our analysis is related to the literature on endogenous timing in Stackelberg markets. It closely follows Hamilton and Slutsky (1990), who show that two perfectly symmetric firms may play endogenously according to the Stackelberg solution. This happens in a two-period model in which both firms can commit themselves to a quantity in the first period. Alternatively, they can decide to wait and produce in the second period (then knowing the other firm's decision). The only subgame-perfect equilibria in this market game that are in undominated strategies are characterized by Stackelberg behaviour.[9]

The remainder of the paper is organized as follows. In Section I we present the basic model and the benchmark case without merger. In Section II we describe the equilibrium outcome if firms merge and are governed by a headquarters that can impose rules for them. In Section III we abandon this assumption and study the model in which the timing of moves is endogenous. Section IV presents some empirical evidence in favour of our model. Finally, Section V summarizes and concludes.

I. THE BENCHMARK CASE WITHOUT MERGER

We consider a market for a homogeneous product with linear demand and cost. Let there be n symmetric firms. We can normalize price and unit such that

inverse demand can be written as $p(X) = \max\{1 - X, 0\}$, with $X = \sum_{i=1}^{n} x_i$ denoting total supply and x_i firm i's individual quantity.

Each firm chooses its supply quantity according to the following game structure. There are two production periods. A firm can choose to produce either in period 1 or in period 2. Production costs do not depend on whether a firm decides to produce early (in 'period 1') or late (in 'period 2'). Only after period 2—that is, when all firms have chosen their outputs—can each firm observe each other firm's output decision and the market opens. This reflects that production and sale do not take place instantaneously (as is assumed in most of the economics literature). Rather, production takes some time and precedes selling.

However, although actual output decisions may not necessarily occur simultaneously, owing to simultaneous information revelation, the output choice in the benchmark case is a standard Cournot–Nash game. Accordingly, the unique Cournot equilibrium is given by $x_i^* = 1/(n + 1)$. Total supply is given by $X = n/(n + 1)$ and the equilibrium price by $p = 1/(n + 1)$. Firms' profits are $1/(n + 1)^2$.

Note that the choice of timing of production is inconsequential in this benchmark case. Given the information assumptions, the benchmark case is structurally equivalent to the standard Cournot model with n symmetric firms. However, the additional choice of timing allows for more structure within more complex organizational forms. This is what we consider next.

II. MODEL A: HEADQUARTERS GOVERN MERGED FIRMS

Suppose two of the n firms merge. A 'holding' is formed with a joint headquarters and with decision-making units in each of the two affiliates, labelled L and I. As discussed briefly in the Introduction, the governance structure in the merged firms is characterized by two properties. First, information flows more easily and quickly between the merged affiliates than between other firms. More precisely, we assume that the two merged firms can observe each other's output decision as soon as it occurs. Second, the headquarters controls the sequencing of output decisions of the two affiliates and can force affiliate L to choose x_L prior to affiliate I's decision. Hence when I chooses x_I it knows the choice x_L made by affiliate L. Of course, all other firms observe x_L and x_I only at the end of period 2, at the same time when L and I also observe these other firms' output choices. This structure is common knowledge. We refer to a merger that results in a holding with two affiliates and this information and decision structure as *a merger with commitment by governance*.

The game that results after the merger has taken place is a sequential game without proper subgames. It can be interpreted as a market with 'partial Stackelberg leadership', and we refer to the firm in the merger that moves first (L) as the 'leader'. The second firm in the merger (I) we refer to as the 'informed firm'. All other firms we refer to as the 'uninformed firms', indexed $u \in U$. The two stages of the game are as follows.

- *Stage 1.* The partial leader (affiliate L of the merged firm) chooses its quantity x_L. Firms not involved in the merger (uninformed firms) either choose their output or decide to wait.

- *Stage 2.* The partial follower (affiliate *I* of the merged firm) observes x_L and chooses its quantity x_I afterwards. Uninformed firms that have decided to wait in stage 1 also decide about their quantities (*without* having observed x_L). Once all firms have decided, the market opens and profits are realized.

With this structure, a strategy of the leader is simply a number, its quantity x_L; the informed firm's strategy is a *function* prescribing for each possible quantity of the leader a quantity of its own. We denote this function by $f(x_L)$. A strategy of one of the uninformed firms prescribes, strictly speaking, the period in which to produce and the quantity that is produced in this period. However, as an uninformed firm's quantity decision is not revealed until the end of period 2, its choice of period is irrelevant. Hence, we can simplify an uninformed firm's strategy to a number, its quantity x_u.

This game has an infinite number of Nash equilibria, similar to a standard Stackelberg game. In contrast to a standard Stackelberg game, the number of equilibria cannot be reduced by simple backward induction, i.e. by requiring subgame perfection. However, by requiring that the informed firm react optimally to its information, i.e. by requiring sequential rationality, we can achieve a unique solution.

As the derivation of the sequentially rational equilibrium is slightly tedious, we relegate the full analysis of the game to the Appendix. The results are as follows. The leader supplies $x_L^* = 2/(n+2)$. Uninformed firms choose $x_u^* = 1/(n+2)$; and the informed firm chooses the function $f^*(x_L) = 2/(n+2) - \frac{1}{2}x_L$, which yields in equilibrium $x_I^* = 1/(n+2)$.

At first sight it may seem surprising that uninformed firms choose the same quantity as the informed firm. After all, one might have suspected that the informed firm 'suffers' more from its knowledge about the leader's quantity than the uninformed firms do. However, in equilibrium this cannot happen. The key to understanding this property is the following observation. In equilibrium all firms know the quantities of all other firms. (Of course, of the informed firm they only know the equilibrium function $f^*(x_L)$, but since they know x_L^* they also know x_I^*). Thus, each uninformed firm has to maximize $x_u(1 - X_{-u}^*)$ with X_{-u}^* being the total quantity of all firms except u. At the same time, the informed firm has to choose $f(x_L)$ such that $x_i(1 - X_{-i}^*)$ is maximized. But this implies that the first-order conditions for uninformed firms and informed firms are symmetric and $x_i = x_u$ *must* hold in equilibrium.

Having solved the market game after the merger, we can now proceed by analysing (a) whether this merger is profitable, (b) whether it decreases or increases welfare, and (c) how it affects the profits of the merged firms' competitors. These questions are not hard to answer.

In order to analyse the profitability of the merger, we have to compare the joint profit of the two firms before and after they merge. Before, the joint profit is $2/(n+1)^2$. After, it is $3/(n+2)^2$. (Simply note that the price after the merger is $1/(n+2)$.) Thus, the change in profits is

$$\frac{3}{(n+2)^2} - \frac{2}{(n+1)^2} = \frac{n^2 - 2n - 5}{(n+2)^2(n+1)^2}$$

which is positive if $n^2 - 2n - 5 > 0$, i.e. if $n \geqslant 4$.

Consider social welfare, which is defined here as the sum of consumer and producer rents. Owing to linearity and symmetry, social welfare is a monotonic function of the total equilibrium quantity. Thus, it is sufficient to compare the induced change in total quantities, which is

$$\frac{n+1}{n+2} - \frac{n}{n+1} = \frac{1}{(n+2)(n+1)}$$

and unambiguously positive. Thus, the merger is welfare improving. Finally, we find that a competitor's profit is unambiguously reduced (from $1/(n+1)^2$ to $1/(n+2)^2$).

We summarize our results in the following proposition.

Proposition 1. In symmetric linear Cournot markets with at least four firms, a merger with commitment by governance is profitable and welfare-improving. Furthermore, it reduces competitors' profits.

III. Model B: Merger without Headquarters

We take the same setup as above. Each of the two merged firms maximizes its own profit. The only aspect we alter is that the two merged firms must now decide autonomously in which period to produce. Since this will lead to the same market structure as above, we shall speak of *a merger with endogenous commitment*. The stages of the game are as follows.

- *Stage 1*: All firms, including the two affiliates of the merged firm, either choose a quantity or decide to wait.
- *Stage 2*: Any affiliate of the merged firm that has decided to wait in the first stage is informed about the other affiliate's decision in stage 1 and then picks its quantity. At the same time, uninformed firms (not involved in the merger) that have decided to wait in stage 1 choose their quantities (without having learned anything about stage 1). The market opens, and profits are realized.

Let the two merged firms be indexed by i and j. Then each merged firm's strategy is a triple $(x_i^1, f_i(x_j^1), x_i^2)$, where x_i^1 either specifies an output for period 1 or indicates that the firm waits, i.e. $x_i^1 \in \mathbf{R} \cup \{W\}$ with W indicating the decision to wait. The function $f(x_j^1)$ is a mapping $\mathbf{R} \rightarrow \mathbf{R}$ specifying the firm's reaction in case it has decided to wait while the other firm has chosen $x_j^1 \neq W$. Finally, x_i^2 specifies firm i's quantity decision for the case in which both affiliates have decided to wait.[10] An uninformed firm's strategy can, as above, be simply described by a number, i.e. its quantity choice x_u, which is taken in either of the two periods.[11]

We focus on equilibria in pure strategies. Some observations about possible subgame-perfect equilibria of this game can now be made.

(1) If one of the merged firms decides to wait, the other will produce in the first period. (The waiting firm will adjust its output to the first mover's quantity; or, to put it differently, regardless of the behaviour of the uninformed firms, there is a Stackelberg-leader advantage.)

(2) In any subgame–perfect equilibrium in which the two merged firms produce in the first period, *all* firms produce standard Cournot quantities $1/(n+1)$. (Otherwise some firm would obviously not play a best reply.)
(3) The situation in which all firms produce Cournot quantities in the first period is an equilibrium in (weakly) dominated strategies. (For one of the merged firms, playing Cournot in the first period can never be better than waiting. On the other hand, waiting can clearly be better than playing Cournot.)
(4) If one of the merged firms decides to wait, i.e. decides to produce in the second period, it will produce the same equilibrium quantity as each uninformed firm. (This follows from the same logic as above.)

Taken together, these observations dramatically narrow down the set of possible solutions. Most importantly, we find that (1), (2) and (3) imply that, in any subgame-perfect equilibrium in undominated strategies, *one of the merged firms has to move first while the other has to wait*. This implies that the same market structure results as in the case with a headquarters. Consequently, the firms will also produce the same quantities so that we get identical market outcomes as in the case with a headquarters.

Proposition 2. In symmetric linear Cournot markets with at least four firms, a merger with endogenous commitment is profitable and welfare-improving. Furthermore, it reduces competitors' profits.

IV. Empirical Evidence

The governance theory outlined in the previous sections makes a number of predictions that can be confronted with empirical evidence. There are the stylized facts on the implications of horizontal mergers for competitors' profits and welfare outlined in the introduction, which are at odds with standard merger models and can be reconciled in our framework. Further, our governance explanation of horizontal merger makes more specific predictions. But information flows, timing decisions and governance rules inside firms are difficult to observe and to measure, and may require extensive interviews for gathering data. This makes it difficult to test this theory directly. Nevertheless, our theory makes two predictions on observable firm behaviour.

First, it makes a prediction regarding capacity adjustments. As the two merging firms choose their quantities sequentially, they should become asymmetric with respect to their market shares. A truly quantitative analysis studying this aspect requires plant-level data of a sort that is not, as of now, available, although the clear prediction of our analysis makes this an interesting question for further research. However, we can look for some cases that qualitatively support the implications of our model.[12] We mention three cases that fit our results nicely and are difficult to explain by synergy effects. A nice (though slightly gory) example comes from the US meat-packing industry, where a consolidation wave in the 1980s was accompanied by significant productions shifts to large plants without small plants being shut down; this is carefully documented in MacDonald *et al.* (1999). Convex cost

functions as in Farrell and Shapiro suggest that production becomes more even. A merger theory based on fixed-cost savings suggests that small plants *are* shut down. Our governance theory predicts that mergers induce a partial shift of production from one plant to another, rendering the distribution of output across plants more uneven, in line with the observed behaviour. Similarly, when Pepsi and Quaker merged in 2001, one firm reduced output (capacity) quite dramatically (it shut down two out of five plants) while the other did not. Some mergers in the automobile industry followed similar patterns, in particular Volvo–Ford, where Volvo significantly reduced capacity at the time of the merger.

A second prediction regards the organizational structure of the firm. The merging firms need to stay as independent decision-making units, perhaps governed by a joint headquarters. In contrast, cost advantages and increasing returns may suggest a fusion of the merging firms to a single unit of production and decision-making. Empirical evidence on this aspect is vast; merger between car producers seems to lead to independent affiliates with a joint headquarters. For instance, neither Volvo and Ford have not fused in the molecular sense, nor have Daimler and Chrysler. Typically, firms acquiring other firms retain target management (see e.g. Hubbard and Palia 1999), and the multi-subsidiary form (which is implicitly assumed in our model) has become the standard organizational form of a merged firm (see e.g. Prechel *et al.* 1999, or Zey and Swenson 1999). As we have shown, such an organizational form may have a significant impact on the structure of the market and can provide a new rationale for mergers if information flows more easily between affiliated firms than between unaffiliated competing firms.

As pointed out above, we cannot find direct evidence regarding the role of information flows that are crucial in our model. But there is some indirect evidence. First, there is some evidence that information flow within the merged firms is essential for merger success (Tetenbaum 1999). Also, the fact that the information flow within firms within a corporation differs from information flows between independent firms is documented by the fact that managers are sometimes even concerned about information flowing *too* easily within a corporation, which leads them to build 'Chinese walls' (see e.g. Pozen and Mencher 1993, or Bonham 2000). Second, there are firms like SynQuest, a large software house, that specifically address the needs of merged firms to enable information flows: 'SynQuest provides sophisticated supply chain design and strategy tools to enable companies with multiple plants, products, warehouses, distribution centers and production capability to measure and design the most profitable way to service existing customers as well as new markets' (www.synquest.com). Such technology will make it easier for firms to use the commitment effect that is key to our result, with or without a central headquarters governing the information flow.

V. Conclusion

Standard merger theory is at odds with a number of stylized facts about mergers. For example, Banerjee and Eckard (1998) find that, during the first great merger wave from 1897 to 1903, competitors of merging firms suffered

significant losses, which is inconsistent with the traditional modelling of mergers. The observation is, however, consistent with our approach, which predicts such losses.

Our approach also predicts the opposite of standard models with respect to the profitability of mergers in a market with linear costs and with respect to their welfare implications. As the new wave of mergers is still irresistible, we observe mergers in virtually all kinds of markets, including those where the constant-returns assumption seems well justified. In the traditional approach where one firm 'disappears' after a merger, this is puzzling. But in reality, acquired firms rarely disappear. As we have shown, this may have a significant impact on the structure of the market which provides a new rationale for mergers.

In the first part of our analysis we showed that, if a joint headquarters can govern the (timing of) decisions of its affiliates, this may render a merger profitable even in the absence of cost advantages through the merger. One assumption drives this result: within a merged firm information flows more quickly and freely, and, because of this, clever governance can induce a commitment advantage for the merged firm even if no other firm can observe what its affiliates are doing. In the second part of our analysis we abandon the assumption of a headquarters and show that, if all firms are free to choose when to produce, the same market structure results as in the presence of a headquarters governing the merged firm. As in Hamilton and Slutsky's (1990) model of endogenous timing (which our model generalizes by adding uninformed firms), we observe endogenous leadership. Thus, it turns out that two simple assumptions which both seem quite realistic make a merger profitable: that production does not take place at one and the same instant for all firms, and that, as pointed out above, a merger may create information channels through which affiliated firms can observe what other affiliates do.

We considered two simple firms that merge and form a more complex entity (a 'corporation') within an industry consisting of n identical Cournot competitors that are single firms, where single firms are units that make precisely one output decision. The governance mechanism that is revealed, however, is more general and qualitatively robust. Similar qualitative results can be obtained if the decision-making entities in the set of competitors have a different organization structure; for instance, some of them could be corporations with similar governance structures as the post-merger corporation that we analyse. To obtain the same qualitative results, it is required that the aggregate output of the firm entities that are not involved in the merger and the two merging firms' joint output are strategic substitutes. Also, one may consider merger of more than two firms.[13]

The policy implications of our analysis are twofold. Socially, mergers may be more welcome than traditional views suggest. However, this may depend on the organizational form the merged companies choose. Hence, in judging the (anti)competitive effect of mergers, governing bodies may wish to be mindful of how the merged firm plans to operate.

On a more general level, the model suggests that one can fully understand the consequences of merger only when carefully considering its consequences for market structure. If one does, the standard view that mergers have to

induce cost advantages to be profitable and/or welfare-improving is no longer warranted.

APPENDIX

To solve the game of Section III, let us proceed step by step. First, consider an uninformed firm u and let X_U denote total output of all uninformed firms. Its best-reply correspondence assigns to each possible combination of x_L, $f(x_L)$ and $X_{U\setminus u} = \sum_{i\in U\setminus\{u\}} x_i$ a unique quantity x_u which maximizes $x_u(1 - x_L - f(x_L) - X_U)$. Thus, firm u's best reply is given by

(A1) $\qquad x_u^* = \frac{1}{2}\left(1 - x_L - f(x_L) - X_{U\setminus u}\right).$

The informed firm's best-reply correspondence assigns to each possible combination of x_L and X_U a function f such that $f(x_L)(1 - x_L - f(x_L) - X_U)$ is maximized. Therefore,

(A2) $\qquad f^*(x_L) = \frac{1}{2}(1 - x_L - X_U)$

has to hold. It is important to notice that there is, for each combination of x_L and X_U, an infinite number of functions f^* fulfilling this condition. The best-reply correspondence demands only that f^* assumes a certain value at one particular point and says nothing about the shape of the function elsewhere. Obviously, this is the reason for the multiplicity of equilibria.

However, requiring sequential rationality narrows down the set of functions for firm I. Sequential rationality demands that firm i reacts optimally in all its information sets. As the information sets of firm I are singletons, there are no problems of specifying I's beliefs. Firm I can only react to what it knows about x_L. Taking into account that (A2) has to hold, this implies that firm i must choose a function of the form

(A3) $\qquad f^*(x_L) = Z - \frac{x_L}{2}.$

In essence, this means that, demanding sequential rationality, we now can analyse a 'truncated game' where Z is firm I's only choice variable. This means that we can rewrite (A1) and (A2) as follows. For a firm u,

(A4) $\qquad x_u^* = \frac{1}{2}\left(1 - \frac{1}{2}x_L - Z - X_{U\setminus u}\right)$

has to hold, and for firm I,

(A5) $\qquad Z^* = \frac{1}{2}(1 - X_U).$

Notice that (A5) ensures uniqueness.

Next, we can focus on the leader L. In the truncated game its best-reply correspondence assigns to each combination of Z and X_U a unique quantity x_L maximizing $x_L\left(1 - \frac{1}{2}x_L - Z - X_U\right)$. Accordingly,

(A6) $\qquad x_L^* = 1 - Z - X_U.$

Using the symmetry of the uninformed firms, we can now solve the following simultaneous equations:

(A7) $\qquad \begin{aligned} x_u^* &= \tfrac{1}{2}\left[1 - \tfrac{1}{2}x_L^* - Z^* - (n-3)x_u^*\right], \\ Z^* &= \tfrac{1}{2}\left[1 - (n-2)x_u^*\right], \\ x_L^* &= 1 - Z^* - (n-2)x_u^*, \end{aligned}$

which gives $x_u^* = 1/(n+2)$, $x_L^* = 2/(n+2)$, and $Z^* = 2/(n+2)$. The implies that the informed firm chooses

$$f^*(x_L) = \frac{2}{n+2} - \frac{1}{2}x_L,$$

which yields in equilibrium $x_I^* = 1/(n+2)$.

NOTES

1. Chandler (1962) is usually credited for having been the first to conceptualize the 'M-form'. A further classical reference is Cyert and March (1963).
2. Zey and Swenson (1999) report similar findings.
3. An exception is Kamien and Zang (1990), where a single owner can operate a number of firms. They show that owners may prefer to run several firms that are in competition with each other instead of operating them as one unit. A similar logic underlies Baye *et al.* (1996), who show that firms in Cournot markets have incentives to form divisions.
4. In a recent article, Nault and Tyagi (2001) argue that improved communication technologies make horizontal alliances and other horizontal organization structures more attractive and more prevalent than traditional centralized structures. Nault and Tyagi take this as a starting point for modelling coordination mechanisms in alliances of geographically dispersed firms.
5. Cabral (2003) shows that merger in markets with differentiated products may increase consumer welfare if there is the possibility of free entry.
6. At first sight, quantity competition might be seen as of lesser importance than price competition. However, as Kreps and Scheinkman (1983) show, standard Cournot analysis might be interpreted as a short-cut to analysing markets where firms have to build up capacities and then engage in price competition.
7. This assumption is mainly for purity. We will show that merger is profitable and welfare-enhancing, even with a linear technology. This result implies that, if there are additional 'synergies' (e.g. cost savings arising from the convexity of cost functions), the merger will be even more profitable. In other words, by focusing on linear technologies we do not restrict the generality of our analysis, but rather focus on the hardest case, and a generalization to cases with 'synergies' is straightforward.
8. A recent unpublished paper by Creane and Davidson (2000) parallels our analysis in the first part of this paper and assumes that headquarters make the choice of the order of moves.
9. The main reason for this result is that playing Cournot quantities in the first period is a (weakly) dominated action. (By waiting, a firm can always react optimally to what its competitor has done previously.)
10. Note that, as Hamilton and Slutsky (1990), we rule out the case where a firm that has chosen to produce in the first period can produce again in the second period. This assumption can be justified by assuming that firms have to make some arrangements for production actually to take place and that, consequently, producing in two periods instead of one causes fixed costs that the firms wish to avoid. However, our results are nevertheless robust in the sense that allowing production in two periods would still yield the same outcomes (see Ellingsen, 1995, for a similar construction).
11. As before, the timing decision of a firm not involved in the merger is irrelevant, as information about output decisions before the end of period 2 is available only within the merged firm.

12. In the absence of such evidence, one might, of course, argue that our model is purely normative and that firms might not yet have found out how to use the corporate structure we describe above to make a merger profitable.
13. Matsumura (1999) has studied the endogenous Stackelberg equilibria that can emerge in Cournot markets with a total number of $n > 2$ single firms. We expect that his results also apply for the internal Stackelberg structure that may emerge if m firms form a corporation of informed but independent decision-makers in a market in which additional Cournot competitors exist: that is, in the absence of a headquarters there will emerge $m - 1$ partial Stackelberg leaders who choose their quantities simultaneously in the early period, and one informed firm within the corporation that assumes the role of a follower.

REFERENCES

BANERJEE, A. and ECKARD, E. W. (1998). Are mega-mergers anticompetitive? Evidence from the first great merger wave. *Rand Journal of Economics*, **29**, 803–27.

BAYE, M. R., CROCKER, K. J. and JU, J. (1996). Divisionalization, franchising and divestiture incentives in oligopoly. *American Economic Review*, **86**, 223–36.

BONHAM, D. H. (2000). Conflict of interest: a task force report. Canadian Institute of chartered accountants, www.cica.ca.

CABRAL, L. M. B. (2003). Horizontal mergers with free-entry: why cost efficiencies may be a weak defense and asset sales a poor remedy. *International Journal of Industrial Organization*, **21**, 607–623.

CHANDLER, A. D. (1962). *Strategy and Structure*. Cambridge, Mass: MIT Press.

CREANE, A. J. and DAVIDSON, C. (2000). Multidivisional firms, staggered competition, and the merger paradox. Mimeo, Michigan State University.

CYERT, R. M. and MARCH, J. G. (1963). *A Behavioral Theory of the Firm*. Englewood Cliffs, NJ: Prenctice-Hall.

DENECKERE, R. and DAVIDSON, C. (1985). Incentives to form coalitions with Bertrand competition. *Rand Journal of Economics*, **16**, 473–86.

ELLINGSEN, T. (1995). On flexibility in oligopoly. *Economics Letters*, **48**, 83–9.

FARRELL, J. and SHAPIRO, C. (1990). Horizontal mergers: an equilibrium analysis. *American Economic Review*, **80**, 107–26.

Federal Trade Commission (1999). Promoting competition, protecting consumers: a plain english guide to antitrust laws. http://www.ftc.gov/bc/compguide/index.htm.

HAMILTON, J. H. and SLUTSKY, S. M. (1990). Endogenous timing in duopoly games: Stackelberg or Cournot equilibria. *Games and Economic Behavior*, **2**, 29–46.

HUBBARD, R. G. and PALIA, D. (1999). A reexamination of the conglomerate merger wave in the 1960s: an internal capital markets view. *Journal of Finance*, **54**, 1131–52.

KAMIEN, M. I. and ZANG, I. (1990). The limits of monopolization through acquisition. *Quarterly Journal of Economics*, **105**, 465–99.

KREPS, D. and SCHEINKMAN, J. (1983). Cournot precommitment and Bertrand competition yield Cournot outcomes. *Bell Journal of Economics*, **14**, 326–37.

MACDONALD, J. M., OLLINGER, M. E., NELSON, K. E. and HANDY, C. R. (1999). Consolidation in US meatpacking. *Agricultural Economics Report*, no. 785.

MATSUMURA, T. (1999). Quantity-setting oligopoly with endogenous sequencing. *International Journal of Industrial Organization*, **17**, 289–96.

NAULT, B. R. and TYAGI, R. K. (2001). Implementable mechanisms to coordinate horizontal alliances. *Management Science*, **47**, 787–99.

Office of Fair Trading (1999). Merger appraisal in oligopolistic markets. *Economic Research Paper* no.19, November.

PERRY, M. K. and PORTER, R. H. (1985). Oligopoly and the incentive for horizontal merger. *American Economic Review*, **75**, 219–27.

PESENDORFER, M. (2003). Horizontal mergers in the paper industry. *RAND Journal of Economics*, **34**, 495–515.

POZEN, R. C. and MENCHER, J. K. (1993). Chinese walls for creditors committees. *Business Lawyer*, **48**, 747–60.

PRECHEL, H., BOIES, J. and WOODS, T. (1999). Debt, mergers and acquisitions, institutional arrangements and change to the multilayered subsidiary form. *Social Sciences Quarterly*, **80**, 115–35.

Salant, S. W., Switzer, S. and Reynolds, R. J. (1983). Losses from horizontal merger: the effects of an exogenous change in industry structure on Cournot–Nash equilibrium. *Quarterly Journal of Economics*, **98**, 185–99.

Tetenbaum, T. J. (1999). Beating the odds of merger and acquisition failure: seven key practices that improve the chance for expected integration and synergies. *Organizational Dynamics*, **28**, 22–36.

Zey, M. and Swenson, T. (1999). The transformation of the dominant corporate form from multidivisional to multisubsidiary: the role of the 1986 Tax Reform Act. *Sociological Quarterly*, **40**, 241–67.