Big fish eat small fish: On merger in Stackelberg markets

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Abstract

In this note we show that the profitability of merger in markets with quantity competition does not only depend on cost conditions but also on the market structure and on the involved firms' "strategic power." Our main result is that bilateral merger can be profitable even if costs are linear—but only in the case of a "strong" firm incorporating a "weak" firm which has adverse effects on welfare.

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1 Introduction

It is well–known that the profitability of horizontal merger with quantity competition crucially depends on firms' cost functions. In a linear Cournot market, for example, two firms never have an incentive to merge while bilateral merger can be profitable if costs are sufficiently convex (see Salant, Switzer, and Reynolds (1983) for the first and Perry and Porter (1985) for the second result). In this note we show that the profitability of merger also depends on the market structure and on the involved firms' "strategic power." Our main result is that bilateral merger with quantity competition can be profitable even if costs are linear—but only in the case of a "strong" firm incorporating a "weak" firm. In that case the newly merged firm produces the same quantity as the strong firm did alone prior to the merger while the weak firm essentially disappears. The price increases sufficiently to make this profitable, but welfare is reduced.[1]

We capture the effects of market structure and strategic power by modeling a simple Stackelberg market with m leaders and $n - m$ followers.[2] Focussing on the case of linear costs, we show that two leaders rarely have an incentive to merge, nor do two followers. However, if a leader buys a follower this increases the joint payoff of the two firms, and such a merger lowers total industry production and welfare. Consequently, antitrust authorities may

[1] A new line of reasoning is explored by Lommerud, Straume and Sorgard (2000) who argue that merger may change firms' strategic situation with respect to a third party. In their particular model, merger may change the bargaining game between firms and unions and may make merger profitable.

[2] This is a straightforward generalization of the standard Stackelberg duopoly model which, for example, has been used by Daughety (1990) to study welfare effects of concentration.

have every reason to be suspicious if two firms that have different strategic power plan to merge.

The remainder of this note is organized as follows. In Section 2 we briefly outline the markets we look at. Section 3 studies the effects of merger and Section 4 concludes.

2 Stackelberg markets

Consider a market for a homogenous product with n firms. Costs are assumed to be linear and normalized to zero. Inverse demand is given by $p(X) = \max\{1 - X,\ 0\}$ with $X = \sum_{i=1}^{n} x_i$ denoting total supply and x_i firm i's individual quantity. There are $m < n$ Stackelberg leaders who independently and simultaneously decide about their individual supply. The remaining $n - m$ firms are Stackelberg followers who decide upon their quantity after learning about the total quantity supplied by the leaders. Let x_l be the quantity of a typical leader and x_f be the quantity of a typical follower. Then, the (subgame–perfect) equilibrium solution implies that $x_l = \frac{1}{m+1}$ and $x_f = \frac{1}{(m+1)(n-m+1)}$. This gives a total supply of $X = \frac{mn-m^2+n}{(m+1)(n-m+1)}$ and a price of $p = \frac{1}{(m+1)(n-m+1)}$. The profit of a leader can be written as

$$\Pi_l(n,m) = \frac{1}{(m+1)^2 (n-m+1)} \tag{1}$$

and that of a follower as

$$\Pi_f(n,m) = \frac{1}{(m+1)^2 (n-m+1)^2}. \tag{2}$$

3 Merger

We consider three cases: a) merger of two leaders, b) merger of two followers, and c) merger of one leader and one follower. A merger with quantity competition essentially means that one firm "disappears" from the market, especially if costs are linear.[3] This means that in case a) the postmerger market will have $m-1$ leaders but still $n-m$ followers. The profit of the newly merged leader equals $\Pi_l(n-1,m-1)$. In case b) there will be m leaders but only $n-m-1$ followers and the profit of the newly merged follower equals $\Pi_f(n-1,m)$. In case c) the numbers of leaders and followers are identical to case b) and the profit of the newly merged leader[4] equals $\Pi_l(n-1,m)$.

Our first result concerns cases a) and b).

Proposition 1 *Two leaders have only an incentive to merge if $m=2$. Similarly, two followers have only an incentive to merge if $n-m=2$.*

Proof For the first statement observe that $\Pi_l(n-1,m-1)-2\Pi_l(n,m)=\frac{-(m^2-2m-1)}{m^2(n-m+1)(m+1)^2}$. This is only positive if $m=2$. For the second statement we calculate $\Pi_f(n-1,m)-2\Pi_f(n,m)=\frac{2n-n^2+2mn-m^2-2m+1}{(m+1)^2(n-m)^2(n-m+1)^2}$. The numerator is positive iff $1-\sqrt{2}<n-m<1+\sqrt{2}$. Hence, the claim follows. □

The proposition shows that, as in standard Cournot markets with linear costs, firms of equal power rarely have an incentive to merge. This is different in case of two firms of different commitment power.

[3] With convex costs still one firm disappears but the newly merged firm may have a "better" cost function.

[4] If a leader merges with a follower in a market with quantity competition, the new firm will stay a leader. This is so because the merged firm can still use the old commitment technology of the former leader firm to commit itself on high output.

Proposition 2 *Merger between a leader and a follower is always profitable.*

Proof $\Pi_l(n-1,m) - \Pi_l(n,m) - \Pi_f(n,m) = \frac{1}{(m+1)^2(n-m)(n-m+1)^2}$. □

The result can be interpreted as saying that a follower's value if integrated in a leader firm (where it disappears) exceeds its value as a stand–alone firm. Or, to use our title's metaphor, if one big fish eats one small fish, it is better off than both of them were as separate beings. Interestingly, this is true even though the big fish does not become bigger: The newly merged firm produces the same quantity as the leader prior to merger, namely $1/(m+1)$. However, the price increases by $1/\left(m+1\right)\left(n-m\right)\left(n-m+1\right)$ which overcompensates the decrease in the joint quantity sold. This is not true for mergers between equally strong firms except in the cases identified above.

However, as far as welfare is concerned all discussed types of mergers have the same effect. Total output is reduced and so is welfare.

4 Discussion

We show that merger in Stackelberg markets between a leader and a follower is always profitable—even if costs are linear. As mergers between equally strong firms decrease joint payoffs in Cournot markets and, with two exceptions, also in Stackelberg markets, we expect merger rather to occur between firms with different strategic market power. In such cases antitrust authorities may be extremely wary as the firms' gain may not be due to efficiency gains as discussed by Farrell and Shapiro (1990). On the contrary, if the linear cost assumption seems justified, welfare is certainly to be reduced.

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