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Can consumer surplus decrease with merger efficiencies?☆

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ABSTRACT

This paper investigates the impact of mergers on consumer welfare within a Cournot model, considering mergers driven by anticipated efficiency gains and potential post-merger entry. In this framework, we demonstrate that: (i) modest efficiencies can make both merger and entry beneficial, benefiting consumers; (ii) moderate efficiencies may deter entry, harming consumers due to the merger; and (iii) significant efficiencies may discourage entry but lead to lower prices, benefiting consumers. This result, therefore, embodies an important policy implication that assessing the overall effect of a merger on consumer surplus requires evaluating merger-specific synergies alongside the likelihood of post-merger entry.

1. Introduction

Could an antitrust authority applying a consumer surplus standard approve a horizontal merger with relatively low technological synergies or efficiencies and block the exact same merger if these cost savings were higher? In this paper, we show that the answer to this question may be positive in the presence of ex-post (or merger-induced) entry, a relevant factor in the appraisal of mergers.[1]

The reason why competition authorities would approve a merger with low efficiencies but may prefer to block it for higher efficiency levels is clear. If the firm resulting from the merger has lower costs it will set a lower price or produce a higher output, depending on the relevant strategic variable. This makes entry less profitable, as the entrant anticipates a more aggressive behavior by at least some of the incumbents. High efficiencies may therefore not trigger entry, whereas lower efficiencies would. Moreover, these lower efficiencies may nonetheless be high enough to make the merger privately profitable and, together with entry, lead to a decrease in the market price.

Merger-induced entry has been previously addressed both in the theoretical and empirical literature. From a theory perspective, Werden and Froeb (1998) find, both in the context of Cournot and Bertrand models, that merger-induced entry makes a merger unprofitable in the absence of efficiency gains, as it causes price to decrease. Spector (2003), on the other hand, allowing for a more general cost structure in a Cournot framework, states that a merger that leads to entry may still be profitable but only if the final equilibrium price lies above the original level. Both results, however, downplay the role of entry, with Werden and Froeb (1998) suggesting that the "proper role for entry in many merger cases may be none whatsoever" concluding that "if a proposed (and, hence, privately profitable) merger does not generate significant efficiency gains, it also cannot be expected to induce entry". The same view is shared by Marino and Zábojník (2006), who use a dynamic endogenous merger model to analyze if ease of entry can mitigate the competitive effects of a merger. By so doing, they conclude that if new firms can enter quickly, it is less likely that the merger is motivated by an increase in market power and more likely that it is motivated by efficiencies. Along related lines, Kaplow (2023) reiterates the relevance of the merging parties' rationality constraint: if a merger is proposed, then it must be profitable and if there is post-merger entry that mitigates price effects, then it is more likely the merger is efficiency driven.[2]

Empirical articles on this subject include Berger et al. (2004), who show that mergers do increase the probability of entry in the banking

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[1] Indeed, as the 2023 US Merger Guidelines mention, "the Agencies assess whether entry induced by the merger would be "timely, likely, and sufficient in its magnitude, character, and scope to deter or counteract the competitive effects of concern.""

[2] Kaplow (2023) also argues that, in some settings, entry may have adverse welfare effects.

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industry, and Siebert (2019), who shows that the effects on entry (and exit) of mergers in the memory chip industry depend on whether these are dominated by market-power or efficiency gains.

We contribute to this discussion by focusing on the entrant's rationality constraint. In particular, to a key aspect of some of the papers mentioned above (the consideration that a merger, when entry is possible, is likely to be motivated by sufficiently high efficiency games) we add that for merger-induced entry to be profitable and, therefore, to be expected to take place, these efficiencies cannot be too large.

Using a linear Cournot model with merger-induced efficiency gains, we show that it is possible that small efficiencies may render both the merger and entry profitable while benefitting consumers, medium efficiencies may prevent entry from taking place with consumers being hurt by the merger, and large efficiencies may lead to no entry but to consumers enjoying a lower price.

The remainder of the paper is organized as follows. The next section presents the model and the main result in the paper: that consumer welfare is not monotonous in the degree of efficiency gains when the possibility of entry is considered. Section 3 concludes. Finally, formal proofs are relegated to the appendix.

2. The model

Assume that there are initially $n \geq 2$ firms that compete *à la* Cournot, selling a homogeneous product. Demand is assumed to be linear and given by $P = A - Q$. The production cost function of incumbent firm i is given by $TC_i(q_i) = G + cq_i$. A potential entrant, firm e, has a cost function similar to the incumbents' but it also includes a fixed sunk entry cost. Hence, $TC_e(q_e) = F + cq_e$ with $F > G \geq 0$ and $A > c > 0$.

Timing is as follows. In the first stage, two exogenously defined incumbents, firm 1 and firm 2, decide whether to merge or not. In the second stage, having observed the merger decision, the entrant decides whether to enter or not. In the last stage, all active firms choose their output simultaneously (i.e. Cournot competition takes place involving all active firms in the industry).

In case a merger takes place, the insiders may benefit from some synergies and may also avoid the fixed cost duplication if $G > 0$.[3] Therefore, the post-merger cost function of the merged firms is $TC_{1+2}(q_{1+2}) = G + (c - x)q_{1+2}$, with $0 < x \leq c$, where parameter x represents the merger-specific synergies.

It is well known that when m firms are active, firm i's Cournot equilibrium profit Π_i (excluding any fixed costs) and the corresponding equilibrium price P are, respectively, given by

$$\Pi_i(m) = \left(\frac{A + \sum_j c_j}{m+1} - c_i\right)^2$$

$$P(m) = \frac{A + \sum_j c_j}{m+1}$$

where $\sum_j c_j$ is the sum across all active firms of their constant marginal costs. It is also well known that in a Cournot model with linear demand and linear costs equilibrium values depend on $A - c$, which we denote by a.

We make the following assumption:

Assumption 1. (a) $\left(\frac{a}{n+2}\right)^2 < F < \left(\frac{a}{n+1}\right)^2$; (b) $x \leq a - n\sqrt{G}$.

Assumption 1(a) ensures that in the absence of a merger there is no entry (as we are considering only the possibility of entry triggered by merger) and that post-merger entry is profitable in the best possible circumstances for the entrant, that is, when there are no merger-specific synergies. Assumption 1(b), on the other hand, ensures that all incumbents' profits (and outputs) are positive so that the merger (with no entry) would not lead any existing incumbents to exit the industry due to fact that the firm resulting from the merger is significantly more efficient than the merger outsiders.

The game is solved by backward induction and the following Proposition characterizes the equilibrium of the whole game as a function of the merger-induced efficiency gains or (variable) cost savings, x.

Proposition 1. *In equilibrium,*

(i) there is a merger followed by no entry and the price does not increase if and only if

$$\frac{a}{n+1} \leq x \leq a - n\sqrt{G}$$

(ii) there is a merger followed by no entry and the price increases if and only if

$$\max\left\{a - (n+1)\sqrt{F}, \frac{n\left(\sqrt{2a^2 - G(n+1)^2} - a\right) - a}{(n-1)(n+1)}\right\} \leq x < \frac{a}{n+1}$$

(iii) there is a merger followed by entry and the price decreases if and only if

$$\frac{\sqrt{2a^2 - G(n+1)^2} - a}{n} \leq x \leq a - (n+1)\sqrt{F}$$

(iv) there is no merger and no entry, otherwise. ■

The intervals for x that lead to cases (i), (ii) and (iv) in Proposition 1 are non-empty for all parameter values. The existence of case (iii), however, depends on parameter values.

If the merger-specific synergy, x, is small, there is no merger and no entry. For instance, if $x = 0$, the merger would trigger entry and the profit of the merged firm would be equal to the profit of only one of the insiders before the merger, which renders the merger unprofitable. Higher values of the synergy may make the two-firm merger profitable while still inducing entry. In this case, the number of firms is kept constant but the merged firm becomes more efficient, leading to a lower equilibrium price for consumers. If the synergy is even higher, the merger will take place but there will be no entry, as the entrant would have to compete with a rival with significantly lower costs and would have a negative profit. In addition, in this case, there are two possibilities. If x is very high, the merger lowers the market price despite the fact that there is no entry because the cost reductions resulting from the merger more than compensate for the decrease in the number of firms. If, instead, x is not that high, the merger increases the price because the cost reduction is high enough to prevent entry but not sufficiently high as to lead to a lower price in the market structure which results from the merger.

If interval (iii) in Proposition 1 is empty, then, as the synergy increases, one moves from a no-merger equilibrium (case (iv)) to an equilibrium with a merger and no entry (cases (i) and (ii)), in which market price is decreasing with the synergy. If, instead, interval (iii) is non empty, then consumer welfare is not monotonous in x. When this is the case, one moves from a no merger equilibrium to a merger with entry equilibrium where prices are lower than before the merger and decrease with x. However, as x increases above a particular level, the entrant decides not to enter and this makes post-merger prices jump upwards, becoming higher than before the merger (case (ii)). Further increases in the merger-specific synergy would eventually make prices become lower than before the merger (case (i)).

Consumer welfare is, therefore, not an increasing function of the merger synergy when the interval included in case (iii) of Proposition 1 is non-empty. The Corollary below establishes a sufficient condition for this to happen.

Corollary 1. *If (but not only if)* $\left(\frac{a}{n+2}\right)^2 < F < \left(\frac{\left(n-\sqrt{2}+1\right)a}{n(n+1)}\right)^2$ *consumer surplus is not monotonous in* x. ■

[3] If $n > 2$, a two firm merger with no cost savings is never profitable as established first by Salant et al. (1983). Fixed cost savings are considered, for instance, in Salant et al. (1983) and Spector (2003).

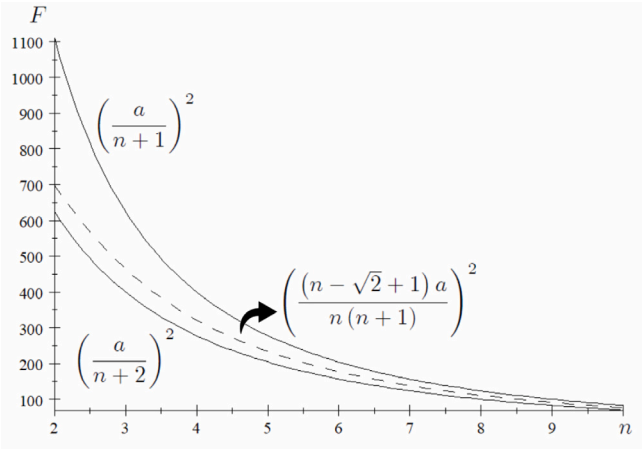

Fig. 1. Relevant thresholds for F as a function of n, represented for $a = 100$.

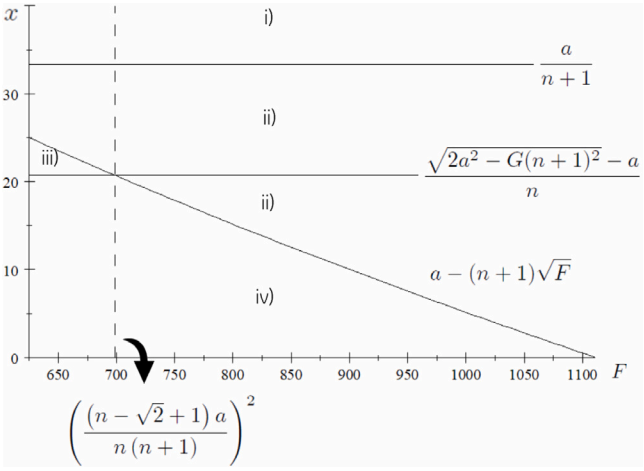

Fig. 2. Relevant intervals in Proposition 1 in the (F, x) parameter space represented for $n = 2$, $a = 100$, $G = 0$ and $\left(\frac{a}{n+2}\right)^2 < F < \left(\frac{a}{n+1}\right)^2$.

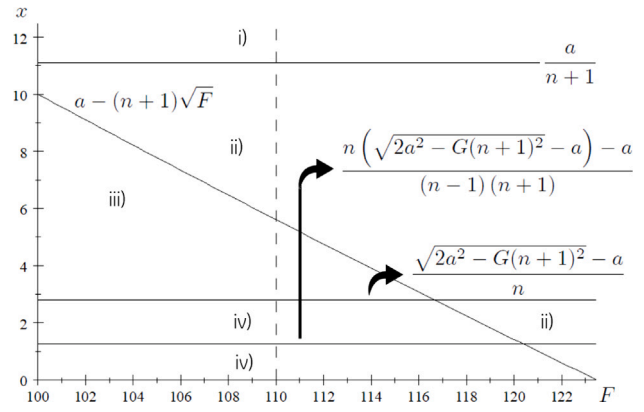

Fig. 3. Relevant intervals in Proposition 1 in the (F, x) parameter space represented for $n = 8$, $a = 100$, $G = a^2/162$ and $\left(\frac{a}{n+2}\right)^2 < F < \left(\frac{a}{n+1}\right)^2$.

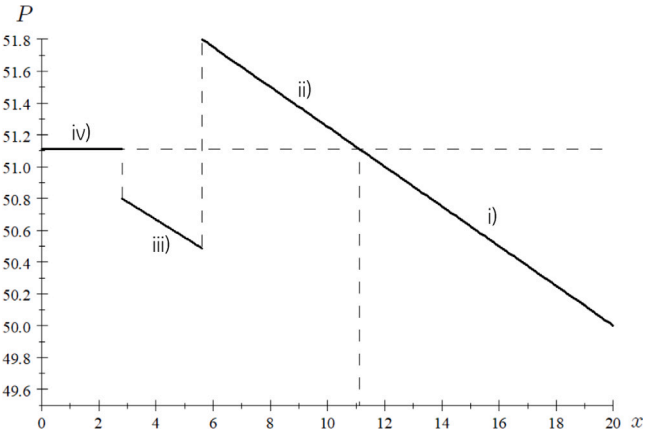

Fig. 4. Equilibrium price P as a function of the megrer specific synergies x (represented for the same parameter values as in Fig. 3 and with $F = 110$).

This interval for F is obtained when $G = 0$, which makes it less likely that the interval in (iii) is non-empty. Fig. 1 shows the upper and lower bounds for F under Assumption 1 as well as the threshold for F presented in Corollary 1.

Fig. 2 represents the relevant cases in Proposition 1, for $n = 2$ and $G = 0$.[4]

From Fig. 2, it might be argued that the parameter space for which consumer surplus is not monotonous in the merger synergy is relatively small. It should be noted, however, that Fig. 2 assumes $n = 2$ and $G = 0$. As Fig. 1 illustrates, the higher n the wider the range of values for F (within the admissible interval defined in Assumption 1(a)) such that consumer surplus is not monotonous in the efficiency gains. Likewise, for higher values of G the set of such parameter values becomes larger.[5] Along these lines, Fig. 3 represents the relevant intervals in Proposition 1 for a numeric example with a larger number of firms and positive incumbent fixed costs. Figs. 2 and 3 are qualitatively similar but, with $n = 8$, a two-firm merger is not necessarily profitable and a new threshold on x is needed to define the interval in (ii).

Finally, Fig. 4 represents the equilibrium price as a function of the merger-specific synergies, identifying the four cases in Proposition 1.

It should be highlighted at this point that, although we have focused our discussion around the merger-specific synergies, both the incumbents' and the entrant's fixed costs play a role in the result. In particular, the discontinuities in Fig. 4 depend precisely on the values of G and F. The first discontinuity in the equilibrium price results from the merger (followed by entry) taking place. This keeps the same number of active competitors but, since one of them benefits from lower marginal costs, the price decreases. This discontinuity happens for lower values of the variable cost synergies when fixed costs savings (G) are larger. The second discontinuity takes place when the merged firm becomes so efficient that entry is discouraged. This discontinuity happens for lower values of the variable cost synergies when the entrant's fixed costs (F) are larger.

3. Conclusions

This paper explores the consumer welfare effects of mergers in a Cournot setting, revealing the intricate interplay between efficiency gains, post-merger entry, and consumer surplus. We find that small efficiencies may benefit merging firms, entry, and consumers, enhancing welfare. However, medium efficiencies present complexities: they

[4] With $n = 2$ and $G = 0$ we have $\frac{n\left(\sqrt{2a^2-G(n+1)^2}-a\right)-a}{(n-1)(n+1)} = \left(\frac{2}{3}\sqrt{2}-1\right)a < 0$ so that the merger with no entry, a merger to monopoly, is always profitable.

[5] Corollary 1 established only a sufficient condition (obtained for $G = 0$) for consumer surplus not to be monotonous in x, which is relaxed for positive G.

may discourage entry, potentially harming consumers through reduced competition and higher prices. Conversely, large efficiencies, while deterring entry, lead to lower prices, benefiting consumers.

A critical policy implication, therefore, emerges from our findings: the possible non-monotonic nature between consumer surplus and efficiency gains levels suggests that mergers involving moderately high synergies could lead to detrimental outcomes for consumers. Thus, this paper emphasizes the importance of assessing efficiency effects in conjunction with entry likelihood to accurately appraise the overall impact of mergers on consumer surplus and, consequently, inform effective merger policies that safeguard both market competition and consumer welfare.

We do not claim that competition authorities should be able to precisely identify the conditions that allow the distinction between mergers inducing entry and benefiting consumers, on the one hand, and mergers deterring entry and potentially harming (or benefiting) consumers, on the other.

When analyzing real-life cases, competition authorities typically assess verifiable efficiencies, requiring merging firms to substantiate their claims. However, it is conceivable that not all efficiency claims can be substantiated, even if they are genuine and real. Consequently, a competition authority may approve a merger under the premise that if substantiated efficiencies alone are sufficient to induce a decrease in market price, then any possible extra-efficiencies that merging parties failed to substantiate would pose no harm.

The purpose of this paper is simply to offer a word of caution regarding this type of reasoning in the context of merger investigations, especially if market entry is a relevant aspect of the approval decision.

Data availability

No data was used for the research described in the article.

Appendix

Proof of Proposition 1. There are three stages in the game: the merger stage, the entry decision stage and the quantity competition stage. The game is solved by backward induction.

Quantity competition stage

There are four different subgames when the quantity competition stage is reached.

(a) If there is no merger and no entry, the profit of any incumbent (gross of fixed costs) is

$$\Pi_i(n) = \left(\frac{a}{n+1}\right)^2$$

In order for firms to have a positive profit, we need that

$$\left(\frac{a}{n+1}\right)^2 - G > 0 \Leftrightarrow G < \left(\frac{a}{n+1}\right)^2$$

which is implied by $G < F \leq \left(\frac{a}{n+1}\right)^2$.

(b) If there is no merger and there is entry, the profit of any firm (gross of fixed costs), entrant included, is

$$\Pi_i(n+1) = \left(\frac{a}{n+2}\right)^2$$

(c) If there is a merger and no entry, the profit (gross of fixed costs) of the merged firm and of the remaining outsiders is

$$\Pi_{1+2}(n-1) = \left(\frac{A+(n-1)c-x}{n-1+1} - (c-x)\right)^2 = \left(\frac{a+x(n-1)}{n}\right)^2$$

$$\Pi_i(n-1) = \left(\frac{A+(n-1)c-x}{n-1+1} - c\right)^2 = \left(\frac{a-x}{n}\right)^2$$

The outsiders have a positive profit (there is no exit) if and only if

$$\left(\frac{a-x}{n}\right)^2 - G > 0 \Leftrightarrow x < a - n\sqrt{G}$$

which holds under Assumption 1(b).

(d) If there is a merger and there is entry, the profit (gross of fixed costs) of the merged firm and of the entrant (or any remaining outsiders) are

$$\Pi_{1+2}(n) = \left(\frac{A+nc-x}{n+1} - (c-x)\right)^2 = \left(\frac{a+nx}{n+1}\right)^2$$

$$\Pi_e(n) = \left(\frac{A+nc-x}{n+1} - c\right)^2 = \left(\frac{a-x}{n+1}\right)^2$$

Note that if entry is profitable for the entrant, the outsiders will also have a positive profit because $G < F$.

Entry decision

If there was no merger, there is no entry as the entrant's profit would be negative (by Assumption 1(a)):

$$\left(\frac{a}{n+2}\right)^2 - F < 0$$

If there was a merger, there is entry if and only if

$$\left(\frac{a-x}{n+1}\right)^2 - F \geq 0 \Leftrightarrow x \leq a - (n+1)\sqrt{F}$$

Merger decision

Recall that if there is no merger, there will be no entry.

If $0 < x \leq a - (n+1)\sqrt{F}$, the merger will be followed by entry. The merger is profitable if and only if

$$\left(\frac{a+nx}{n+1}\right)^2 - G \geq 2\left(\left(\frac{a}{n+1}\right)^2 - G\right) \Leftrightarrow x \geq \frac{\sqrt{2a^2 - G(n+1)^2} - a}{n}$$

and price always decreases because the number of competitors is the same but one of them became more efficient.

If $a - (n+1)\sqrt{F} < x \leq a - n\sqrt{G}$, the merger will be followed by no entry. The merger is profitable if and only if

$$\left(\frac{a+x(n-1)}{n}\right)^2 - G \geq 2\left(\left(\frac{a}{n+1}\right)^2 - G\right) \Leftrightarrow x \geq \frac{n\left(\sqrt{2a^2 - G(n+1)^2} - a\right) - a}{(n-1)(n+1)}$$

and the price decreases if and only if

$$\frac{A+(n-1)c-x}{n-1+1} < \frac{A+nc}{n+1} \Leftrightarrow x > \frac{a}{n+1}$$

Summing up, in equilibrium:

(i) there is a merger followed by no entry and the price does not increase if and only if

$$x \geq \max\left\{a - (n+1)\sqrt{F}, \frac{n\left(\sqrt{2a^2 - G(n+1)^2} - a\right) - a}{(n-1)(n+1)}, \frac{a}{n+1}\right\}$$

(ii) there is a merger followed by no entry and the price increases if and only if

$$\max\left\{a - (n+1)\sqrt{F}, \frac{n\left(\sqrt{2a^2 - G(n+1)^2} - a\right) - a}{(n-1)(n+1)}\right\} \leq x < \frac{a}{n+1}$$

(iii) there is a merger followed by entry and the price decreases if and only if

$$\frac{\sqrt{2a^2 - G(n+1)^2} - a}{n} \leq x \leq a - (n+1)\sqrt{F}$$

(iv) Otherwise, there is no merger and no entry.

To simplify the intervals for x note that, for any admissible G and n, we have

$$\frac{n\left(\sqrt{2a^2 - G(n+1)^2} - a\right) - a}{(n-1)(n+1)} < \frac{\sqrt{2a^2 - G(n+1)^2} - a}{n} < \frac{a\sqrt{2} - a}{n} < \frac{a}{n+1}$$

and that

$$a-(n+1)\sqrt{F}<\frac{a}{n+1}\Leftrightarrow F>\frac{n^2a^2}{(n+1)^4}$$

which is true for all admissible F and n because $\left(\frac{a}{n+2}\right)^2>\frac{n^2a^2}{(n+1)^4}$. ■

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