

Efficiency Gains and Myopic Antitrust Authority in a Dynamic Merger Game*

Massimo Motta
Universitat Pompeu Fabra, Barcelona
European University Institute, Florence
massimo.motta@iue.it

Helder Vasconcelos
IDEI, Université de Toulouse
vasconce@cict.fr

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Abstract

This paper models a sequential merger formation game with endogenous efficiency gains in which every merger has to be submitted for approval to the Antitrust Authority (AA). Two different types of AA are studied: first, a myopic AA, which judges a given merger without considering that subsequent mergers may occur; and, second, a forward looking AA, which anticipates the ultimate market structure a given merger will lead to. By contrasting the decisions of these two types of AA, merger policy implications can be drawn. In particular, the *efficiency offence* argument does not find *any* justification under a forward looking AA.

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JEL classification: D43; L13; L41.

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1 Introduction

Economic analysis suggests that efficiency gains play a crucial role in determining the effect of mergers on consumer and total welfare.¹ Accordingly, Antitrust Authorities (AAs) should try and estimate whether efficiency gains are likely or not to offset the higher market power enjoyed by the merging firms. This is precisely the approach indicated by the Merger Guidelines released by the US Department of Justice, which

“...will not challenge a merger if cognizable efficiencies are of a character and magnitude such that the merger is not likely to be anticompetitive in any relevant market. To make the requisite determination, the Agency considers whether cognizable efficiencies likely would be sufficient to reverse the merger’s potential to harm consumers in the relevant market, e.g. by preventing price increases in that market.” (US Merger Guidelines, revised April 8, 1997, section 4).

The European Commission (EC) has so far had a more ambiguous approach towards efficiency gains. It has been debated whether the wording of the European Merger Regulation No. 4064/89 allows or not for an efficiency defence.² However, in practice, the EC has so far never used efficiency gains arguments to clear a merger. In the past, whenever cost reductions have been claimed by the merging parties, the EC dismissed those claims on various grounds.³

Further, the EC used possible cost reductions as an argument *against* a merger in at least one of the early cases.⁴ None the less, some of the recent EC decisions have raised doubts that the EC is using again some version of *efficiency offence* arguments. The widely discussed *General Electric-Honeywell* merger is a case in point.⁵ General Electric is a leading producer of jet engines for large commercial aircraft and Honeywell of avionics products. Among other concerns, the EC thought that the merged firms could have bundled engine and avionics products, to the detriment of competitors. The EC argued that although the welfare effect would have been beneficial in the short-run, in the

¹ See Farrell and Shapiro (1990) and, for a general discussion of the effects of mergers, Motta (2003).

² See for instance Neven, Nuttall and Seabright (1993: 62-63, and 116-117), and Jacquemin (1990). However, article 1.1(b) of the Merger Regulation says that in its appraisal of the merger, the Commission shall take into account, among other things “...the interests of the intermediate and ultimate consumers, and the development of technical and economic progress provided that it is to consumers’ advantage and does not form an obstacle to competition.” This would seem to allow for efficiency considerations in mergers.

³ For instance, in *Aérospatiale-Alenia/DeHavilland* (Case IV/M.053 (October 2, 1991), OJ L334/42, 1991, at 65) the EC argued that cost savings would have been negligible, had not been properly quantified, were not merger-specific (they could have been attained without the need of a concentration) and would have not gone in any case to consumers’ advantage. Other cases where defendants raised efficiency considerations were *Accor/Wagon-Lits*, *MSG/Media Services*, *Mercedes-Benz/Kassbohrer*. See also Noël (1997: 512-514).

⁴ See *AT&T/NCR*, Case IV/M.050 (18 January 1991). Other cases are discussed by Noël (1997: 512) and Neven et al. (1993: 116-117).

⁵ *General Electric/Honeywell*, case COMP/M.2220.

long-run competitors would have left the industry and GE/Honeywell become a monopolist, thereby harming welfare.⁶

The extent to which the EC might still use efficiency offence arguments has probably been exaggerated, and we are convinced that European merger policy will soon explicitly accept efficiency defence arguments.⁷ Nevertheless, a more general theoretical question remains open, and this concerns whether efficiency gains might indeed be anti-competitive in some cases.

In our opinion, there are two distinct, although possibly related, rationales for efficiency offence arguments. The first lies in the possibility that merged firms become so efficient that, even without engaging in strategic behavior, their competitors will be unable to compete and will exit the market, causing an overall negative effect. The second resides in the possibility that, after merging, two firms might engage in strategic anti-competitive practices aimed at exploiting their increased (market or financial) power so as to force rivals to exit.

This paper focuses on the first possible motivation for an efficiency offence argument. We analyse a simple model where a merger increases firms' capacity, which in turn leads to scale economies. When such efficiency gains are very small, there would be no merger (we use a Cournot model). When they are of intermediate importance, outsider firms lose competitiveness but continue to operate profitably, resulting in a more efficient market outcome, the case usually analysed in the literature. However, a merger might give the two merging firms such important cost savings that - without engaging in any predatory practice or any "strategic" action - rivals would be unable to survive in the industry.

The last case might seem to provide some rationale for the efficiency offence arguments. In fact, there exist two objections that should be considered before drawing the conclusion that efficiency gains might be detrimental. First, it is not enough to show that competitors would exit the industry to conclude that the merger has negative effects: one should show that consumers would be hurt as well (antitrust policy does not protect competitors, it protects competition!). Second, and perhaps more important, if the merger gives rise to such important cost savings, should we not expect that competitors would react to attain similar savings, rather than waiting to be forced out of the market?

Our simple formal setting allows to consider both points. First, we show that if efficiencies are very strong, prices will be lower after the merger - even if the competitive disadvantage oblige some firms to exit. Second, we show that a static model where the effects of an *exogenous* merger are analysed might be misleading. In a dynamic setting such as the one we propose here, if a merger provides important cost savings, then it will be followed by a merger of the rivals. In other words, if there exist efficiency gains to be reaped from a merger, outsiders will respond by merging as well. This "defensive" merger will allow

⁶ Similar concerns have also been expressed in other cases where the EC has proposed the so called "*portfolio theory*" of merger effects. See e.g., *Guinness/Grand Metropolitan* (case IV/M.938); *Coca-Cola/Amalgamated Beverages* (case IV/M.796); *Coca-Cola/Carlsberg* (case IV/M.833).

⁷ The recent EC Green Paper on the Reform of the Merger Regulation is witness of the willingness to incorporate efficiency considerations in EU merger policy.

the outsiders to the first merger to match the efficiency gains of the first merger partners, leading to a final outcome which is positive for society. Indeed, we show that if the AA is forward looking, that is if it takes into account that the first merger will be followed by another, no efficiency offence argument would be justified. Either cost savings are small, and the merger(s) should be blocked; or cost savings are large, and the merger(s) should be allowed.

Apart from the discussion of the efficiency offence argument, we regard the dynamic feature of our merger model as the main contribution of this paper.⁸ Most of the existing models of mergers do not deal with the dynamics of the merger processes, as they simply compare a pre-merger situation with a post-merger situation, without taking into account that a merger might trigger other mergers. Exceptions are Gowrinsankaran (1999) and Fauli-Oller (2000).

Relative to these papers, we explicitly model the presence of an Antitrust Authority that is an active player of our game, and is called to authorise or block a merger whenever one is proposed.

We contrast two games. In the first, the AA is myopic: when a merger is proposed, the AA judges it without considering that further mergers might occur. This myopic behaviour leads the AA to use an efficiency offence argument and block the merger under some parameters constellation.

In the second game, the AA is forward looking and is able to correctly anticipate the future. Along the equilibrium path, if efficiency gains are large enough the first merger between two firms will be authorised, because the AA knows that it will be followed by another merger by the outsiders - that will also be authorised, because otherwise there would be inefficient exit. (The remaining two firms will also want to merge to monopoly, but this last merger will not be authorised by the AA, unless efficiencies are extremely high.) Therefore, in our model, the efficiency offence argument does not find any justification under a forward looking AA.

The paper continues as follows. Section 2 introduces the basic model, which is chosen as the simplest possible setting where the elements we are interested in could emerge. Section 3 analyses the game where the AA behaves myopically. Section 4 analyses the dynamic game, where the AA is forward looking. Section 5 concludes the paper by discussing how we plan to extend our model beyond the admittedly simple form it takes in this paper.

2 Basic model

We consider a model in which there are four firms which operate in a market with linear demand

$$p = a - Q, \tag{1}$$

⁸ Motta (2003, chapter 5) also formalises an efficiency offence argument, but limits attention to the static framework that corresponds to section 3 of this paper. The treatment in Motta (2003) is based on a differentiated products model with price competition, but the similarities in the static analysis make us believe that the results we obtain in the dynamic setting would extend to his model.

where Q is the industry output and $a > 0$.

What distinguishes firms is the amount of capital they own. The total supply of capital is assumed to be fixed to the industry. For the sake of simplicity, the total quantity of capital available in the industry is normalized to one.⁹ Let k_i , $k_i \in \{\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, 1\}$, denote the fraction of the industry capital owned by firm i , $i \in \{1, \dots, 4\}$.

The cost structure is a key feature of this model. The cost function of a firm which owns a fraction k_i of the industry capital and produces q_i units of output is given by:

$$C(q_i, k_i) = \left(c + \frac{\alpha}{k_i}\right) q_i + 4k_i f, \quad (2)$$

where $\alpha \geq 0$, $\sum_{i=1}^4 k_i = 1$ and $f > 0$.

Hence, we assume that each firm operates with a constant marginal cost of production, but the level of its marginal cost is a decreasing function of its share in the industry capital, k_i . In addition, it is assumed that there exists a plant specific fixed cost f , which has to be paid for each 1/4 of the industry capital owned by the firm.

The previous function aims at capturing two distinct cost effects induced by a merger. First, a merger brings the individual capital of merging firms into a single larger resulting firm and, therefore, it gives rise to endogenous efficiency gains by decreasing marginal costs. The higher the value of α , the stronger the efficiency gains induced by a merger.¹⁰ Second, by creating a larger firm, a merger has also the effect of increasing fixed costs proportionally. This effect is captured by the parameter f in the cost function.¹¹

In the analysis which follows, it will be assumed that firms compete *à la* Cournot and are allowed to merge before competition in the product market occurs. However, when firms want to merge, they will have to ask the Antitrust Authority (henceforth, AA) for authorisation.

Two different scenarios are dealt with. First, we assume that the AA has a completely myopic behaviour (section 3). When deciding whether to authorise or not a given merger, it does not take into account that the merger under consideration can be followed by other mergers. We then turn to a second scenario (section 4) in which it is assumed that the AA is forward looking in the sense that it anticipates the ultimate market structure a merger will lead to, and takes it into account when deciding on a proposed merger.

Throughout the paper, we assume that the AA maximises *consumer welfare*. This is consistent with the current standards used both in the US and in the

⁹ Obviously, this suppresses de novo entry into the industry.

¹⁰ This essential feature of a merger was first proposed by Perry and Porter (1985). In their framework firms' marginal cost is linear in output and mergers reduce variable costs. The same model is also used by Vasconcelos (2001), who analyses the possible pro-collusive effects of a merger.

¹¹ This specification is used to rule out further scale economies simply due to sharing of fixed costs. An effect of this specification is that efficiency gains benefit both consumers and the merging firms, and allows unnecessary divergences between a consumer welfare and a total welfare standard.

EU to assess mergers. In the US, the “substantial lessening of competition” (SLC) test has been interpreted by both the enforcement agencies (the DoJ and the FTC) and the Courts that a merger is unlawful if it is likely that it will lead to an increase in price (that is, to a decrease in consumer surplus).¹² In the EU, it is currently debated whether to switch to the SLC test or keep the current dominance test, which would deem incompatible mergers that created or reinforced a dominant position. It is less clear whether this test is closer to a consumer welfare or a total welfare standard, but the wording of article 1.1 (see footnote 2 above) states that an efficiency gain is in principle admitted to the extent that it benefits consumers, thus implying a consumer welfare standard.

By assuming that the AA assesses mergers according to a consumer surplus standard we do not want to imply that this *should* be the right standard.¹³ We adopt this assumption only because it describes current practice in the major antitrust jurisdictions. An advantage of this assumption is also that it allows us to keep the analysis extremely simple.

3 “Static” analysis (myopic AA)

In this section, we analyse a simple game where from an initial symmetric market structure, two of the four firms consider to merge. In the first stage, the two firms decide whether to propose a merger (they will do it, when the merger gives higher profits). In the second stage, the AA decides whether to authorise the merger or not. This simple game is a restricted version of the dynamic game we present in the next section 4, where the first merger might be followed by other mergers. Since we assume in the present section that the AA is myopic, by definition it will not take into account that other mergers might occur, and consequently there is no need to consider the stages which follow the second stage of the game.

Initial market structure Let us assume that the status quo industry structure is a symmetric one. Hence, each firm has a share 1/4 of the industry capital. Each firm i , therefore, chooses q_i by solving the following maximisation problem

$$\max_{q_i} \left\{ (a - q_i - \sum_{j \neq i} q_j) q_i - (c + 4\alpha) q_i - f \right\}. \quad (3)$$

¹²Two oft-cited decisions are: FTC v. University Health, Inc., 938 F.2d 1206, 1222-1223 (11th Cir.1991); United States v. United Tote, Inc., 768 F. Supp. 1064, 1084-1085 (D. Del. 1991). The quote from the revised US Merger Guidelines at the beginning of this paper makes this approach explicit: efficiency gains arguments would be accepted only to the extent that they will prevent price increases in the market.

¹³See Lyons (2002) for arguments in favour of the consumer surplus standard in merger control.

>From here we find that, due to symmetry, the equilibrium quantities at the initial market structure are equal for all firms and are given by

$$q\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{a - c - 4\alpha}{5}. \quad (4)$$

It is easily checked that the associated equilibrium level of profit and the consumer surplus are given by:

$$\Pi\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = \left(\frac{a - c - 4\alpha}{5}\right)^2 - f, \quad (5)$$

$$CS\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{8}{25}(a - c - 4\alpha)^2. \quad (6)$$

Assumption 1 Let us assume that

$$\alpha < \frac{(a - c)}{4} \equiv \bar{\alpha}; \quad f < \left(\frac{a - c - 4\alpha}{5}\right)^2 \equiv \bar{f}. \quad (7)$$

These two conditions are imposed to exclude the trivial case in which production is not viable at the status quo market structure.¹⁴

A merger between two firms Suppose that there is a merger proposal between two of the four firms in the industry. If the merger occurs, then a larger (and, hence, more efficient) firm is created, owning 2/4 of the industry capital. In the post-merger Cournot equilibrium, the merged entity (say, firm l) and a representative outsider (say, firm s_i) will choose their levels of output by solving the following maximisation problems, respectively,

$$\max_{q_l} \left\{ \left(a - q_l - \sum_{j \neq l} q_j \right) q_l - (c + 2\alpha) q_l - 2f \right\}, \quad (8)$$

$$\max_{q_{s_i}} \left\{ \left(a - q_{s_i} - \sum_{h \neq s_i} q_h \right) q_{s_i} - (c + 4\alpha) q_{s_i} - f \right\}. \quad (9)$$

Now, due to symmetry, one has that $\forall s_i, q_{s_i} = q_s$. Very simple algebra shows that the equilibrium level of output for the merged entity (firm l) and for each of the two outsiders to this merger are respectively given by

$$q_l\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{a - c + 2\alpha}{4}, \quad (10)$$

$$q_s\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) = \max\left\{0, \frac{a - c - 6\alpha}{4}\right\}. \quad (11)$$

¹⁴If $\alpha \geq (a - c)/4$, then $dC(q_i, 1/4)/dq_i = c + 4\alpha > a$, which in turn implies that $q(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}) = 0$. Likewise, four firms would not co-exist if $f > \bar{f}$.

Remark 1 $q_s = 0$ if $\alpha \geq (a - c)/6$.

Hence, if the merger gives rise to very high synergies, the two (smaller) outsider firms are constrained to exit the market.

Suppose for the moment that $\alpha < (a - c)/6$. From the equilibrium outputs above, one can obtain by substitution the equilibrium levels of profits for the merged entity and for each of the merger outsiders

$$\Pi_l \left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4} \right) = \left(\frac{a - c + 2\alpha}{4} \right)^2 - 2f, \quad (12)$$

$$\Pi_s \left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4} \right) = \left(\frac{a - c - 6\alpha}{4} \right)^2 - f. \quad (13)$$

In addition, consumer surplus is given by

$$CS \left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4} \right) = \frac{1}{32} (3(a - c) - 10\alpha)^2 \quad (14)$$

Now, notice that after a merger between two of the firms in the status quo market structure, the induced post-merger market structure might be either $\{\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\}$ or simply a monopoly market structure of the type $\{\frac{2}{4}\}$, depending on whether after the merger the two outsiders are able to make positive profits or not. These two different cases will be dealt with in the analysis that follows, where we seek the subgame perfect Nash equilibrium (henceforth, SPNE) in pure strategies of the proposed two stage game.

Analysis os Stage 2 At the *second* stage of the game, the AA has to decide whether or not to allow a merger between two randomly selected firms, if the merger has been submitted for approval. The behavior of the AA in each of the above mentioned possible scenarios is as follows.

- If $\alpha < (a - c)/6$ and $f < ((a - c - 6\alpha)/4)^2 \equiv \tilde{f}$, then from eq. (13), one concludes that the two merger outsiders are able to make positive profits after the merger has taken place. If this is the case, then the AA will decide to authorise the submitted merger only if:

$$CS \left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4} \right) = \frac{1}{32} (3(a - c) - 10\alpha)^2 > CS \left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4} \right) = \frac{8}{25} (a - c - 4\alpha)^2, \quad (15)$$

which is equivalent to

$$\frac{a - c}{14} \simeq 0.071429 \leq \alpha < \frac{a - c}{6}. \quad (16)$$

Hence, in order to authorise the merger, the AA will require that the efficiency gains obtained through the merger are sufficiently high.

- If, instead,

$$\begin{aligned}
& - \alpha \geq (a - c) / 6, \text{ or} \\
& - \alpha < (a - c) / 6 \text{ and } \left(\frac{(a-c)-6\alpha}{4} \right)^2 \equiv \tilde{f} \leq f < \bar{f},
\end{aligned}$$

then from Remark 1 and eq. (13), one concludes that in this case the merger induces the outsiders to exit the industry. Notice that when after the merger the relevant market structure is characterised by a single monopolist operating with 2/4 of the industry capital, very simple algebra shows that the merged entity equilibrium profit and the associated consumer surplus are given by:

$$\Pi\left(\frac{2}{4}\right) = \left(\frac{a - c - 2\alpha}{2}\right)^2 - 2f, \quad (17)$$

$$CS\left(\frac{2}{4}\right) = \frac{1}{8}(a - c - 2\alpha)^2. \quad (18)$$

Now, the AA faced with such a merger proposal inducing the exit by outsiders, will decide to veto it if the following inequality holds:

$$CS\left(\frac{2}{4}\right) = \frac{1}{8}(a - c - 2\alpha)^2 < CS\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{8}{25}(a - c - 4\alpha)^2, \quad (19)$$

which in turn implies that a merger would *not* be authorised by the (myopic) AA if efficiency gains induced by the merger are sufficiently low, i.e., if:

$$\alpha < \frac{3(a - c)}{22} \simeq 0.13636(a - c). \quad (20)$$

Let us now turn to the analysis of the firms' decisions at the first stage of the game.

Analysis of Stage 1 As a preliminary remark, it should be stressed that we assume there are no administrative costs that firms must incur for submitting the merger to the AA. Hence, when firms anticipate that the merger will be blocked, they are indifferent between asking or not authorisation at the AA. We assume throughout that in case of indifference, firms do propose a merger to the AA.¹⁵

In order to investigate firms' merger decision at the *first stage* on whether or not to submit a merger, one has to distinguish again between the scenario in which a merger does not constrain outsiders to leave the industry and the scenario in which it does push outsiders out of the market.

¹⁵This implicitly means that the firms do not incur any administrative cost from filing a merger. As will become clear, this assumption does not matter much, as the equilibrium outcome would not change if we assumed positive filing costs (or that, when indifferent, the firms do not propose the merger.)

- If $\alpha < (a - c)/6$ and $f < ((a - c - 6\alpha)/4)^2 \equiv \tilde{f}$, then, as explained above, the two merger outsiders are able to make positive profits after the merger has taken place. Therefore, from (5) and (12), one has that the insider firms will find this merger profitable if the following condition holds:

$$\Pi_i \left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4} \right) = \left(\frac{a - c + 2\alpha}{4} \right)^2 - 2f > 2\Pi \left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4} \right) = 2 \left[\left(\frac{a - c - 4\alpha}{5} \right)^2 - f \right], \quad (21)$$

which in turn implies that the merger is submitted to the AA if

$$\frac{1}{2} \left(\frac{89 - 60\sqrt{2}}{103} \right) (a - c) \simeq 0.020132 (a - c) \leq \alpha < \frac{a - c}{6}. \quad (22)$$

Hence, in order for the insider firms to find the merger profitable, they will require efficiency gains obtained through the merger to be sufficiently high.¹⁶ It should be stressed, however, that the set of parameter values given by the previous condition is larger than the one described by eq. (16), which means that for low values of the efficiency parameter α , namely for $\alpha \in [0.020132 (a - c), (a - c)/14]$, the merger will be submitted by the firms but blocked by the myopic AA.

- If, instead,

$$\begin{aligned} & - \alpha \geq (a - c)/6, \text{ or} \\ & - \alpha < (a - c)/6 \text{ and } \left(\frac{(a - c) - 6\alpha}{4} \right)^2 \equiv \tilde{f} \leq f < \bar{f}, \end{aligned}$$

then outsiders are constrained to exit the market after the merger. Hence, from (5) and (17), one concludes that the two potential merging parties will decide to merge if:

$$\Pi \left(\frac{2}{4} \right) = \left(\frac{a - c - 2\alpha}{2} \right)^2 - 2f > 2\Pi \left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4} \right) = 2 \left[\left(\frac{a - c - 4\alpha}{5} \right)^2 - f \right], \quad (23)$$

which turns out to be satisfied for all $\alpha \in [0, \bar{\alpha})$, where $\bar{\alpha}$ is given by eq. (7). Hence, the selected firms will always decide to submit the merger to the AA.

The behavior of a myopic AA when deciding whether or not to authorise a merger which triggers the exit of the outsiders to such a merger can be summarised as follows:¹⁷

¹⁶ Notice, in particular, that in the extreme case in which $\alpha = 0$ (no efficiency gains), no merger would occur. This is related to Salant, Switzer and Reynolds (1983). Their well known result in static Cournot games with constant marginal costs can be summarised as follows. Two (coalitions of) firms will never be interested in merging if they only care about present profits and there are at least three existing (coalitions of) firms in the industry.

¹⁷ Remember that from Assumption 1, $f < \bar{f}$

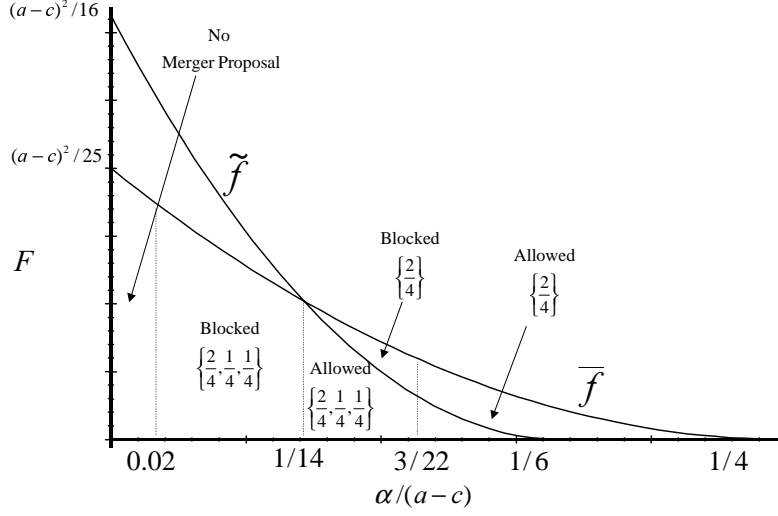


Figure 1: Equilibria of the game with a myopic AA

1. If

(a) $\alpha \geq (a - c) / 6$, or

(b) $3(a - c) / 22 \leq \alpha < (a - c) / 6$ and $f \geq \left(\frac{(a-c)-6\alpha}{4} \right)^2 \equiv \tilde{f}$,

then the merger will always be authorised. Outsiders would be pushed out of the market after the merger has taken place but efficiency gains are so high that consumers would gain.

2. If, instead, $(a - c) / 14 \leq \alpha < 3(a - c) / 22$ and $f \geq \left(\frac{(a-c)-6\alpha}{4} \right)^2 \equiv \tilde{f}$, then the merger would *not* be authorised by the AA. After the merger, outsiders are not able to recover their fixed cost but consumers would be worse off. This is the *efficiency offence scenario* and in what follows we argue that the AA is behaving myopically when deciding to block such a merger.

Figure 1 illustrates the full (that is, including the cases where the merger would not trigger exit by outsiders) equilibrium outcome of this two stage game.

4 Dynamic analysis (forward looking AA)

In this section, starting from the same status quo industry structure $\{\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\}$, our aim is to investigate the strategic interaction between firms (potential merging parties) and the AA, in a situation where the AA is endowed with foresight. The AA, when making a decision on whether or not to allow a given merger, takes into account that the merger may be followed by further mergers and, therefore, it speculates on the (consumer) welfare associated with the market structure that merger will lead to. This situation is modeled as a six-stage game involving the following sequence of decisions.

- In the *first stage*, nature allows two of the four firms in the status quo industry structure to merge if they wish so. If they decide to merge, they will have to ask for authorisation at the AA.
- In the *second stage*, the AA decides whether to authorise the merger or not. If it does not authorise it, then the game will have come to a final node (since even restarting at this node would always lead us to a similar merger proposed and refused by the AA) and product market competition occurs between the four symmetric firms in the status quo industry structure.
- In the *third stage*, if the AA has decided to authorise the merger at stage 2, it is the turn of the next two firms (the outsiders to the previous merger) to decide if they want to merge or not. If they do not want to, then the merger game stops and market realisation occurs. If, instead, they want to merge, they have to ask for authorisation at the AA.
- In the *fourth stage*, the AA decides whether it wants to authorise the defensive merger between the outsiders of the first merger. If the AA vetoes the merger, the merger game stops here and the product market stage occurs, with associated payoff realisation. Else, we find ourselves at a structure $\{\frac{2}{4}, \frac{2}{4}\}$, but we allow for a further round of the merger game.
- In the *fifth stage*, the firms are allowed to seek a merger to monopoly. If they decide not to do it, the merger game stops and product market competition occurs. If, instead, they want to merge, they will have to ask the AA for authorisation.
- In the *sixth stage*, the AA decides whether or not to allow the merger to monopoly and, after its decision has been taken, product market competition occurs.

As in the previous section, we will use as a solution concept the SPNE in pure strategies, so that we proceed by solving the game by backward induction.

4.1 Analysis of the SPNE of the game

As usual, we solve the game by backward induction.

Analysis of Stage 6 If the game arrives at the *sixth stage*, then the AA will have to choose between the two alternative market structures $\{\frac{2}{4}, \frac{2}{4}\}$ and $\{1\}$. If the AA decides to block the merger, then the resulting market structure will be $\{\frac{2}{4}, \frac{2}{4}\}$. This industry structure results from two previous mergers (approved in stages two and four, respectively) and is composed of two equally efficient firms (say, firms i and j), owning $2/4$ of the industry capital each. When this is the industry structure, firm i chooses its level of production q_i by solving the following maximisation program:

$$\max_{q_i} \{(a - q_i - q_j) q_i - (c + 2\alpha) q_i - 2f\}. \quad (24)$$

Now, due to symmetry, the equilibrium quantities are equal for both firms and they are given by:

$$q\left(\frac{2}{4}, \frac{2}{4}\right) = \frac{a - c - 2\alpha}{3}. \quad (25)$$

Hence, the Cournot profits per-firm in an industry structure $\{\frac{2}{4}, \frac{2}{4}\}$ are:

$$\Pi\left(\frac{2}{4}, \frac{2}{4}\right) = \left(\frac{a - c - 2\alpha}{3}\right)^2 - 2f. \quad (26)$$

In addition, consumer surplus is given by:

$$CS\left(\frac{2}{4}, \frac{2}{4}\right) = \frac{2}{9} (a - c - 2\alpha)^2. \quad (27)$$

If, instead, the AA decides to approve the merger, then the resulting market structure will be a monopoly operating with the whole industry capital, $\{1\}$. When this is the case, very simple algebra shows that the equilibrium level of profit and the consumer surplus are, respectively, given by:

$$\Pi(1) = \left(\frac{a - c - \alpha}{2}\right)^2 - 4f, \quad (28)$$

$$CS(1) = \frac{1}{8} (a - c - \alpha)^2. \quad (29)$$

Now, making use of (27) and (29), one concludes that the AA will decide to block a merger between two firms owning $2/4$ of the industry capital towards complete monopolisation of the industry if

$$CS(1) = \frac{1}{8} (a - c - \alpha)^2 < CS\left(\frac{2}{4}, \frac{2}{4}\right) = \frac{2}{9} (a - c - 2\alpha)^2, \quad (30)$$

or, equivalently,

$$-\frac{1}{72} (a - c - 5\alpha) (7(a - c) - 11\alpha) < 0$$

which in turn implies that the merger will be blocked if:¹⁸

$$\alpha < \frac{(a-c)}{5}. \quad (31)$$

Therefore, *the AA will allow the merger to monopoly* only if $\alpha \geq (a-c)/5$.

Analysis of Stage 5 In the *fifth* stage, if a duopolistic structure has emerged from the previous stages of the game, firms have to decide whether or not to seek a merger to monopoly. As in the previous section, we assume that there are no administrative costs that firms must incur for submitting the merger to the AA and that in case of indifference between proposing or not, firms do propose the merger to the AA. Now, from (26) and (28), one has that firms will have an interest in merging to monopoly if:

$$\Pi(1) = \left(\frac{a-c-\alpha}{2}\right)^2 - 4f > 2\Pi\left(\frac{2}{4}, \frac{2}{4}\right) = 2 \left[\left(\frac{a-c-2\alpha}{3}\right)^2 - 2f \right], \quad (32)$$

which turns out to be satisfied for all $\alpha \in (0, \bar{\alpha})$, where $\bar{\alpha}$ is given by eq. (7). Hence, at the fifth stage of the game the two coalitions in the market will always decide seek a merger leading to complete monopolisation of the industry.

This result is not surprising. Even in a Cournot setting with linear demand where firms have the same (constant) marginal cost either before and after the merger, a merger from duopoly to monopoly is always found to be profitable (see Salant, Switzer and Reynolds (1983)). In our setting, firms have a double incentive to participate in the merger. Apart from reducing competition in the market, a merger allows the involved firms to realise a cost advantage over the unmerged rivals. When firms merge, they afford a (marginal) cost reduction over the unmerged rivals through endogenous efficiency gains. Hence, the incentive for merger is reinforced.¹⁹

Analysis of Stage 4 In the *fourth* stage, the AA has to decide whether to accept a merger between the outsiders to the first merger. Two cases must be considered here.

1. If $\alpha \geq (a-c)/5$, the AA anticipates that if the merger is approved, the final equilibrium market structure will be a monopoly. It also anticipates that if it vetoes the merger, the outsiders of the first merger would be constrained to exit the industry.²⁰ Therefore, it will authorise the merger if:

¹⁸ Notice that the second root (in terms of α) is given by $\alpha = (a-c) 7/11$ which is greater than $\bar{\alpha}$ (assumption 1) and, therefore, should be discarded.

¹⁹ Recall that fixed costs play no role in firms' merger decision. Each firm's share in the monopoly fixed cost equals the fixed cost the firm would pay as an independent duopolist with 2/4 of the industry capital, $2f$.

²⁰ See Remark 1.

$$CS(1) = \frac{1}{8}(a - c - \alpha)^2 \geq CS\left(\frac{2}{4}\right) = \frac{1}{8}(a - c - 2\alpha)^2, \quad (33)$$

which always holds: since the merger allows to keep assets that otherwise would be forced to disappear from the industry, it is always better to authorise it.²¹

2. If $\alpha < (a - c)/5$, the merger will lead to the creation of a perfectly symmetric duopolistic structure, $\{\frac{2}{4}, \frac{2}{4}\}$. Two sub-cases should be considered here:

- If $\left(\frac{(a-c)-6\alpha}{4}\right)^2 \equiv \tilde{f} \leq f$, the AA correctly anticipates that if it said no to the merger the two outsiders of the first merger would be constrained to exit the industry (they would not be able to cover fixed costs of production) and, therefore, the market structure at equilibrium would be $\{\frac{2}{4}\}$. As a result, from (18) and (27), one concludes that the merger will be allowed only if:

$$CS\left(\frac{2}{4}\right) = \frac{1}{8}(a - c - 2\alpha)^2 < CS\left(\frac{2}{4}, \frac{2}{4}\right) = \frac{2}{9}(a - c - 2\alpha)^2, \quad (34)$$

or, equivalently,

$$-\frac{7}{72}(a - c - 2\alpha)^2 < 0, \quad (35)$$

which is always true. Thus, the AA will always allow the defensive merger in this interval.

- If $f < \tilde{f}$, the outsiders will not exit the industry if their merger were blocked. Therefore, the merger will be allowed if:

$$CS\left(\frac{2}{4}, \frac{2}{4}\right) = \frac{2}{9}(a - c - 2\alpha)^2 \geq CS\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{1}{32}(3(a - c) - 10\alpha)^2, \quad (36)$$

which turns out to be satisfied for $\alpha \geq (a - c)/14$.

Analysis of Stage 3 In the *third* stage, we have to check whether the outsiders of the first merger (if it has been proposed in the first stage and approved in the second stage by the AA) will want to merge or not. Again, we have to consider different cases according to the level of efficiency gains.

²¹It is better in terms of welfare to have a (more efficient) monopolist owning the whole industry capital, than having a monopolist with only half of the industry capital.

1. If $\alpha \geq (a - c)/5$, it is easy to check that the merger is always profitable. By merging, firms will eventually end up in a full monopoly, whereas by not merging, they will get zero profit, since they would be unable to cover fixed cost and, therefore, would be constrained to exit the market.
2. If $\alpha < (a - c)/5$, two sub-cases arise:
 - (a) If $(a - c)/14 \leq \alpha < (a - c)/5$, firms anticipate that by merging they will eventually be in a duopolistic structure, whereas by not merging they would be obliged to exit. Hence, using (26), we have that the merger will be profitable if:

$$\Pi\left(\frac{2}{4}, \frac{2}{4}\right) = \left(\frac{a - c - 2\alpha}{3}\right)^2 - 2f \geq 0,$$

which is satisfied if:

$$f \leq \frac{1}{2} \left(\frac{a - c - 2\alpha}{3}\right)^2 \equiv f'. \quad (37)$$

But it is easy to check that this condition is always satisfied in the relevant range of parameter values as described by assumption 1. Therefore, the two firms that have not been involved in the first merger will always want to merge in this interval.

- (b) If, instead, $\alpha < (a - c)/14$, then outsiders correctly anticipate that by merging they will be in a duopoly structure, but by not merging they will survive. Therefore, the merger is profitable if:

$$\Pi\left(\frac{2}{4}, \frac{2}{4}\right) = \left(\frac{a - c - 2\alpha}{3}\right)^2 - 2f \geq 2\Pi_s\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) = 2\left(\frac{a - c - 6\alpha}{4}\right)^2 - 2f, \quad (38)$$

which holds for $\alpha \geq (19 - 12\sqrt{2})(a - c)/146 \cong .0139(a - c)$. Therefore, the merger will not be proposed only if $\alpha < (19 - 12\sqrt{2})(a - c)/146$, which is lower than $(a - c)/14$.

Analysis of Stage 2 In the *second* stage, if the two randomly selected firms at the first stage decide to submit a merger to the AA, the AA has to decide whether to allow it or not.

Three separate cases should be considered:

1. If $\alpha \geq (a - c)/5$, the first merger will ultimately lead to a monopoly. Therefore, it will be allowed if:

$$CS(1) = \frac{1}{8}(a - c - \alpha)^2 \geq CS\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = \frac{8}{25}(a - c - 4\alpha)^2, \quad (39)$$

that is always true in the interval $(a - c)/9 \leq \alpha \leq (a - c)/4$. Hence, it will always be authorised.

2. If $(a-c)/14 \leq \alpha < (a-c)/5$, the AA anticipates that this first merger will be followed by a second merger that will give rise to a perfectly symmetric duopolistic structure. Therefore, the right comparison is not between $CS(\frac{2}{4})$ and $CS(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4})$, which is what a myopic authority would do, but rather the first merger will be authorised if the following inequality holds:

$$CS(\frac{2}{4}, \frac{2}{4}) = \frac{2}{9} (a-c-2\alpha)^2 \geq CS(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}) = \frac{8}{25} (a-c-4\alpha)^2, \quad (40)$$

which, as can be easily checked, holds if $\alpha \geq (a-c)/14$, or $\alpha \gtrsim .0714286(a-c)$. Therefore, in the interval we consider here, the first merger will be allowed.

3. If $\alpha < (a-c)/14$, the AA anticipates that the first merger will not be followed by another,²² implying that the first merger will be authorised if:

$$CS(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}) = \frac{1}{32} (3(a-c) - 10\alpha)^2 \geq CS(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}) = \frac{8}{25} (a-c-4\alpha)^2. \quad (41)$$

But we know from section 3 (in particular, from eqs. (15) and (16)) that this inequality is always false in the interval considered. Therefore, the merger will not be authorised.

Case 2 is the most interesting among those analysed here. As can be seen from Figure 2, our result implies that the merger will be authorised *even in the area where* $(a-c)/14 \leq \alpha < 3(a-c)/22$ and $\tilde{f} \leq f < \bar{f}$, that corresponds to mergers blocked by a myopic AA under an efficiency offence.

The comparison with section 3 shows that when $\alpha \in [(a-c)/14, 3(a-c)/22]$ and $f \geq \tilde{f}$, a myopic AA would want to block a merger by using an *efficiency offence* argument, but a forward looking AA would authorise the same merger because it expects that the outsiders would react by merging in their turn, thus leading to a market structure that is associated with a higher consumer welfare. In other words, having an AA that, in making a decision about a given merger, takes fully into account the reactions of firms in response to this merger, avoids the mistake of blocking some mergers in which the outsiders are expected to react by merging too, thus avoiding exiting the industry and giving rise to a final market structure where consumer welfare is enhanced.

Analysis of Stage 1 In the *first stage* of the game, two randomly selected firms in the status quo industry structure are given the opportunity to decide whether or not to merge. As explained above, there are no administrative costs of submitting a merger to the AA for approval. Thus, when firms anticipate

²² From (36), one has that a defensive merger would be blocked by the AA at stage 4 when $\alpha < (a-c)/14$.

that a merger will be blocked, they are indifferent between submitting or not the merger to the AA.

Three cases are relevant here:

1. If $\alpha \geq (a - c)/5$, firms anticipate that the first merger will be followed by a merger by outsiders, and eventually by a merger grouping the whole industry. Therefore, the first merger will be proposed if:

$$\Pi(1) = \frac{1}{2} \left[\left(\frac{a - c - \alpha}{2} \right)^2 - 4f \right] \geq 2\Pi\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = 2 \left[\left(\frac{a - c - 4\alpha}{5} \right)^2 - f \right]. \quad (42)$$

It is possible to check that this inequality is true in the interval considered: the merger will be proposed.

2. If $(a - c)/14 \leq \alpha < (a - c)/5$, firms anticipate that if the first merger is approved, then the outsiders will react by merging in their turn, thus leading to a symmetric duopoly market structure, $\{\frac{2}{4}, \frac{2}{4}\}$.²³ As a result, and making use of eqs. (5) and (26), one concludes that the selected firms will decide to submit the merger to the AA if

$$\Pi\left(\frac{2}{4}, \frac{2}{4}\right) = \left(\frac{a - c - 2\alpha}{3} \right)^2 - 2f \geq 2\Pi\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right) = 2 \left[\left(\frac{a - c - 4\alpha}{5} \right)^2 - f \right]. \quad (43)$$

The previous condition turns out to be satisfied for all $\alpha \in [0, \bar{\alpha})$, where $\bar{\alpha}$ is given by eq.(7), which implies that selected firms will always decide to merge and submit the proposal to the AA.

3. If $\alpha < (a - c)/14$, the first merger will not be followed by others. The merger is profitable if $\Pi_l\left(\frac{2}{4}, \frac{1}{4}, \frac{1}{4}\right) \geq 2\Pi\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{4}\right)$, a case we have already analysed in section 3, where we found this inequality holds for $\alpha \geq 0.020132(a - c)$.²⁴

This completes the analysis of the whole game, which is summarised by Figure 2.

Notice that in the area where $\alpha < (a - c)/6$ and $\tilde{f} \leq f < \bar{f}$ (that is, where an efficiency offence argument would push the AA to block the merger), the AA will authorise the merger submitted for its approval at stage 2. The reason for this is that the AA knows that along the equilibrium path, this merger will be followed by a defensive merger by the first merger outsiders. The defensive merger (but not a further merger which would lead to complete monopolisation

²³From (34), one knows that a defensive merger will always be allowed by the AA at the fourth stage. On the other hand, eq. (31) implies that a merger from a symmetric duopoly towards complete monopolisation will not be allowed by the AA (at the sixth stage) for the considered range of values for the efficiency parameter α .

²⁴See eqs. (21) and (22).

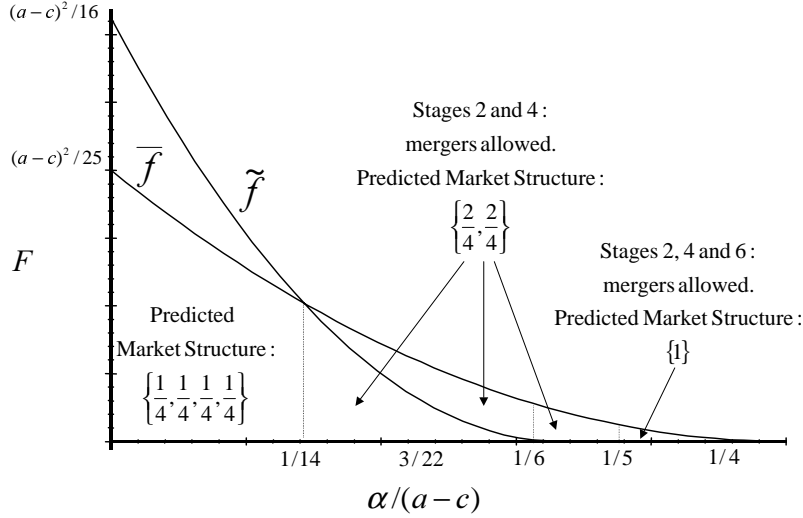


Figure 2: Equilibrium outcomes with a forward looking AA

of the industry) will also be authorised at stage 4, and consumer welfare will increase.

Furthermore, note that our dynamic mergers game where the AA plays an active role in authorising mergers predicts (in the case where the AA is forward-looking) a market structure which depends on the efficiency gains. The higher the scope for efficiency gains, the more concentrated the market structure that will arise from this dynamic merger game.

5 Conclusion

This paper has taken seriously the efficiency offence argument that has (rightly or wrongly) sometimes been attributed to the EC. We have showed that efficiency gains attained by merging parties are never detrimental in our model, even when they might lead to exit of competitors. This is for two reasons. First, in some cases there might be such important efficiency gains that they would lead to lower prices despite the lower number of firms in the industry (but even a myopic Antitrust Authority would recognise this argument). Second, and more important, we have showed that when there exist efficiency gains, a merger between two firms will be followed by a merger between its rivals, that also want to take the opportunity of saving costs. The final structure after the two mergers would be more concentrated but more efficient (if a further merger to monopoly is proposed, it will not be authorised unless efficiency gains are extremely high

- and in this case complete monopolisation would be beneficial too). A forward looking AA would anticipate this outcome, and rightly allow the first merger, knowing that it will be followed by a second one. A myopic AA would instead block the first merger whenever it puts (un-merged) rivals in such a competitive disadvantage that they would be forced to exit the industry.

Apart from hopefully clarifying the weak rationale behind efficiency offence stories, our main contribution here probably lies in the attempt of going beyond a static setting when analysing the effects of mergers, and in explicitly considering the role of Antitrust Authority in a dynamic merger game. Nevertheless, we are fully aware that the game we analyse here is an extremely simple one, and we plan to fully endogenise the merger process, by allowing any coalition among the firms in the industry to be possibly formed.^{25,26} Currently, we are also working to endogenise the game in another respect, which is to allow firms to attain efficiency gains through internal, rather than external growth, that is to let them choose between merging or investing in accumulating additional capacity.^{27,28}

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²⁵ For instance, after the first merger between two firms, there might either be a merger between the two outsiders, or a merger that involves an outsider and the two first merger insiders. This leads to a richer, but also more complex, game. Given our focus on the effects of efficiency gains, we have chosen here the simpler game within which our results could be showed.

²⁶ For endogenous mergers, see for instance Kamien and Zang (1990), Horn and Persson (2001 a,b) and Gowrisankaran (1999).

²⁷ In Gowrisankaran (1999), firms are also allowed to take investment decisions. The price to pay is that the analysis becomes extremely complex, though: analytical results are not obtained in his model.

²⁸ Obviously, in the real world there might well be situations where the outsiders of a merger - for whatever reasons - are unlikely to merge. This case was not considered here, but could be addressed properly in a model where the outsiders could respond by increasing their capacity by investing, rather than by merging.

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