

Efficiency Gains and Structural Remedies in Merger Control*

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Abstract

This paper studies the role of structural remedies in merger control in a Cournot setting where (endogenous) mergers are motivated by prospective efficiency gains. Every merger has to be submitted to an Antitrust Authority (AA) which, apart from blocking or unconditionally approving it, might approve a modified version of the concentration where divestitures are required. Some important merger policy implications can be drawn. First, when divestitures are required, the AA over-fixes, i.e., goes beyond the recreation of the level of competition that existed prior to the transaction. Second, by insisting in over-fixing, the AA may discourage firms to look for more efficient mergers. Finally, structural remedies are shown to open up new merger opportunities to firms.

Keywords: Merger remedies, Endogenous mergers, Efficiency gains, Failing Firm Defence.

JEL classification: D43, L13; L41; L51.

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1 Introduction

When a merger review is concluded, the Antitrust Authority (AA) has a number of options: to unconditionally approve the proposed concentration, to prohibit it, or to clear it subject to commitments. In Europe, The European Commission (EC) has rarely prohibited notified transactions outright. In addition, a considerable proportion of completed mergers that faced review by the EC has involved remedial conditions (the so called *merger remedies*) for particular harms.¹

Merger remedies can be grouped in two different categories. (i) *Structural remedies* modify the allocation of property rights and create new firms: they include the divestiture of an entire ongoing business, or partial divestiture. (ii) *Behavioral remedies* set constraints on the merged firms' property rights: they might consist of engagements by the merging parties not to abuse certain assets available to them, or to enter into specific contractual arrangements.

It is well known that behavioral remedies might be problematic and that the EC, in the Notice adopted on December 2000 outlining its policy in relation to merger remedies,² clearly expressed its preference for divestitures of entire business. The Notice emphasizes that the divested assets must consist of a viable business, meaning that the business must be able to compete effectively with the merged entity. Moreover, since the viability of the divested business depends on the purchaser's suitability to run the business effectively, the EC Notice also attaches great importance to the profile of the purchaser. Hence, generally, parties involved in divestiture commitments are required to divest the relevant assets to a Commission approved purchaser that must be identified prior to the consummation of the transaction (the so called 'up-front buyer requirement').³

¹For some simple summary statistics on the importance of merger remedies in the disposition of mergers by the EC see Motta, Polo and Vasconcelos (2003).

²EC, 'Notice on remedies acceptable under Council Regulation no. 4064/89 and under Commission Regulation no. 447/98', *Official Journal*, 2 March 2001, C 68/3.

³See EC Notice, paragraph 20.

Even though there is a wide literature on the effects of mergers on consumer and total welfare,⁴ economic theory has not devoted much attention to the study of merger remedies.⁵ In this paper we study the role of structural remedies in merger control by considering a Cournot setting where mergers are motivated by prospective efficiency gains and must be submitted for approval to an AA.

To the best of our knowledge, the only paper that studies structural remedies in a Cournot framework with efficiency gains is Medvedev (2004). There exist, however, three major differences between Medvedev's framework and the setting used in this paper. First, even though Medvedev also uses a cost structure inspired on the paper by Perry and Porter (1985), where the amount of fixed capital owned by a given firm determines its production costs, in his setting the antitrust agency can ask the merged entity to divest *any* subset of the acquired assets. In contrast, in this paper it is assumed that there is only a discrete number of possible divestitures which can be selected since, according to the EC Notice on merger remedies and as explained above, the divested activities (capital assets in our model) must consist of a viable business. This implies that, in equilibrium, firms may strategically opt for merger proposals in which they know the AA cannot require restructuring through divestitures. Second, in this paper merging parties are not exogenously given. The merger process is fully endogenized in the sense that we allow any coalition of firms in the industry to be possibly formed (and be part of a merger proposal).⁶ The merging parties anticipate the behavior of the AA towards the different merger proposals it can face and submit for approval the merger that yields them the highest expected

⁴A general discussion on the effects of mergers can be found in Motta (2004). For an economic analysis of the role of efficiency gains in determining the impact of merger on welfare see Farrell and Shapiro (1990).

⁵There is, however, a strand of the literature which argues that divestitures might exacerbate pro-collusive effects of mergers if the merger-plus-divestiture industry structure turns out to be more symmetric than the status quo one. See Compte, Jenny and Rey (2002) and Vasconcelos (2005).

⁶The current paper is, therefore, also related to the literature on endogenous mergers. Some important papers in this area are Gowrisankaran (1999), Kamien and Zang (1990), Fauli-Oller (2000) and Horn and Persson (2001 a,b).

profits. Lastly, Medvedev only considers situations where all firms in the industry are active both before and after the merger, while in this paper we also study the cases in which the outsiders to a merger may be pushed out of the industry if the merger is approved. This fact allows for the discussion of the use of the *failing firm defence* concept in merger control.

This paper also incorporates an active AA within a merger game. This AA works with an enlarged toolbox for merger control since, apart from deciding to block or unconditionally approve the merger, it can also decide to partially approve the merger, i.e., to approve the merger subject to the condition that some of the acquired assets are divested. This divestiture commitment can either give rise to the emergence of a new independent competitive entity or to the strengthening of an existing competitor not involved in the merger (merger outsider). The AA is also assumed to appraise the merger on the basis of its impact on consumer welfare. This is for two reasons. First, this assumption describes the current practice in the major antitrust jurisdictions.⁷ Second, this assumption allows us to keep the analysis extremely simple.

Within this framework, some important merger policy implications are obtained. First, when the AA has the possibility to partially approve a merger proposal, it turns out that the required divestitures of assets induce a more competitive outcome (in terms of lower equilibrium prices) after the merger-plus-divestiture than prevailed before in the status quo industry structure. This model, therefore, provides a theoretical rationale for the “over-fixing” effect which was noted by Farrell (2003). The intuition is simple. Endowed with a richer toolbox available for merger control, the AA uses the opportunity of the merger notifications to reshape the industry structure by reallocating the available assets in the industry so as to maximize consumer welfare. This implies that, as highlighted by Rey (2003), in the presence of merger remedies the AA’s task becomes closer to that of an

⁷See Motta and Vasconcelos (2004) for a discussion of the current standards used both in the US and in the EU to assess mergers. See also Lyons (2002) for arguments in favour of the consumer surplus standard in merger control.

industry-specific regulator. Second, even though in this setting a merger is motivated by prospective efficiency gains, the AA insistence in over-fixing may, in some circumstances, lead firms to give up seeking more efficient mergers. Lastly, the possibility of approving mergers subject to the condition that some assets are divested enables the AA to take decisions at a more specific level, which in turn allows some merger proposals that in the absence of structural remedies would be blocked, to be (partially) approved by the AA. In this sense, one can say that structural remedies open up new merger opportunities to firms.

The rest of the paper is organized as follows. In Section 2, the basic model is described and the equilibrium analysis of the proposed game is performed. Section 3 discusses the merger policy implications which are obtained with our simple formal setting. Finally, Section 4 offers some concluding comments.

2 The Model

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

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

where Q is the industry output.

What distinguishes firms is the amount of capital they own. The total supply of capital is assumed to be fixed to the industry (and equal to K units). Let k_i denote firm i 's capital holdings, where $k_i \in \{1, 2, \dots, K\}$. Hence, we normalize the smallest indivisible unit of capital assets to be one.

The cost function of a firm which owns k_i units of the industry capital and produces q_i units of output is given by:

$$C(q_i, k_i) = \frac{\alpha K}{k_i} q_i + k_i f, \tag{2}$$

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

This cost structure was proposed by Motta and Vasconcelos (2004).⁸ It assumes that each firm operates with a constant marginal cost of production, but the level of its marginal cost is a decreasing function of its capital holdings, k_i . In addition, it is assumed that there exists a plant specific fixed cost f , which has to be paid for each unit of the industry capital owned by the firm.⁹

This way of modelling the cost structure aims at capturing two distinct cost effects induced by a merger. First, a merger brings the capital of merging parties into a single larger entity and, therefore, gives rise to endogenous efficiency gains. The higher the value of α is, the stronger the efficiency gains induced by a merger are. 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.

As is shown in Appendix A, in a Cournot-Nash equilibrium with n active firms, firm i 's equilibrium quantity, the market price and the individual profits are respectively given by:

$$q(k_i; \mathbf{k}_{-i}) = \frac{1 - \alpha K \left(\frac{n}{k_i} - \sum_{j \neq i} \frac{1}{k_j} \right)}{n + 1}, \quad (3)$$

$$p(k_i, \mathbf{k}_{-i}) = \frac{1 + \alpha K \sum_{j=1}^n \frac{1}{k_j}}{n + 1}, \quad (4)$$

$$\Pi(k_i; \mathbf{k}_{-i}) = (q(k_i, \mathbf{k}_{-i}))^2 - k_i f, \quad (5)$$

where \mathbf{k}_{-i} is a vector of dimension $(n - 1)$ including the capital holdings of firm i 's rival firms.

In what follows, we assume that the total quantity of capital available in the industry is equal to four units ($K = 4$) and that this available capital is equally distributed amongst the four firms in the status quo industry

⁸This function is inspired on the one proposed by Perry and Porter (1985). In their framework firms' marginal cost is linear in output and mergers reduce variable costs.

⁹This specification is used to rule out further scale economies due to sharing of fixed costs.

structure. Assume also that there are at least two potential entrants (entrepreneurs) that have the expertise and required technology to enter in this market (at no cost) but do not have any unit of capital.

2.1 The Game

Before Cournot competition takes place at the market place, firms play the following three stage game with the AA. At the first stage, one firm at the status quo industry structure is randomly selected and has the opportunity to propose a merger to the AA. This firm may propose a merger with all or a subset of its rivals. Amongst all feasible mergers, the firm will propose the merger that gives it the highest expected profits. In the second stage, the AA decides whether to authorize or not the proposed merger. At this stage, the AA can take three different decisions: (i) accept the proposed merger; (ii) reject the proposed merger; and (iii) accept partially the merger, i.e., accept the merger subject to the condition that some units of the merged entity capital are divested to an incumbent rival firm or to a new firm which is attracted into the market. Finally, if a merger was proposed by the randomly selected firm and approved by the AA and if the outsiders to this merger would be pushed out of the industry as a result of the merger, then there is a third stage of the game where the remaining active firm can propose a *rescue merger* with the outsider exiting firms.¹⁰ This merger will always be cleared by the AA under the *failing firm defence* concept.¹¹

Two notes regarding the case in which the merger is partially approved by the AA are in order at this point. First, notice that in Europe the AA has a decisive role in the identification of the purchaser of the divested assets.¹²

¹⁰Notice that this last stage could also be seen as a situation where the remaining active firm has the opportunity to make a take-it-or-leave-it offer to buy the assets of the exiting (outsider) firms.

¹¹The *failing firm defence* is a legal and economic concept accepted by the EU and US competition authorities. According to this concept, a transaction can be regarded as a rescue merger if the competitive market structure would deteriorate in a similar fashion even if the merger did not take place (i.e. because the undertaking would exit the market). Approving a rescue merger is a way of keeping the assets of the exiting firms in productive use.

¹²As stressed in the EC Notice (paragraph 49), “in order to ensure the effectiveness

Hence, in what follows, it is assumed that when a modified version of the merger proposal is approved, the remedy chosen by the AA specifies the number of units of capital to be divested and also the purchaser of those units.¹³ Second, there is only a discrete number of possible divestitures which can be selected. This is for two reasons. On the one hand, there is an upper bound to the units of capital that can be divested. The randomly selected firm (at stage 1) cannot be asked at stage 2 to divest all the units it proposed to acquire; only a subset of those units can be divested. On the other hand, it is assumed that a firm can only be asked to divest multiples of the smallest indivisible unit of this asset, which we normalized to be one. The idea here is that of divesting a plant or a group of plants.¹⁴ This is motivated by the fact that the EC Notice on remedies emphasizes that the divested activities (capital assets in our model) must consist of a viable business, meaning that the business must be able to compete effectively with the merged entity.¹⁵ In addition, the Notice (paragraph 46) stresses that “in a typical divestiture commitment, the business to be divested normally consists of a combination of tangible and intangible assets, which could take the form of a pre-existing company or group of companies”.

Assumption 1 Let us assume that

$$\alpha < \frac{1}{4} \equiv \bar{\alpha}; \quad f < \left(\frac{1 - 4\alpha}{5} \right)^2 \equiv \bar{f}. \quad (6)$$

These two conditions are imposed to exclude the trivial case in which production is not viable at the status quo market structure.¹⁶

of the commitment, the sale to a proposed purchaser is subject to prior approval by the Commission. The purchaser is normally required to be a viable existing or potential competitor, independent and unconnected to the parties, possessing the financial resources, proven expertise and having the incentive to maintain and develop the divested business as an active competitive force in competition with the parties.”

¹³This is similar to the assumption in Medvedev (2004) that the AA has veto power over the choice of the purchaser of the divested units of capital.

¹⁴Capital assets are not perfectly divisible in our model.

¹⁵See EC Notice, paragraph 14.

¹⁶If $\alpha \geq 1/4$, then $dC(q_i, 1)/dq_i = 4\alpha \geq 1$, which in turn implies that the equilibrium quantity in the status quo industry structure is $q(1; 1, 1, 1) = 0$. Likewise, four firms would not co-exist if $f > \bar{f}$ since $\Pi(1; 1, 1, 1) = ((1 - 4\alpha)/5)^2 - f$ (see eq. (5)).

2.2 Equilibrium Analysis

In what follows, we seek the symmetric¹⁷ subgame perfect Nash equilibria (henceforth, SPNE) in pure strategies of the proposed two stage game, following the usual backward induction procedure.

Analysis of the third stage If the game arrives at the third stage, then the merged entity resulting from the merger proposal at stage 1 can propose a rescue merger with the exiting outsider firm(s).

If the initial merger involves two firms and the outsiders to this merger are constrained to exit the industry, then the merged entity will be interested in proposing a rescue merger if

$$\Pi(4) = \left(\frac{1-\alpha}{2}\right)^2 - 4f \geq \Pi(2) = \left(\frac{1-2\alpha}{2}\right)^2 - 2f, \quad (7)$$

which in turn implies that fixed costs should be sufficiently low:

$$f \leq \frac{\alpha(2-3\alpha)}{8} \equiv f_2^r. \quad (8)$$

If instead the initial merger involves three firms and the outsider to this merger is pushed out of the industry as a result of this merger, then the merged entity will propose a rescue merger with the single outsider (exiting) firm if

$$\Pi(4) = \left(\frac{1-\alpha}{2}\right)^2 - 4f \geq \Pi(3) = \left(\frac{3-4\alpha}{6}\right)^2 - 3f, \quad (9)$$

which turns out to be satisfied if

$$f \leq \frac{\alpha(6-7\alpha)}{36} \equiv f_1^r. \quad (10)$$

Note that in both cases just described, the AA would always approve the rescue merger. If a rescue merger is proposed, then a previous merger was approved and the outsider(s) to this merger would not be able to survive in the industry. In that case, the AA clearly prefers to have a monopolist with

¹⁷Firms endowed with the same amount of capital are assumed to have the same output and profit in equilibrium.

the entirety of industry capital units than a monopolist operating with only a subset of those units of capital (after the failing firm(s) have exited the industry).¹⁸

Analysis of the second stage If the game arrives at the second stage, the AA can be faced with three different merger proposals: a merger between two firms, a merger between three firms or a merger leading to complete monopolization of the industry. We analyze each of these three scenarios in turn.

SCENARIO 1: MERGER INVOLVING 2 FIRMS

If a merger between two firms is proposed, then the AA has to decide whether or not to allow this merger. Notice, however, that when faced with this merger proposal, the AA cannot ask for a divestiture as a condition to clear the transaction. The randomly selected firm at stage 1 is only buying 1 unit of capital and we have assumed that the acquiring firm cannot be asked to divest all the units that it bought. Hence, since the possibility of asking for a divestiture is absent, merger control in this scenario amounts to a yes/no decision by the AA.

As explained in Motta and Vasconcelos (2004), after a merger between two of the four firms in the status quo market structure, the induced post-merger market structure might be either $\{2, 1, 1\}$ or simply a monopoly market structure of the type $\{2\}$.¹⁹ If after the merger the two outsiders are able to make positive profits, the induced market structure is $\{2, 1, 1\}$. In that case, from eqs. (3) and (5), one has that the equilibrium levels of profits

¹⁸From (4), very simple algebra shows that, for any $\alpha > 0$, $p(4) < p(3) < p(2)$.

¹⁹By restricting attention to symmetric SPNE, we are not considering here the case in which only one outsider is forced to exit the industry if a merger involving two firms is approved (Appendix A in Motta and Vasconcelos (2004) is devoted to the analysis of this asymmetric scenario). Considering asymmetric equilibria would lead us to a richer but also more complex game. Hence, we have chosen to restrict attention to this simpler game within which our results could be shown.

of the merged entity and of each of the merger outsiders are respectively given by:

$$\Pi(2; 1, 1) = \left(\frac{1+2\alpha}{4}\right)^2 - 2f, \quad (11)$$

$$\Pi(1; 2, 1) = \left(\frac{1-6\alpha}{4}\right)^2 - f. \quad (12)$$

In addition, from eq. (4), it can be easily checked that the equilibrium market price is:

$$p(2, 1, 1) = \frac{1+10\alpha}{4}. \quad (13)$$

Two different reasons can, however, imply that, in the absence of a subsequent rescue merger, the two merger outsiders would be unable to make positive profits and would therefore exit the industry after the merger. First, if $\alpha \geq 1/6$, the merger gives rise to very high synergies and the two (smaller) outsider firms would be constrained to produce zero in equilibrium.²⁰ Second, if $f \geq \left(\frac{1-6\alpha}{4}\right)^2 \equiv \tilde{f}_2$, outsiders would not be able to recover their fixed costs in case the merger goes through.

The analysis of the equilibrium decisions of the AA in this scenario can be summarized as follows:

- If $\alpha < 1/6$ and $f < ((1-6\alpha)/4)^2 \equiv \tilde{f}_2$, then the two merger outsiders are able to make positive profits after the merger has taken place and the AA will decide to authorize the submitted merger only if

$$p(2, 1, 1) = \frac{1+10\alpha}{4} \leq p(1, 1, 1) = \frac{1+16\alpha}{5}, \quad (14)$$

which in turn implies that efficiency gains have to be sufficiently high:

$$\frac{1}{14} \simeq 0.071429 \leq \alpha < \frac{1}{6}. \quad (15)$$

²⁰From (3), it can be easily shown that $q(1; 2, 1) = \max\{0, (1-6\alpha)/4\}$.

- If $\alpha \geq 1/6$, then, in the absence of a rescue merger, the outsiders to the merger would exit the industry (efficiency gains are so high that they would produce zero in equilibrium). The AA, however, anticipates that, since $f \leq f_2^r$ in this region of parameter values (see eq. (8)), after this first merger, the merged entity will propose a rescue merger with the (exiting) outsiders firms, leading to a final equilibrium market structure where there is a monopolist owning the entirety of industry capital. Therefore, the first merger will be approved by the AA if

$$p(4) = \frac{1 + \alpha}{2} \leq p(1, 1, 1, 1) = \frac{1 + 16\alpha}{5}, \quad (16)$$

which holds for any $\alpha \geq 1/9$. Hence, for any $\alpha \in [1/6, 1/4)$, the AA approves the merger involving two firms since it anticipates that, along the equilibrium path, this merger will be followed by a rescue merger leading to a final market structure with a monopolist owning the entirety of industry capital and where consumer surplus is higher than the one in the status quo industry structure.

- Lastly, if $\alpha < 1/6$ and $(\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2 \leq f < \bar{f}$, then two different subcases should be distinguished:

1. If $f > f_2^r$, where f_2^r is given by eq. (8), the AA anticipates that this merger is not going to be followed by a rescue merger and the outsiders would be induced to exit the industry after the merger (since they would be unable to recover fixed costs). Hence, the AA would only approve the two-firms merger if the following condition holds:

$$p(2) = \frac{1 + 2\alpha}{2} \leq p(1, 1, 1, 1) = \frac{1 + 16\alpha}{5}, \quad (17)$$

which is satisfied if efficiency gains are sufficiently high, i.e., if

$$\alpha \geq \frac{3}{22} \simeq 0.13636. \quad (18)$$

However, in the region of parameter values we are considering in this subcase, the previous condition always fails to hold. As a

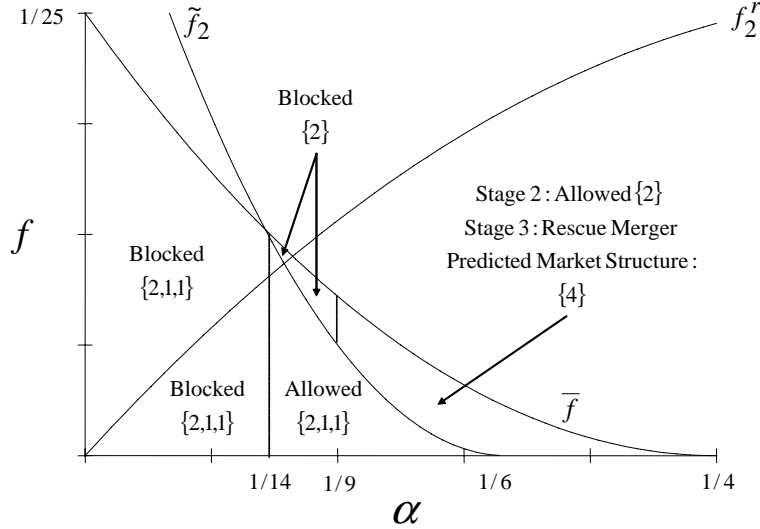


Figure 1: AA decisions - Scenario 1

result, the AA will decide to block the merger involving two firms in the status quo industry structure.

2. If instead $f \leq f_2^r$, then the AA anticipates that, in case of approval, the first merger is going to be followed by a rescue merger leading to complete monopolization of the industry. Hence, the AA will only approve the merger if $p(4) \leq p(1, 1, 1, 1)$ and from eq. (16) we know that this is the case only if $\alpha \geq 1/9$.

Figure 1 illustrates this result.

SCENARIO 2: MERGER INVOLVING 3 FIRMS

Suppose now that there is a merger proposal between three of the four firms in the industry. If the merger is approved by the AA, then a larger (and, hence, more efficient) firm is created, owning 3 units of the industry

capital. From (3), one has that in the post-merger Cournot equilibrium, the output levels of the merged entity and of the outsider firm are respectively given by:

$$q(3; 1) = \frac{4\alpha + 3}{9}, \quad (19)$$

$$q(1; 3) = \max \left\{ 0, \frac{3 - 20\alpha}{9} \right\}. \quad (20)$$

Remark 1 $q_s = 0$ if $\alpha \geq 3/20$.

Hence, if the merger gives rise to very high synergies, the (smaller) outsider firm is constrained to exit the market.

Suppose for the moment that $\alpha < 3/20$. From the equilibrium outputs above, one can obtain by substitution the equilibrium levels of profits for the merged entity and for the merger outsider:

$$\Pi(3; 1) = \left(\frac{4\alpha + 3}{9} \right)^2 - 3f, \quad (21)$$

$$\Pi(1; 3) = \left(\frac{3 - 20\alpha}{9} \right)^2 - f. \quad (22)$$

In addition, from (4), we may conclude that the equilibrium price is given by:

$$p(3, 1) = \frac{3 + 16\alpha}{9}. \quad (23)$$

Notice that if a merger between three of the four firms in the status quo market structure is unconditionally approved, then there are three possible induced market structures: $\{3, 1\}$, $\{3\}$ and $\{4\}$. In particular:

- (i) If $\alpha < 3/20$ (see Remark 1) and $f < ((3 - 20\alpha)/9)^2 \equiv \tilde{f}_3$, then from (22) it is clear that the outsider firm is able to make positive profits in equilibrium. The induced market structure is therefore a duopoly of the type $\{3, 1\}$, and firms equilibrium profits are given by eqs. (21) and (22).

(ii) If instead $\alpha \geq 3/20$ and/or $f \geq ((3 - 20\alpha)/9)^2 \equiv \tilde{f}_3$, then a three-firms merger will always induce a final monopoly industry structure. The monopolist can, however, own either 3 or 4 units of the industry capital. These two situations are discussed in turn. First, if a rescue merger is not proposed after the first merger, then the outsider firm is constrained to exit the industry and the resulting market structure is a monopoly of the type $\{3\}$. Second, if the merged entity proposes subsequently a rescue merger so as to buy over the exiting unit of capital belonging to the outsider firm, the induced market structure is composed of a monopolist owning the entirety of the industry capital, $\{4\}$.

We now turn to the study of the AA decisions when faced with a merger proposal involving three firms in the status quo industry structure.

When a merger involving three firms is submitted to the AA for approval, there are two possible divestitures that can be selected by the AA as a condition to clear the merger. In both cases, 1 unit of capital is divested. If this unit of capital is divested to the outsider of the proposed merger, then the induced market structure is $\{2, 2\}$. If instead the AA requires that the unit of capital is divested to an entrant, then the ex-post merger market structure will be a triopoly of the type $\{2, 1, 1\}$. Let us start by comparing these two feasible divestitures from a consumer welfare point of view. Making use of (4), very simple algebra shows that:

$$p(2, 2) = \frac{1 + 4\alpha}{3} \leq p(1, 1, 1, 1) = \frac{16\alpha + 1}{5} \text{ for } \alpha \geq 1/14, \quad (24)$$

$$p(2, 2) = \frac{1 + 4\alpha}{3} \leq p(2, 1, 1) = \frac{1 + 10\alpha}{4} \text{ for } \alpha \geq 1/14, \quad (25)$$

$$p(2, 2) = \frac{1 + 4\alpha}{3} \leq p(2) = \frac{1 + 2\alpha}{2} \text{ for } \alpha \leq 1/2, \quad (26)$$

$$p(2, 2) = \frac{1 + 4\alpha}{3} \leq p(3) = \frac{3 + 4\alpha}{6} \text{ for } \alpha \leq 1/4, \quad (27)$$

$$p(2, 2) = \frac{1 + 4\alpha}{3} \leq p(4) = \frac{1 + \alpha}{2} \text{ for } \alpha \leq 1/5, \quad (28)$$

and, finally,

$$p(3, 1) = \frac{3 + 16\alpha}{9} \leq p(1, 1, 1, 1) = \frac{16\alpha + 1}{5} \quad (29)$$

if efficiency gains are sufficiently high, i.e., if

$$\alpha \geq \frac{3}{32} \simeq 0.09375. \quad (30)$$

Now, making use of the above conditions, two different cases should be distinguished:

- If $\alpha \in [1/14, 1/6)$ and $f < (\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2$, then the AA can either select a divestiture to the merger outsider (leading to a duopoly symmetric industry structure of the type $\{2, 2\}$) or a divestiture to an entrant, in which case the induced market structure is $\{2, 1, 1\}$ (since both the new entrant and the merger outsider are able to make positive profits in equilibrium). However, from eq. (25), we have that in this range of parameter values $p(\frac{2}{4}, \frac{2}{4}) \leq p(\frac{2}{4}, \frac{1}{4}, \frac{1}{4})$, which in turn implies that the AA will opt for a divestiture to the merger outsider.²¹

- If, instead,

– (i) $\alpha \geq 1/6$, or

– (ii) $\alpha < 1/6$ and $(\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2 \leq f < \bar{f}$,

the AA anticipates that if a divestiture to an entrant is required, then neither the new firm nor the outsider to the proposed merger are able to make positive profits and compete with the merged

²¹At this point, one should also check that the rival (outsider) firm has an interest to buy the divested unit of capital. In case the outsider firm buys the divested assets, then its profit in the market structure induced by the merger-plus-divestiture equals $\Pi(2; 2) = ((1 - 2\alpha)/3)^2 - 2f$ (see eqs. (3) and (5) for the derivation of this profit). If instead the same divested assets are bought by an entrant, then the outsider firm expects to earn $\Pi(1; 2, 1) = ((1 - 6\alpha)/4)^2 - f$ (see eq. (12)). Now, very simple algebra shows that in the region of parameter values considered in assumption 1, it is always the case that $\Pi(2; 2) > \Pi(1; 2, 1)$, which in turn implies that the outsider firm always has an interest to buy the divested unit of capital.

entity. This in turn implies that if this remedy is selected, two units of the capital asset would exit the industry, unless a rescue merger takes place in stage 3. As shown above, a rescue merger involving two exiting units of the industry capital would be proposed (and approved) only if fixed costs are sufficiently low, i.e., if $f \leq f_2^r$, where f_2^r is given by condition (8). Two subcases should then be considered. First, if $f > f_2^r$, then a rescue merger would not take place and the market structure induced by the merger-plus-divestiture to an entrant would be $\{2\}$. Hence, whether a divestiture to the merger outsider or to a new entrant attracted into the market is preferred depends on whether $p(2, 2) < p(2)$, or otherwise. Now, from (26), it is clear that, in the subcase under study, the AA will opt for a divestiture to the merger outsider. Second, if instead $f \leq f_2^r$, then, in a situation where a divestiture to an entrant is selected by the AA, a rescue merger would be subsequently proposed (and approved), leading to a final market structure where a monopolist owns the entirety of the industry capital. If this is the case, then the AA will prefer a divestiture to an entrant to a divestiture to the merger outsider only if $p(4) < p(2, 2)$. Making use of eq. (28), one concludes that a divestiture to an entrant is preferred only if $\alpha > 1/5$.

Figure 2 summarizes this result.

To conclude the analysis of Scenario 2, we now turn to the study of the decision by the AA on whether to approve unconditionally the proposed merger or to partially approve it. Three different cases should be addressed, as illustrated by Figure 3.

- If $\alpha \in [1/14, 3/20)$ and $f < ((3 - 20\alpha)/9)^2 \equiv \tilde{f}_3$, then if the merger is unconditionally approved, the outsider to the merger is able to survive in the industry. In addition, in case a divestiture is required as a condition to approve the proposed merger, the AA always prefers a divestiture to the outsider to a divestiture to an entrant (see Figure

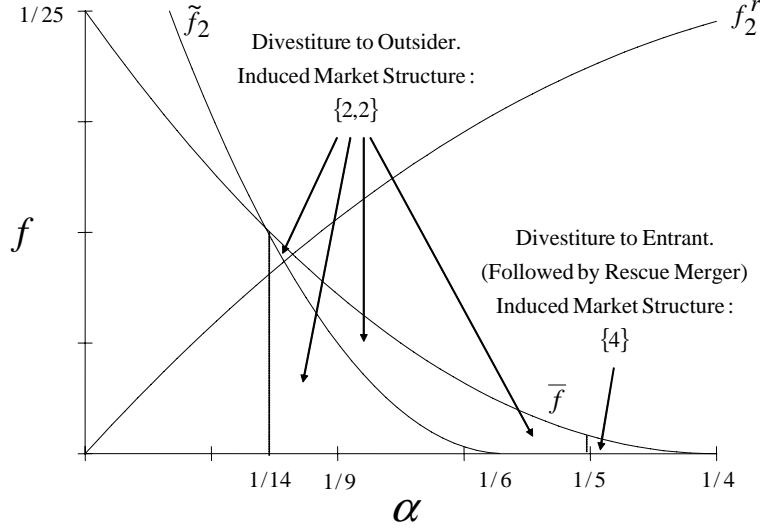


Figure 2: AA choice between divestitures - Scenario 2

2). This implies that the proposed merger involving three firms will be unconditionally approved if:

$$p(3, 1) = \frac{3 + 16\alpha}{9} \leq p(2, 2) = \frac{1 + 4\alpha}{3}. \quad (31)$$

The previous condition, however, always fails to hold. This in turn implies that in this region of parameter values, the AA will always (partially) approve the merger subject to the condition that 1 unit of capital is divested to the merger outsider. The induced market structure will then be $\{2, 2\}$.

- If $\alpha < 1/5$ and $\tilde{f}_3 \leq f < \bar{f}$, then the AA knows that, in case the merger is partially approved, the AA requires that 1 unit of capital is divested to the merger outsider and the induced market structure will be a symmetric duopoly of the type $\{2, 2\}$. In case, however, the AA unconditionally approves the merger, then, in the absence of a

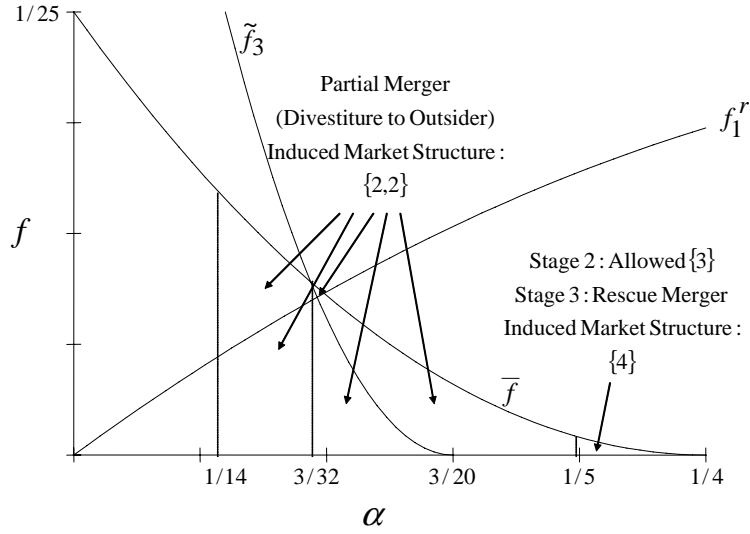


Figure 3: AA decisions - Scenario 2

subsequent rescue merger, the outsider firm would be pushed out of the industry. So, two different scenarios should be considered:

1. If $f \leq f_1^r$, where f_1^r is given by eq. (10), in case the first merger is unconditionally approved by the AA, a subsequent rescue merger takes place and the induced market structure is a monopoly of the type $\{4\}$. However, since in the region of parameter values we are considering in this scenario $p(2,2) < p(4)$ (see eq. (28)), the AA will decide to approve the first merger subject to the condition that one unit of capital is divested to the merger outsider, leading to a merger-plus-divestiture market structure of the type $\{2,2\}$.
2. If $f > f_1^r$, then a rescue merger would never follow the first (unconditionally approved) merger and, therefore, the AA would only approve unconditionally the merger if $p(3) \leq p(2,2)$. However, from (27), we know that the previous condition is false for

any parameter value in the region defined by assumption 1. This in turn implies that the AA will again authorize the proposed merger but subject to the condition that 1 unit of capital is divested to the merger outsider (and the induced market structure will be $\{2, 2\}$, as in the previous case).

- If instead $\alpha \geq 1/5$, the AA has two options. First, it can approve the merger unconditionally, anticipating that this merger will be followed by a rescue merger leading to a final market structure of the type $\{4\}$, since $f \leq f_1^r$ whenever $\alpha \geq 1/5$ (see eq. (10) and Figure 3). Second, it can partially approve the merger subject to the condition that one unit of capital is divested to an entrant. However, both this entrant and the merger outsider will not be able to survive in the market, which in turn implies that a rescue merger will follow the (partially approved) merger and the final industry structure will again be a monopolist owning the entirety of the industry capital. The AA is therefore indifferent between the two options. In what follows we assume that in this case the AA will unconditionally approve the first merger, anticipating that a subsequent rescue merger between the merged entity and the outsider to the first merger (which owns a single unit of capital) will occur.

SCENARIO 3: MERGER TO MONOPOLY

Suppose now that the randomly selected firm (at stage 1) proposes a merger to the AA leading to complete monopolization of the industry. If this is the case, then the AA has to choose between approving the proposed merger unconditionally, reject the merger and approve the merger partially. There are three possible partial mergers since the AA can select in this case 3 possible divestitures: (i) divestiture of 2 units of capital to an entrant (leading to the market structure $\{2, 2\}$); (ii) divestiture of 1 unit of capital to an entrant (leading to a duopoly market structure of the type $\{3, 1\}$ or

to a monopoly market structure, depending on whether the new entrant is able or not to make positive profits when operating with the acquired assets, respectively), and (iii) divestiture of 1 unit of capital to a first entrant and 1 unit of capital to a second entrant (leading to a duopoly market structure of the type $\{2, 1, 1\}$ or to a monopoly industry structure, depending on whether the entrants will be able to operate profitably or not with the unit of capital which is allocated to each of them).

If we start by studying the AA preferences over the three possible divestitures just described, we could describe the AA preferences with a figure very similar to Figure 3. The conclusions would, therefore, be that:

- The AA will never choose to divest 1 unit of capital to a first entrant and 1 unit of capital to a second entrant;
- If $\alpha \in [1/14, 1/5]$ the AA prefers the divestiture of 2 units of capital to an entrant (leading to a symmetric duopolistic industry structure of the type $\{2, 2\}$);
- If instead $\alpha > 1/5$, the AA would be indifferent between unconditionally approving the merger and asking for a divestiture of 1 unit of capital to an entrant. If a divestiture is required, the entrant is not able to operate profitably with that unit in equilibrium and a rescue merger is going to follow the first (partially approved) merger where the merged entity resulting from the first merger buys back the divested unit of capital.

Knowing the AA preferences over the three possible partial mergers just described, we can now study the AA decision between fully approving the proposed merger to monopoly and partially approving it. Notice that when the proposed merger is unconditionally approved, then the resulting industry structure will be a monopolist with the entirety of industry capital, $\{4\}$. From eqs. (3) - (5), one can easily conclude that the monopolist's equilibrium

level of profit and the market price are, respectively, given by:

$$\Pi(4) = \left(\frac{1-\alpha}{2}\right)^2 - 4f, \quad (32)$$

$$p(4) = \frac{1+\alpha}{2}. \quad (33)$$

Now, from (28), we know that $p(2,2) \leq p(4)$ for $\alpha \leq 1/5$. Hence, the final decision taken by the AA when faced with a proposal of a merger to monopoly is as follows:

- If $\alpha \in [1/14, 1/5]$ the AA approves the merger subject to the condition that 2 of the industry capital are divested to an entrant which is attracted into the market and a perfectly symmetric duopolistic structure is created;
- If instead $\alpha > 1/5$, efficiency gains are so strong that the AA decides to unconditionally approve the merger since it gives rise to the best possible outcome for the society.

This result is illustrated in Figure 4.

Analysis of the first stage At the first stage, the randomly selected firm in the status quo industry structure is given the opportunity to propose a merger to the AA. Before proceeding with the equilibrium analysis, it must be pointed out that we assume that there are no administrative costs that the firm must incur if a merger is proposed to the AA. Hence, when firms anticipate that the merger will be blocked, they are indifferent between submitting it or not to the AA for approval.

Let us first consider the case in which $\alpha \in [1/14, 1/5]$. When this is the case, then from figures 3 and 4, one has that a merger between 3 or 4 firms in the status quo industry structure will never be unconditionally approved. If a merger between 3 firms is proposed, then at stage 2 the AA will require a divestiture of 1 unit of capital to the merger outsider and the induced market structure is a symmetric duopoly of the type $\{2, 2\}$. If instead a merger to

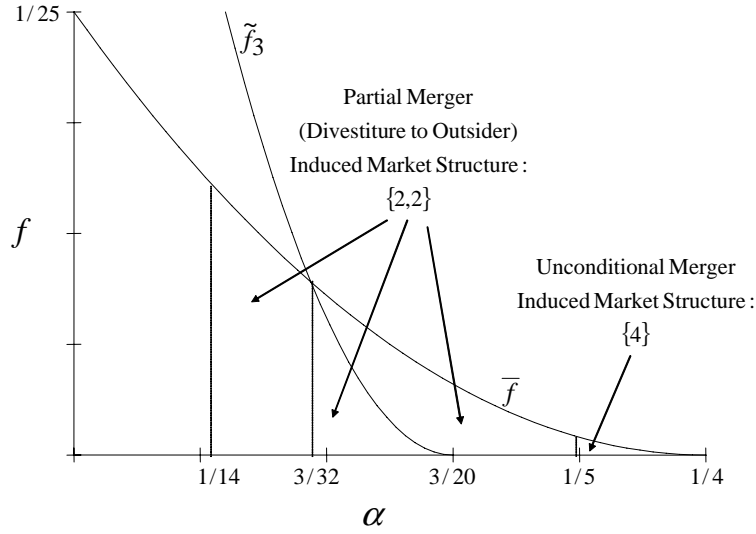


Figure 4: AA decisions - Scenario 3

monopoly is submitted, firms anticipate that in the following stage the AA will require that 2 units of capital are divested to a new entrant which is attracted into the market, and the induced market structure will again be $\{2, 2\}$. Making use of eq. (5), simple algebra shows that firms' equilibrium profits in this duopoly industry structure are given by:

$$\Pi(2; 2) = \left(\frac{1 - 2\alpha}{3} \right)^2 - 2f. \quad (34)$$

Hence, at stage 1, the randomly selected firm is indifferent between proposing a merger involving 3 firms or all firms in the status quo industry structure since the merger-plus-divestiture induced industry structure will be the same in both cases. The firm may, however, opt for a merger involving two firms only (scenario 1) and the corresponding AA decisions in that case are illustrated in Figure 1. So, combining the results illustrated in Figures 1, 3 and 4, one concludes that three different subcases should be distinguished (when we have that $\alpha \in [1/14, 1/5]$):

- (i) If $\alpha \in [1/14, 1/6)$ and $f < ((1 - 6\alpha)/4)^2 \equiv \tilde{f}_2$, then if there is a two-firms merger proposal, the AA will, as explained above, unconditionally approve it and, if this merger takes place, the two merger outsiders are able to make positive profits in equilibrium. Hence, in this region of parameter values, the randomly selected firm will prefer to submit a merger proposal involving two firms to a merger proposal involving 3 or all firms in the status quo industry structure if (see eqs. (11) and (34)):

$$\Pi(2; 1, 1) = \left(\frac{1+2\alpha}{4}\right)^2 - 2f \geq \Pi(2; 2) = \left(\frac{1-2\alpha}{3}\right)^2 - 2f, \quad (35)$$

which turns out to be satisfied for all $\alpha \in [1/14, \bar{\alpha}]$.²²

Hence, in this region of parameter values, the randomly selected firm will always decide to submit a merger involving two firms to the AA.

- (ii) If $\alpha \in [1/9, 1/5]$ and $(\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2 \leq f < \bar{f}$, then, as explained above, if there is a two-firms merger proposal, the AA unconditionally approves it since it anticipates that this first merger is going to be followed by a rescue merger leading to complete monopolization of the industry, {4}. Thus, the randomly selected firm will, in this region of parameter values, submit a two-firms merger to the AA for approval rather than a merger involving an higher number of merging parties if the following condition holds:

$$\Pi(4) = \left(\frac{1-\alpha}{2}\right)^2 - 4f \geq \Pi(2; 2) = \left(\frac{1-2\alpha}{3}\right)^2 - 2f, \quad (36)$$

which in turn implies that fixed costs should be sufficiently low

$$f \leq \frac{(\alpha + 1)(5 - 7\alpha)}{72}. \quad (37)$$

The previous condition, however, turns out to be always satisfied whenever $f < \bar{f}$ (assumption 1). This in turn implies that in this

²²It is worth remarking at this point that, making use of eq. (5), it can be easily shown that $\Pi(2; 1, 1) > 2\Pi(1; 1, 1, 1)$ in the region of parameter values we are considering in this case.

region of parameter values, the randomly selected firm will always decide, as in the previous case, to submit a merger proposal involving 2 firms to the AA. In the case under analysis, however, this first two-firms merger will induce a subsequent rescue merger leading to complete monopolization of the industry.²³

- (iii) Lastly, if $\alpha \in [1/14, 1/9)$ and $(\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2 \leq f < \bar{f}$, the randomly selected firm anticipates that the only two merger proposals which are going to be approved by the AA in the following stage are the ones involving three or all firms in the status quo industry structure. This randomly selected firm also knows that these two mergers are going to be partially approved by the AA (in the following stage) and that the induced market structure after the merger-plus-divestiture is always going to be a symmetric duopoly of the type $\{2, 2\}$, as explained above. Hence, this firm is indifferent between these two possible mergers since in both cases the merged entity final equilibrium profit is given by (34). Now, making use of (5), simple algebra shows that in the status quo industry structure, firms' individual profit equals:

$$\Pi(1; 1, 1, 1) = \left(\frac{1-4\alpha}{5}\right)^2 - f. \quad (38)$$

So, the randomly selected firm will propose a merger involving either three or all firms in the status quo industry structure if $\Pi(2; 2) \geq 2\Pi(1; 1, 1, 1)$. From (34) and (38), it is straightforward to show that this merger profitability condition is always satisfied for $\alpha < (1/4) \equiv \bar{\alpha}$ (assumption 1). Hence, in this region of parameter values, the merger (involving three or four firms) is always submitted for approval by the randomly selected firm.

Let us now turn to the analysis of the case in which $\alpha > 1/5$. In this region of parameter values, it is clear that the randomly selected firm is indifferent between a merger involving two, three or all firms in the status quo

²³From eq. (5) it is straightforward to check that $\Pi(4) \geq 4\Pi(1; 1, 1, 1)$ for all $\alpha < (1/4) \equiv \bar{\alpha}$ (assumption 1).

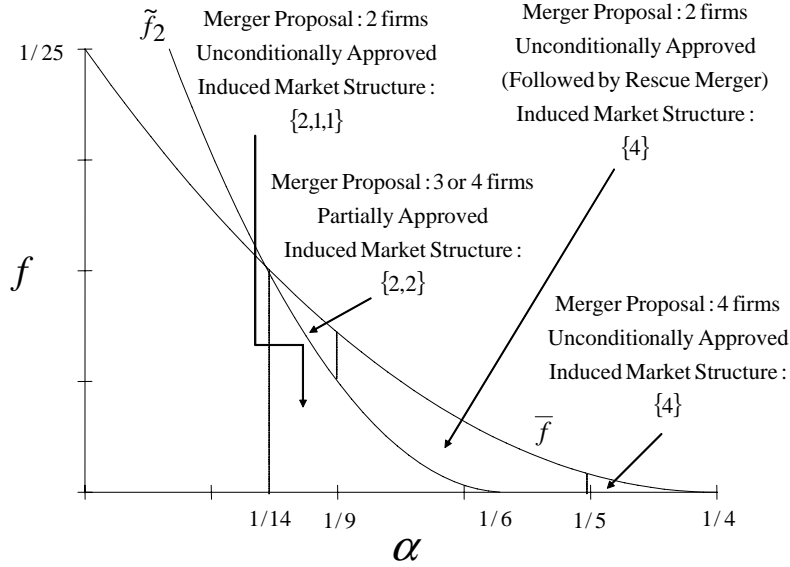


Figure 5: Equilibria of the game

industry structure. A merger involving all firms is always unconditionally approved by the AA. In the alternative scenarios where a merger involving two or three firms is proposed, the AA decides to unconditionally approve the notified concentration as well and, along the equilibrium path, a rescue merger follows the first merger. This implies that the capital belonging to the outsider firms ends up being absorbed by the merged entity resulting from the first merger. In all cases, the final market structure is always going to be a monopolist owning the entirety of the industry capital, $\{4\}$.

Figure 5 illustrates the full equilibrium outcome of this three-stage game.

3 Merger Policy Implications

The results of the present paper embody some important merger policy implications, which we summarize in this section.

First, by having an AA as an active player of the game seeking to maxi-

mize consumer welfare, it turns out that, whenever partial mergers are part of the equilibrium path, we end up with a *more* competitive outcome after the merger-plus-divestiture than prevailed before (in the status quo industry structure). Hence, this simple model provides a theoretical rationale for the “over-fixing” effect of (structural) remedies which was noted by Farrell (2003, p. 98). The intuition behind this result is simple. The AA waits for the merger proposal and uses this opportunity to make use of its enlarged toolbox available for merger control to reshape the industry structure by reallocating the available assets in the industry so as to maximize consumer welfare. This implies that, as pointed out by Rey (2003, p. 130), there is a change in the nature of merger control since “introducing the possibility of remedies ... puts the merger control office in a position close to that of an industry-specific regulator”.²⁴

Second, and perhaps more importantly, even though in this setting a merger is motivated by prospective efficiency gains, the AA insistence in over-fixing may induce firms to abandon merger proposals comprising more efficient mergers. The intuition is simple. In some circumstances, the randomly selected firm at stage 1 may strategically avoid over-fixing by opting for merger proposals where the acquired assets (being indivisible) cannot be partially divested. The following example illustrates this point. Making use of eqs. (11) and (21), it can be easily shown that for every $f < \bar{f}$ (assumption 1) $\Pi(3; 1) > \Pi(2; 1, 1)$. In addition, from (13) and (23), one may conclude that

$$p(3, 1) = \frac{3 + 16\alpha}{9} \leq p(2, 1, 1) = \frac{1 + 10\alpha}{4} \text{ for } \alpha \geq 3/26. \quad (39)$$

Hence, if we consider the region of parameter values such that $\alpha \in [3/26, 3/20)$ and $f < ((3 - 20\alpha)/9)^2 \equiv \tilde{f}_3$,²⁵ it is straightforward to conclude that if the AA decision amounted to a yes/no decision, the randomly selected firm would prefer to submit to the AA for approval a (more efficient) merger

²⁴It must be stressed here, however, that the AA cannot act on its own initiative to reallocate the assets. It has to wait for the merger proposal to be made.

²⁵When $\alpha \in [3/26, 3/20)$, simple algebra shows that $\tilde{f}_3 \leq \tilde{f}_2$.

involving three firms than a merger involving only two firms. Moreover, that three-firms merger would be approved by the AA (in the absence of structural remedies). In the presence of structural remedies, however, the firm does not submit a merger proposal involving three firms since it anticipates that the merger-plus-divestiture induced market structure will be a symmetric duopoly of the type $\{2, 2\}$ (see Figure 4), where the merged entity earns a profit which is lower than the one it obtains in the market structure $\{2, 1, 1\}$.

Third, notice that in the region of parameter values where $\alpha \in [1/9, 1/5]$ and $\tilde{f}_2 \leq f < \bar{f}$, not only asset indivisibility is used to avoid over-fixing,²⁶ but it is also strategically used to induce a two-steps merger process leading to complete monopolization of the industry. The randomly selected firms avoids over-fixing by submitting a two-firms merger and, since the outsiders to this merger would be unable to make positive profits in equilibrium, a rescue merger is subsequently proposed and approved under the failing firm defence concept. This rescue merger allows the merged entity resulting from the first merger to buy over the exiting capital belonging to the outsider firms.

Fourth, by enriching the toolbox available for merger control, structural remedies allow the AA to be much more specific in its final decisions. This in turn implies that some merger proposals which are now partially accepted, wouldn't be cleared if an unconditional decision had to be taken. To illustrate this point, consider the case of a three-firms merger proposal (scenario 2 above). Suppose first that the AA has to take an unconditional decision. Then, if $\alpha \in [1/14, 3/32)$, a merger involving three firms would never be approved by the AA since in this region of parameter values we have that $p(3, 1) > p(1, 1, 1, 1)$ (see eqs. (29) and (30)). However, if we now consider a situation where the AA can include structural remedies in its decisions, then we have seen that in this very same region of parameter values the

²⁶If an alternative merger involving three or all firms in the status quo industry structure is proposed, then the AA will only partially approve it and the market structure resulting from the merger-plus divestiture is (in both situations) a duopoly of the type $\{2, 2\}$ (see Figures 3 and 4).

three-firms merger is approved by the AA subject to the condition that 1 unit of capital is divested to the merger outsider (see Figure 3). Hence, the possibility of involving structural remedies in the merger decisions opens up new merger opportunities to firms.

Finally, notice that only in the region in which $\alpha \in [1/14, 1/9)$ and $(\frac{1-6\alpha}{4})^2 \equiv \tilde{f}_2 \leq f < \bar{f}$ structural remedies are used by the intervening AA so as to impose conditions to clear the merger and induce a merger-plus-divestiture market structure which is the socially optimal one.

4 Conclusion

If the analysis performed by an AA shows that the effect of a proposed merger will be to substantially lessen competition in the relevant market, the AA may still decide not to block the merger. It can approve a modified version of the merger proposal where merging parties adopt certain commitments to modify the notified concentration.

In Europe, for instance, the number of cases in which the EC has cleared a merger subject to remedial conditions that restructure the notified transaction has been much higher than the number of cases in which the proposed concentration was prohibited outright. Economic theory has, however, devoted very scarce attention to the study of merger remedies.

The present paper studies the role of structural remedies in merger control in a setting where firms compete *à la* Cournot in the product market and mergers are motivated by prospective efficiency gains. The strategic interaction between the firms and the AA is modelled as a dynamic game where: (i) the merger process is fully endogenized; and (ii) every merger has to be submitted for approval to an AA, which is an active player of the game and is endowed with an enriched toolbox for merger control: whenever a merger is proposed, the AA can decide to unconditionally authorize or block it, but it has also the possibility to approve the merger subject to the condition that some assets are divested to an AA approved purchaser (partially approve the merger).

Some important merger policy implications can be obtained with our simple formal setting. First, whenever partial mergers are part of the equilibrium path, the AA goes beyond recreating the level of competition that existed prior to the proposed transaction. The AA tends to demand divestitures to clear the merger proposal that will make the market more competitive than in the status quo industry structure (this represents the so called “over-fixing” effect of remedies). Second, the anticipation that the AA insists in over-fixing may, in some circumstances, lead the firms to refrain from seeking and submitting for approval more efficient mergers. Lastly, by enriching the toolbox available for merger control, structural remedies allow the AA to take decisions at a more specific level, which in turn implies that some mergers that, in the absence of structural remedies, would be blocked by the AA, end up being partially approved. Hence, structural remedies create new merger opportunities to firms.

A natural extension of the model developed in this paper would be to rule out the assumption that the industry capital is initially fully distributed so as to allow firms to enter into the industry with new capacity. For the purposes of this paper, however, models of this sort are left for further research.

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A The Asymmetric Cournot Equilibrium

Let c_i denote the marginal cost of firm i . Now, from Lehto and Tombak (1997), we have that in a n -firm Cournot equilibrium with (constant) asymmetric marginal costs (and no fixed costs) where the inverse demand is given by (1), the individual output, the market price and the individual profits are respectively given by:

$$q_i^* = \frac{1 - nc_i + \sum_{j \neq i} c_j}{n + 1}, \quad (40)$$

$$p^* = \frac{1 + \sum_{i=1}^n c_i}{n + 1}, \quad (41)$$

$$\pi_i^* = (q_i^*)^2. \quad (42)$$

In our setting, $c_i = \alpha K/k_i$ and firm i 's fixed costs are $k_i f$. Therefore, the specific form of the previous three functions (for the case in which n firms are active) is the following:

$$q(k_i; \mathbf{k}_{-i}) = \frac{1 - \alpha K \left(\frac{n}{k_i} - \sum_{j \neq i} \frac{1}{k_j} \right)}{n + 1}, \quad (43)$$

$$p(k_i, \mathbf{k}_{-i}) = \frac{1 + \alpha K \sum_{j=1}^n \frac{1}{k_j}}{n + 1}, \quad (44)$$

$$\Pi(k_i; \mathbf{k}_{-i}) = (q(k_i, \mathbf{k}_{-i}))^2 - k_i f, \quad (45)$$

where \mathbf{k}_{-i} is a vector of dimension $(n - 1)$ with the capital holdings of the rival firms.