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Cost-saving or Cost-enhancing Mergers: the Impact of the Distribution of Roles in Oligopoly

Preliminary version

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Abstract

We consider firms perfectly symmetrical on production costs in the pre-merger game but the cost of the merged entity may be amended due to the anti-competitive effects of the merger. The lack of empirical precision concerning the effect of the merger on production costs (Scherer, 1980 or Tichy, 2002) justifies our theoretical model in which we do not specify *a priori* the exact production cost in the post merger game. Two firms in Stackelberg oligopoly game take part in the merger. The aim of this paper is to identify under which conditions on the cost the merger is privately profitable and socially desirable when firms in the coalition are either leaders or followers. We show that a merger could remain profitable even if the merged entity suffers from efficiency losses and we identify the condition on efficiency gains below which the merger takes place with the exclusion of all rivals. Among all possible cases, a profitable merger between two firms of different roles (leader & follower) could potentially give rise to more efficiency losses than the one encompassing firms of the same role. Moreover, profitable mergers can induce either an increase or a decrease in social welfare except for the case where two leaders decide to merge. Consequently this paper argues that Competition Authorities must supervise more closely two-firm mergers including either one or two followers.

Keywords: Horizontal Merger, Efficiency gains, Efficiency losses, Stackelberg oligopoly, Market power
JEL classification: D43 ; L11 ; L13 ; L41

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1 Introduction

When horizontal mergers are motivated by the achievement of efficiency gains it is natural to assume that the production cost after the merger decreases. Cost-savings caused by the merger may arise from the combination of multiple factors: rationalization of production, economies of scale, economies of scope, purchasing economies and so on. One can also imagine that the merger give rise to efficiency gains by increasing the incentives of the merging parties to invest in cost-reducing R&D.

Nevertheless, the positive impact of horizontal mergers on efficiency is weakened by the increase in the monopoly power. When competition becomes softer, the incentives of companies to engage in cost reduction activities may be reduced (approach advocated by the proponents of the productive efficiency) and a horizontal merger with anti-competitive effects decreases the pressure to realize efficiency gains. In the case where the market price following a merger increases, the production cost of the merging entity may increase while keeping the market power unaltered. This impact of a merger on price is obtained when we assume that firms are engaged in quantities competition with homogenous products and when costs are symmetric and linear. In this contest, horizontal mergers imply a reduction in the number of competitors. As a result, the market price increases as well as the concentration degree[1] and the firm's market power. Nevertheless, changes in product market competition are likely to adversely affect managerial incentives (Brander and Spencer, 1983). Horizontal mergers may reduce the incentives of managers and workers to exert effort. If we suppose that the production cost of a firm reflects partially the effort deployed by a manager, the managerial contract which induces the manager to carry on the optimal level of effort is affected by the pressure of the product market competition (Hart, 1983). When the competition is softer, both the risk of bankruptcy and the layoff risk decrease, so it could imply indirectly a reduction in the managerial effort[2] and in the efficiency of the firm[3]. Furthermore, production inefficiency could stem from a conflict between corporate cultures, it could also arise from some difficulties in motivating workers in the newly merged entity. Mergers may also limit the ability of shareholders to provide the right incentives to managers by making it harder to engage in yardstick competition. Finally, horizontal mergers through their impact on the rivalry may weaken contractual relations within the merged company and indirectly damage their efficiency.

The question of efficiency gains related to horizontal mergers is widely discussed[4] whereas there is a consensus concerning their effects on the market

[1] From an empirical viewpoint, Schmalensee (1989) notes that the increase in markets concentration in many countries stems from mergers.

[2] this argument may be reversed if it is argued that the marginal returns of the entrepreneurial effort increases when the intensity of competition decreases (Schmidt, 1997)

[3] This type of argument can also be put forward in the case of a cartelization of the market.

[4] In empirical studies, it is suspected the achievement of efficiency gains in the event of horizontal merger when profits and sales increase (since the data on the costs are not directly

price. According to Scherer :*"an impressive accumulation of evidence points to the conclusion that mergers seldom yield substantial cost savings, real or pecuniary"* (Scherer, 1980, p.546 quoted by Levin, 1990, p.1238). Tichy (2002) observes that only 25% of mergers generate efficiency gains. In some studies, it has been also identified that firms involved in merger operations may register a decline in their market share (Mueller, 1985). This lack of empirical precision concerning the effect of the merger on production costs justifies our theoretical model in which the production cost of the merged entity is amended due to the merger. The exogenous uncertainty relating to the magnitude of cost variation in relationship with the merger interacts with both the private profitability and the social desirability of anticompetitive horizontal mergers. From the theoretical viewpoint, in a Cournot oligopoly game with incomplete information in efficiency gains, Amir et al,.(2009) consider that outsiders are uncertain about the merged entity's cost. They find that if the non-merged firms sufficiently believe that the merger will generate large enough efficiency gains, the two-firms merger will be profitable.

In our model, there are both leaders and followers within the industry. All firms bear the same marginal cost of production before the decision to merge. Considering that the merger can give rise to either efficiency gains or efficiency losses, there is uncertainty on what will be the production cost of the merged entity. We focus on all possible two-firm mergers and their effects on the profitability of the merging firms when the marginal cost incurred by the merging firms may vary after the decision to merge. We evaluate the magnitude on cost reduction/increase of a profitable merger according to the role of firms (followers and/or leaders) engaged in the coalition. We study also the impact of horizontal mergers on welfare.

A common feature of theoretical models on horizontal merger in Stackelberg games is that the profitability of mergers is examined in a context where there is no change in the marginal production cost. Under this assumption, several authors have shown that the private incentive to merge is clearly reinforced by the coexistence of leaders and followers in the industry even in the presence of linear cost. When a merged firm changes its behavior from a Cournot-Nash player to a Stackelberg leader player (Levin, 1990), the private incentive to merge is higher and antagonism between the private and the collective advantage of the merger disappears [5]. In a game where asymmetric roles among the firms in the pre-merger situation (Stackelberg leader and Stackelberg follower compete in homogeneous good market) are introduced[6], mergers can also improve welfare

available). One of the difficulties of this methodology is that it does not allow to distinguish between the effect of cost lowering and the effect of the increase in the market power.

[5]Profitable mergers can also generate a rise in social welfare

[6]The possibility of a merger in a generalized hierarchical Stackelberg model are examined by Hamada and Takarada (2007). They show that the incentive to merge is strengthened when the merger encompasses firms that are at different stages and make production decisions sequentially in the pre-merger situation.

and profits. For instance, when two followers decide to merge and when the newly merged entity behaves as a leader on the product market, the social welfare and merging firms' profits increase even without cost savings following the merger (Daughety, 1990). In Stackelberg markets with n rival firms and linear costs, two leaders rarely have an incentive to merge, nor do two followers when the new entity stays in the same category (Huck, Konrad and Mueller, 2001). The private incentive to merge is strongly enhanced when the coalition concerns a leader and a follower but such mergers lead to a decline of social welfare (Feltovich, 2001). When all firms in a Stackelberg game share the same convex cost, a two-firm merger between either two leaders or two followers[7] become profitable if a sufficient cost convexity is introduced (Heywood and McGinty, 2007). Escrihuela-Villar and Fauli-Oller (2008) assume that prior to the merger the leaders are more efficient than followers. They show that when the followers are inefficient enough, mergers among followers become profitable.

In this paper, we extend the theoretical literature dealing with the effects of horizontal mergers in Stackelberg games in two main directions. In the one hand, by considering that the merger introduces some uncertainty on what will be the cost of the newly merged entity. A merger brings on efficiency gains when the merged firm has a lower marginal production cost. Conversely, efficiency losses appears when a merged firm produces at a higher marginal cost than would separate entities do. In the other hand, by taking all possible two-firm mergers into account we compare the extent of efficiency losses related to beneficial mergers and to identify the necessary production efficiency leading to the market monopolization.

We show that some mergers could remain profitable even if the merger generates efficiency losses. The threshold value in efficiency losses which depart profitable mergers from unprofitable ones is the highest when the coalition gathers a leader and a follower and the merged entity behaves as a leader. Consequently, a profitable merger between two firms of different roles (leader & follower) could give rise to more potential efficiency losses than the one encompassing firms of the same role. On the opposite side, the threshold value in efficiency gains below which a merger implies the monopolization of the market (the exclusion of outsiders) is the highest when two leaders decide to merge. If we infer the easiness to merge from the magnitude in the cost variation allowing for profitable merger, then firms belonging to different types (leader & follower) are more prone to merge. When the merger gathers two firms sharing the same role in the oligopoly and in the absence of redistribution of roles, the welfare-raising mergers are not always the profitable mergers. Nevertheless when the merger stems from firms of different roles or contains two firms followers resulting in a newly merged leader (redistribution of roles), all the welfare-raising mergers are profitable but some profitable mergers can induce a decrease in welfare. Con-

[7]Perry and Porter(1985) have demonstrated that when firms are engaged in a Cournot game of the convexity of the function of cost reinforces the incentive to merge.

sequently, this paper argues that Competition Authorities must supervise more closely bilateral mergers which consist of either one or two followers.

The paper is organized as follows. Section 2 presents the model and specifies the subgame perfect equilibria for different types of mergers. Section 3 is devoted to a discussion on the private incentive to merge according to the parameter representative to magnitude in cost variation for the merged entity. An analysis in terms of welfare is carried out in section 4.

2 The Model

2.1 The pre-merger situation

We consider an industry composed of n initially active firms producing homogenous products who compete by setting quantity schedules. In a first stage, $m < n$ firms act as Stackelberg leaders and independently decide on their individual supply. In a second stage, $n - m$ Stackelberg followers decide upon their quantity after learning about the total quantity supplied by the leaders. Initially we assume $m \geq 2$ and $n \geq m + 2$, the strict inequalities ensure that in every cases the outsiders gather either leaders or followers in the post merger situation.[8]. All firms face the same constant average cost normalized to 1. The market price is determined by the linear inverse demand curve $P = a - Q$ where $a > 1$. The aggregate industry output is given by $Q = \sum_{i=1}^{n} q_i$ and q_i stands for the firm i's individual quantity. We have $Q = Q^l + Q^f$ with $Q^l = \sum_{i=1}^{m} q_i^l$ and $Q^f = \sum_{i=m+1}^{n} q_i^f$. The superscript 'l' stands for a leader and 'f' represents a follower.

The equilibrium is obtained by backward induction. At the second stage, each follower maximizes its profit (π_i^f) considering as given the production level of leader (Q_l), to find the subgame perfect Nash equilibrium for followers, we maximize the profits of followers for every possible value of q_i^l. The optimal production (q_i^f) of a follower firm results from:

$$\max_{q_i^f} \pi_i^f = (a - Q^l - Q^f - 1)q_i^f$$

Then the best-response function for a follower firm is shown by $q_i^f = a - 1 - Q^f - Q^l$. The aggregate output of all followers as a function of the output of leaders is then $Q^f = \frac{n-m}{n-m+1}(a - 1 - Q^l)$

At the first stage, a leader selects its profit-maximizing output (q_i^l) anticipating the best response function of each follower:

$$\pi_i^l = \left[a - 1 - q_i^l - Q_{-i}^l - \frac{n-m}{n-m+1}(a - 1 - Q_{-i}^l - q_i^l)\right] q_i^l$$

[8]The particular cases: both $m = 0$ and $m = n$ correspond to a Cournot industry, the firms are in the simultaneous game.

where $Q^l_{-i} = Q^l - q^l_i$

In the pre-merger situation, equilibrium outputs and price are then:

$$q^l = \frac{a-1}{m+1}$$
$$q^f = \frac{a-1}{(m+1)(n-m+1)}$$
$$P = \frac{a+m(n-m)+n}{(m+1)(n-m+1)}$$

The corresponding individual profits are:

$$\pi^l(n,m) = \frac{(a-1)^2}{(m+1)^2(n-m+1)}$$

$$\pi^f(n,m) = \frac{(a-1)^2}{(m+1)^2(n-m+1)^2}$$

Obviously, the distribution of roles among firms exhibits the first mover advantage: each leader benefits from higher market share and higher profit in the pre-merger game.

2.2 The post merger situation

Since we consider a quantity competition with homogenous product and linear costs, the bilateral merger means that one firm disappears from the market. *Ceteris paribus*, the market power increases in the post merger game. We want to capture the range of cost variation for merged firms allowing a profitable merger. Consequently, we assume that the production cost for firms engaged in the coalition varies in the amount $\triangle c$. The marginal cost of the newly merged entity becomes $1 + \triangle c$ while the non-merged firms' cost remains constant and equals to 1. When $\triangle c < 0$, the bilateral merger generates efficiency gains. This case corresponds to the usual argument which put forward the increase in productive efficiency generated by the merger itself. On the opposite side, if $\triangle c > 0$ the merger causes efficiency losses. We assume also the condition on the parameter a : $a > max\{1, 1 + \triangle c\}$.

In order to capture the impact of the roles' distribution of merging firms on the incentive to merge, we examine four scenarios : a merger between two leaders (case A), a merger between two followers (case B), a merger between two followers resulting in a newly merged leader (case C) and a merger between one leader and one follower resulting in a newly merged leader (case D).

Case A: a merger between two leaders

In the post merger situation, the industry is composed of $m-1$ leaders but still $n-m$ followers since the newly merged entity behave as a leader.

Given the best response function of followers, both the output ($\hat{q}_I^{l,A}$) that maximize the merged firm's profit ($\hat{\pi}_I^{l,A}$) and the output ($\hat{q}_O^{l,A}$) that maximize the leader outsiders' profits ($\hat{\pi}_O^{l,A}$) are obtained. The profit function is described respectively by

$$\hat{\pi}_O^{l,A} = (a - \hat{Q}^A - 1)\hat{q}_O^{l,A}$$
$$\hat{\pi}_I^{l,A} = (a - \hat{Q}^A - 1 - \triangle c)\hat{q}_I^{l,A}$$

where $\hat{Q}^A = (m-1)\hat{q}_O^{l,A} + \hat{q}_I^{l,A} + (n-m-1)\hat{q}_O^{f,A}$

We then obtain the following expressions for the equilibrium production of the leader insider ($\hat{q}_I^{l,A}$), of one leader outsider ($\hat{q}_O^{l,A}$) and of one follower ($\hat{q}_O^{f,A}$) :

$$\hat{q}_I^{l,A} = \frac{(a-1) - \big[(m-1)n - (m-2)m - 1\big]\triangle c}{m}$$
$$\hat{q}_O^{l,A} = \frac{(a-1) + (n-m+1)\triangle c}{m}$$
$$\hat{q}_O^{f,A} = \frac{(a-1) + (n-m+1)\triangle c}{m(n-m+1)}$$

When the merger generates efficiency gains, both leaders and followers outsiders restrict the production at equilibrium. The contraction of production is the highest for firms belonging to the category of leaders outsiders.

The price is:

$$\hat{P}^A = \frac{a - 1 + (n-m+1)(\triangle c + m)}{m(n-m+1)}$$

The profit of the newly merged entity:

$$\hat{\pi}_I^{l,A}(\triangle c) = \frac{\left[(a-1) - \big[(m-1)n - (m-2)m - 1\big]\triangle c\right]^2}{m^2(n-m+1)}$$

Case B: a merger between two followers

We consider that two followers take part in the merger. The distribution of roles in the industry is assumed not to be altered by the merger decision in the way merged entity behaves as a follower. The industry contains $n-1$ firms with m

leaders.

The merged entity produces ($\hat{q}_I^{f,B}$), where:

$$\hat{q}_I^{f,B} = \frac{a-1+\triangle c}{(n-m)(m+1)} - \triangle c$$

the equilibrium quantities of each category of outsider ($\hat{q}_O^{l,B}$ for one leader and $\hat{q}_O^{f,B}$ for one follower) are as follows:

$$\hat{q}_O^{l,B} = \frac{a-1+\triangle c}{m+1}$$
$$\hat{q}_O^{f,B} = \frac{a-1+\triangle c}{(m+1)\,(n-m)}$$

The market price is:

$$\hat{P}^B = \frac{a-1+(n-m)(m+1)+\triangle c}{(n-m)(m+1)}$$

The corresponding equilibrium profit of the newly merged follower is:

$$\hat{\pi}_I^{f,B}(\triangle c) = \frac{\left[a-1-((n-m)(m+1)-1)\triangle c\right]^2}{(n-m)^2(m+1)^2}$$

Case C: a merger between two followers then the merged entity behaves as a leader

Here, we consider a special type of merger wherein two followers merge and the result is a firm that behaviorally is a leader. As a result, there are $m+1$ firms that behave as leaders and in contrast $n-m-2$ followers. This case was examined by Daughety (1990) who found that a horizontal merger was potentially profitable for the merged firm in the absence of efficiency gains [9]. Here, we extend the analysis by considering a possible change on cost caused by the merger.

Let $\hat{q}_I^{l,C}$ and $\hat{q}_O^{l,C}$ be the leader's quantity conditional on being inside and outside the merger. We have:

$$\hat{q}_I^{l,C} = \frac{(a-1)-\left[m(n-m)+(n-2m-1)\right]\triangle c}{m+2}$$

[9] He also demonstrates that this type of merger might be advantageous from the point of view of social welfare.

$$\hat{q}_O^{l,C} = \frac{a-1+(n-m-1)\triangle c}{m+2}$$

A typical follower outside the merger produces:

$$\hat{q}_O^{f,C} = \frac{a-1+(n-m-1)\triangle c}{(m+2)(n-m-1)}$$

The equilibrium price:

$$\hat{P}^C = \frac{a-3+n(m+2)-m(m+3)+\triangle c(n-m-1)}{(m+2)(n-m-1)}$$

We then obtain the profit of the newly merged leader:

$$\hat{\pi}_I^{l,C}(\triangle c) = \frac{\Big[(a-1)-\big[m(n-m)+(n-2m-1)\big]\triangle c\Big]^2}{(m+2)^2(n-m-1)}$$

Case D: a merger between one leader and one follower then the merged entity behaves as a leader

The number of leaders is the same as that in the case B, but the number of leaders outside the merger equals to $m-1$. The quantity produced by the merged entity which behaves as a leader($\hat{q}_I^{l,D}$):

$$\hat{q}_I^{l,D} = \frac{a-1-m\triangle c}{m+1}$$

The quantities of one leader outsider($\hat{q}_O^{l,D}$) and of one follower outsider ($\hat{q}_O^{f,D}$):

$$\hat{q}_O^{l,D} = \frac{a-1+\triangle c}{m+1}$$
$$\hat{q}_O^{f,D} = \frac{a-1+\triangle c}{(m+1)(n-m)}$$

The equilibrium price:

$$\hat{p}^D = \frac{a - 1 + (n-m)(m+1) + \triangle c}{(n-m)(m+1)}$$

The profit of the newly merged leader ($\hat{\pi}_I^{l,D}$):

$$\hat{\pi}_I^{l,D}(\triangle c) = \frac{\left[a - 1 - m\triangle c\right]\left[(a-1) - ((n-m)(m+1) - 1)\triangle c\right]}{(n-m)(m+1)^2}$$

3 Private incentive to merge and market monopolization

The results from the previous section enable us to deal with conditions under which merger increases the profits of the merging parties. The incentive to merge is given by the comparison of the sum of profits earned by merging firms in pre-merger situation and the profit earned by the newly merged entity.

3.1 Case A

The profitability of the merger result from the sign of the variation in profits ($\Delta\Pi_I^{l,A}$):

$$\Delta\Pi_I^{l,A} = \hat{\pi}_I^{l,A}(\triangle c) - 2\pi^l(n,m)$$

The extend of the cost variation for merged firms interact with the private incentive to merge. We define $\triangle c_{sup}^A$ the threshold value of $\triangle c$ which separates profitable from unprofitable mergers. When $\triangle c^A < \triangle c_{sup}^A$ (respectively $\triangle c^A > \triangle c_{sup}^A$) we have $\Delta\Pi_I^{l,A} > 0$ (respectively $\Delta\Pi_I^{l,A} < 0$). We also define $\triangle c_{inf}^A$ as the value of $\triangle c^A$ below which outsiders are ruled out of the market. It is given by the conditions : $\hat{q}_O^{l,A} = 0$ and $\hat{q}_O^{f,A} = 0$. Note that when we have $\triangle c_{inf}^A < \triangle c^A < \triangle c_{sup}^A$, the merger is profitable and the two categories of outsiders remain on the market.

The exact expressions of these costs are given by

$$\triangle c_{inf}^A = \frac{1-a}{n-m+1}$$
$$\triangle c_{sup}^A = \eta_A + \omega_A - 1$$

with

$$\eta_A = \frac{(a-2) + \left[(m-1)n - (m-2)m\right]}{(m-1)(n-m+1)}$$
$$\omega_A = -\frac{m\sqrt{2}(a-1)}{(m^2-1)(n-m+1)}$$

A risk of exclusion of all outsiders (leaders and followers) exists if the efficiency gains arising from the merger are sufficiently high and if the market demand is sufficiently low. At the opposite, for $a > 2 - m + n$, the conditions $\hat{q}_O^{l,A} > 0$ and $\hat{q}_O^{f,A} > 0$ are verified regardless of merged firm's marginal cost. In such a case, the merger cannot lead to the exclusion of outsiders.

When $m > 2$, we have $\eta_A + \omega_A < 1$ implying that $\triangle c_{sup}^A$ is strictly less than 0. This ceiling on $\triangle c^A$ means that without efficiency gains none of two-firms merger is profitable. When no leader belongs to category of outsiders (m=2), $\triangle c_{sup}^A > 0$ thus the bilateral merger between two leaders is always profitable when $\triangle c = 0$ (in line with the result of Huck et al., 2001).

Result 1: *If two leaders are engaged in bilateral mergers:*
(i) profitable mergers could lead to market monopolization when the demand size is not too large ($a < n - m + 2$),
(i.i) mergers with efficiency losses remain profitable when no leader belongs to outsiders.

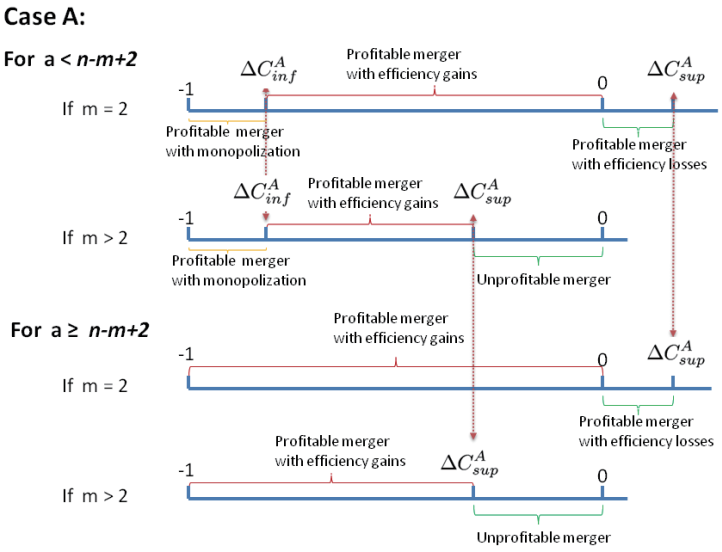

Figure 1: Cost-saving and cost-enhancing mergers in case A

The existence of leaders outside of merger ensures that mergers don't give rise to the efficiency losses.

3.2 Case B

The incentive to merge is described by

$$\Delta\Pi_I^{f,B} = \hat{\pi}_I^{f,B} - 2\pi^f(n,m)$$

The conditions related to a profitable merger ($\triangle c_{sup}^B$) and to the monopolization of the market ($\triangle c_{inf}^B$) are given by:

$$\triangle c_{inf}^B = 1 - a$$
$$\triangle c_{sup}^B = \eta_B + \omega_B - 1$$

with

$$\eta_B = \frac{a - 2 + (n-m)(m+1)}{(n-m)(m+1) - 1}$$
$$\omega_B = -\frac{\sqrt{2}(n-m)(a-1)}{m^3 - m^2 n + mn(n-1) + n^2 - 1}$$

Result 2: *If two followers are engaged in bilateral mergers:*
(i) profitable mergers could lead to market monopolization when the demand size is not too large ($a < 2$)
(i.i) merger with efficiency losses remain profitable when no follower belongs to outsiders.

As we have already noticed, profitable mergers between two leaders (case A) always generate efficiency gains when outsiders gather both leaders and followers ($m > 2$). In case of mergers between two followers, efficiency losses may appear when outsiders gather both leaders and followers ($m < n - 2$).

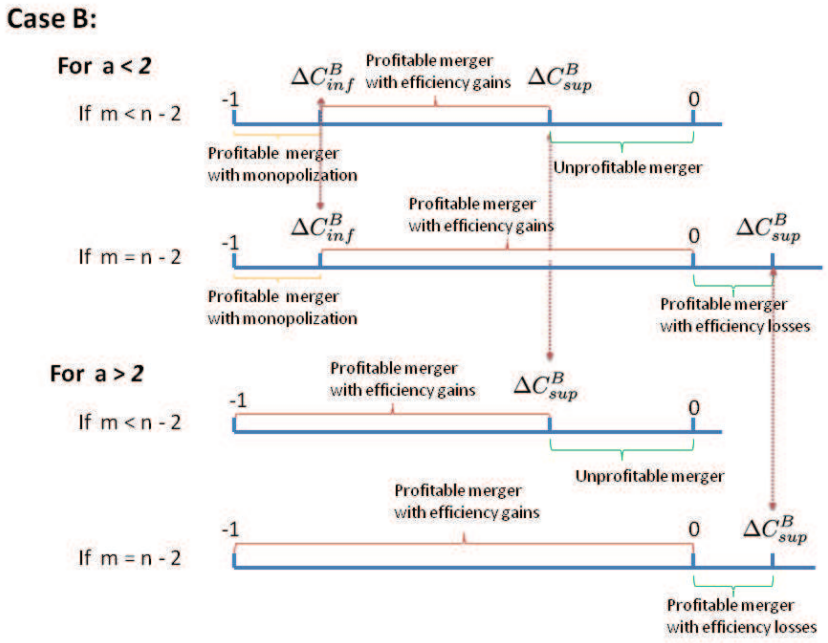

Figure 2: Cost-saving and cost-enhancing mergers in case B

3.3 Case C

The incentive to merge is given by the comparison of the sum of profits earned by two of the $n-m$ pre-merger followers and the profit earned by the newly merged entity:

$$\Delta\Pi_I^{l,C} = \hat{\pi}_I^{l,C}(\triangle c) - 2\pi^f(n,m)$$

Then we obtain boundaries of $\triangle c$ insuring a profitable merger ($\triangle c^C_{sup}$) and the monopolization of the market ($\triangle c^C_{inf}$):

$$\triangle c^C_{inf} = \frac{n-m-a}{n-m-1} - 1$$
$$\triangle c^C_{sup} = \eta_C + \omega_C - 1$$

with

$$\eta_C = \frac{a-2+\left[m(n-m)+(n-2m)\right]}{(n-m-1)(m+1)}$$
$$\omega_C = -\frac{(a-1)(m+2)}{(m+1)^2(n-m+1)}\frac{1}{\sqrt{n-m-1}}$$

We can notice that if we suppose $\triangle c = 0$ ($\triangle c^C_{sup} > 0$), a merger between two followers resulting in a new leader is always profitable. The outcome of Daughety (1990) is verified.

The merger in case B generates a firm of the same category and the value of $\triangle c$ should be less than 0. By contrast, the merger in case C yields a new leader and $\triangle c^C_{sup}$ is greater than 0. The merged firm counteracts the inefficiency on the cost by the first mover advantage.

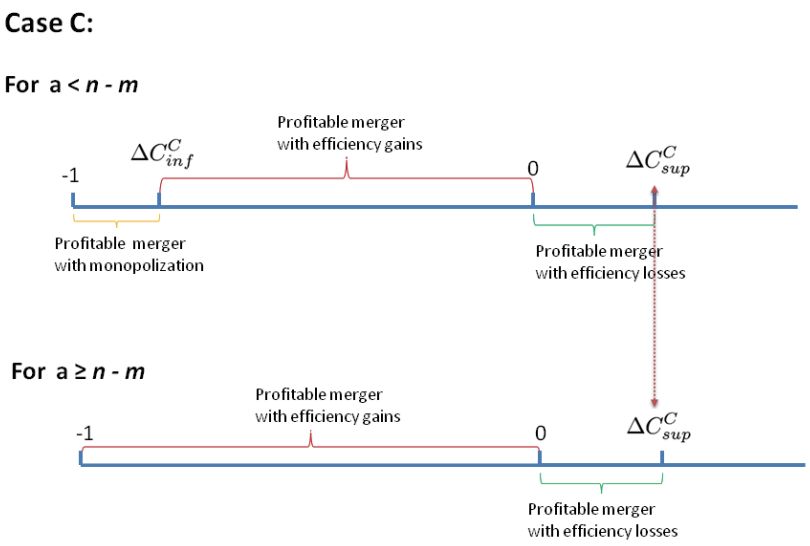

Figure 3: Cost-saving and cost-enhancing mergers in case C

In case of low demand ($a < 2 < n - m$), there is a risk of market monopolization in the post merger situation when the merged entity behaves as a leader (case C) but when the two merged followers continue to behave as a follower, the merger never excludes outsiders of the market even if efficiency gains are high. The reverse is true when demand is high ($a > n - m$).

3.4 Case D

Huck, Konrad and Muller (2001) observe that a merger between one leader and one follower leading to a leader increases the joint profits of firms independently of the number of competitors. If we suppose $\triangle c = 0$, we obtain the same result.

The private incentive to merge ($\Delta\Pi_I^{l,D}$) will be defined by the following expression:

$$\Delta\Pi_I^{l,D} = \hat{\pi}_I^{l,D}(\triangle c) - \pi^l(n,m) - \pi^f(n,m)$$

According to three conditions detailed before, then we have the expression of $\triangle c_{sup}^D$ and $\triangle c_{inf}^D$ where

$$\triangle c_{inf}^D = 1 - a$$
$$\triangle c_{sup}^D = \eta_D + \omega_D - 1$$

with

$$\eta_D = \frac{2m^3 + m^2(1-2n) - m(n-2) + n + a(1+m^2-n-mn) - 1}{2m(1+m+m^2-n-mn)}$$

$$\omega_D = \frac{(a-1)\sqrt{m^6 - 2m^5(2n+1) + m^4(6n^2+4n+3) - 4m^3(n^3+n) + m^2(n^4-4n^3+7) + 2m(n^4-2n+1) + (n^2-1)^2}}{2m[m^3 - 2m^2n + mn(n-1) + n^2 - 1]}$$

The outcome of case D is similar to the result in case C: the merger could leave out all of the outsiders when the demand is sufficiently small; it is also possible that a profitable merger with efficiency losses occurs. This contrast with the case A and the case B where the maximum boundary is always less than 1 (except $n - m = 2$ in case B).

Result 3: *If two followers or one firm of each category are engaged in bilateral mergers, mergers with efficiency losses remain profitable independently of the size of demand when the merged entity behaves as a leader.*

In the following section, we rank the parameters $\triangle c_{inf}$ and $\triangle c_{sup}$ in different scenarios.

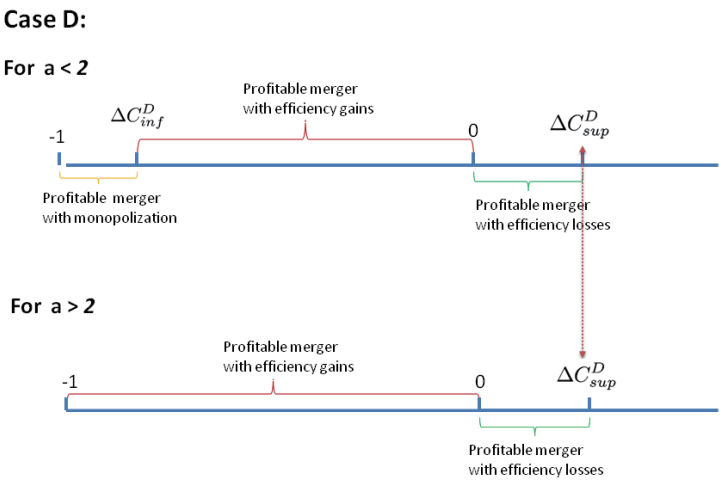

Figure 4: Cost-saving and cost-enhancing mergers in case D

4 Efficiency gain and efficiency loss levels

4.1 Ranking

We classify $\triangle c_{inf}$ and $\triangle c_{sup}$ in four different cases. $\triangle c_{inf}$ represents the threshold on the post merger marginal cost below which the merger leads to the monopolization. The larger the value of $\triangle c_{inf}$ is, the higher the risk of the merger with monopolization. We exclude $m = 2$ and $n - m = 2$ in order to ensure that in every cases outsiders gather either leaders or followers in the post merger situation.

$$\begin{aligned}
\triangle c^A_{inf} &= \frac{1-a}{n-m+1} \\
\triangle c^B_{inf} &= \triangle c^D_{inf} = 1-a \\
\triangle c^C_{inf} &= \frac{1-a}{n-m-1}
\end{aligned}$$

Result 4: *For all* $n \geq 5$, $\triangle c^A_{inf} > \triangle c^C_{inf} > \triangle c^B_{inf} = \triangle c^D_{inf}$

A merger between two leaders to form a new leader comes about the most probably compared to the three other cases. Note that whether the merger with monopolization or not depends also upon the parameter 'a'.

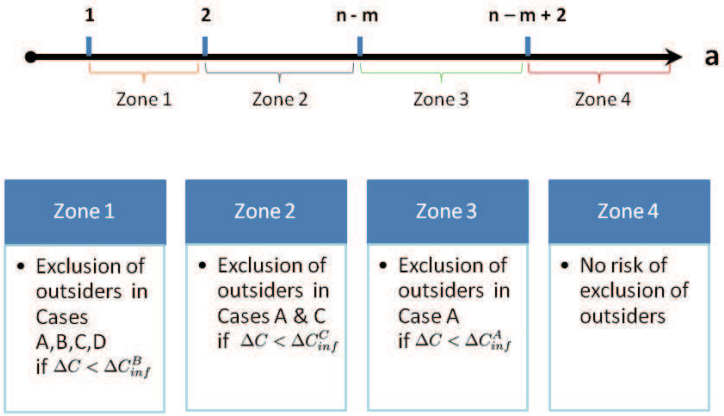

Figure 5: Possible market monopolization

We now turn to the analysis on $\triangle c_{sup}$. Taking the initial conditions ($a > max\{1, c\}$, $m > 2$ and $n > m + 2$) into account, we compare all the $\triangle c_{sup}$ in 4 different scenarios. We have

Result 5:

- *for all* $n \geq 5$, $\triangle c^D_{sup} > \triangle c^C_{sup} > 0$ *and* $\triangle c^A_{sup}, \triangle c^B_{sup} < 0$
- *the ranking between* $\triangle c^A_{sup}$ *and* $\triangle c^B_{sup}$ *depends upon* n *and* m*:*
  - ✠ *when* $n = \{5, 6, 7, 8\} : \triangle c^A_{sup} < \triangle c^B_{sup} < 0$
  - ✠ *when* $n \geq 9$*:*
    - *if* $m \in \left(3, F(n)\right)$, $\triangle c^B_{sup} < \triangle c^A_{sup} < 0$
    - *if* $m \in \left(F(n), n-2\right)$, $\triangle c^A_{sup} < \triangle c^B_{sup} < 0$

  with $F(n) = \frac{\sqrt{17-12\sqrt{2}+12n-6\sqrt{2}n+6n^2-4\sqrt{2}n^2}-3+2\sqrt{2}+2n-\sqrt{2}n}{2(3-\sqrt{2})}$

Since the value of upper bound of $\triangle c$ in cases C & case D is greater than 0, a merger with anticompetitive effects could lead to efficiency losses.

If the number of competitors is sufficiently low ($n < 9$) or if the number of leaders is large enough (for $n \geq 9$, $m > F(n)$), we have : $\triangle c^B_{sup} > \triangle c^A_{sup}$. This inequality means that a profitable merger between two leaders requires more cost reduction in comparison with a profitable merger between two followers. In other words, the conditions on efficiency gains under which the merger is profitable in the case where the coalition gathers two followers are less restrictive.

The higher $\triangle c_{sup}$ is, the greater the potential efficiency losses due to the merger is. Thus, mergers between one leader and one follower resulting in a new leader (case D) generate potential efficiency losses higher than the similar mergers consisted of two followers to form a leader (case C).

The ceiling of $\triangle c$ depends upon the redistribution of roles between the pre-merger and the post merger situations. If we compare profitable mergers in case B to ones in case C, it is when two followers can form a leader that efficiency losses exist while similar mergers between two followers without redistribution of roles always generate efficiency gains.

4.2 Market power analysis

The market power is usually defined as the difference between the price charged by a firm and its marginal production cost. When we impose the condition: $P_{AM} = P_{BM} + \triangle c$, the merger does not change the market power of the merged firm[10]. This condition implicitly defines the variation in the production cost $\triangle \tilde{c}_i$ for which the market power of the merged firm remains constant.

Result 6: *If we compare $\triangle \tilde{c}_i$ with $\triangle c^i_{sup}$ (for $i \in \{A, B, C, D\}$), we have:*

- $\triangle \tilde{c}_i < \triangle c^i_{sup} < 0$ for $i \in \{A, B\}$
- $\triangle c^i_{sup} > \triangle \tilde{c}_i > 0$ for $i \in \{C, D\}$

The inequalities obtained in cases C and D mean that a merger could remain profitable even if it induces both efficiency losses and a decrease in the market power. Conversely, since $\triangle \tilde{c}_i < \triangle c^i_{sup} < 0$ for $i \in \{A, B\}$, a profitable merger always induces efficiency gains but can generate a decrease in the market power when $\triangle c \in [\triangle \tilde{c}_i, \triangle c^i_{sup}]$.

5 Welfare Analysis

If the merger alters the behavior of the merging firms, notwithstanding efficiency gains (the production cost is assumed to remain constant), the welfare can be raised (Daughety 1990). In particular, a merger between two followers resulting

[10]The subscript 'AM' denotes the situation 'after the merger' and the subscript 'BM' denotes the case 'before the merger'

in a new leader does not introduce a discrepancy between private incentive and social desirability since when the merger is profitable it is also welfare-raising.

We first analyze the welfare variations due to different types of mergers in the case where $\triangle c = 0$. We identify for each scenario, the merger is welfare-enhancing or welfare-losing. Then, in order to take into account a possibility of variation in the marginal cost with the decision to merge, simulations give results on the impact of mergers on profits and welfare.

5.1 No impact of merger on efficiency : the case where $\triangle c = 0$

In this case, our model corresponds to the analysis proposed by Daughety (1990) and HKM (2001). We obtain that both a merger between two leaders resulting in a new leader (case A) and a merger between two followers resulting in a new follower (case B) lead to an increase in the total profit of the merged entity but a decrease in the consumer surplus and in the total welfare. Similar results are obtained in the case of a merger between one leader and one follower resulting in a new leader (case D). In the three above cases, the effect of the merger on the industry structure is simply a decrease in the number of one type of firm with no change in the number of the other type.

The case of two followers' forming a leader (case C) is quite different because the number of leaders increases while the number of followers decreases, then the impact of the merger on the welfare is altered. On the one hand, the decrease in the number of firms tends to reduce welfare. On the other hand, since leaders produce a higher output level than followers, the increase in the number of leaders introduces a countervailing tendency toward higher quantity and higher welfare. We find the same result as Daughety (1990): this type of merger is welfare raising if the industry is initially made up predominantly of followers[11]. The intuition of this result is the following one. An industry with too many followers results in a poorer market performance in terms of welfare. Hence, a merger creating a new leader may have a positive effect, which is inversely proportionate to the number of leaders. As the number of leaders increases, this effect becomes slight and could be more than outweighed by the negative aspect of the merger (via the reduction in the number of competitors).

5.2 Mergers with cost variation ($c \neq 1$) : Simulations ($n = 12$, $3 \leq m \leq 9$, $a = 100$)

In the previous subsection where it is assumed that the merger does not impact the cost, all possible mergers have no ability to enhance the social welfare except for the case C (merger between two followers resulting in a leader). We extend the analysis and we study afresh now the welfare with taking into account a

[11] If $m < \frac{n}{3} - 1$, industry output and welfare are increased by the merger (Daughety, 1990)

possible change in cost due to the merger.

We impose the conditions $n = 12$ and $3 \leq m \leq 9$ implying that, in the post merger situation, the category of outsiders gathers either followers and leaders firms. As we have studied in the previous section, when $a > n - m + 2$, mergers with monopolization never take place. We choose $a = 100$ in order to avoid mergers with monopolization. We exclude this case since mergers with monopolization, which lessen the competition to a maximum extent, unambiguously decrease the social welfare.

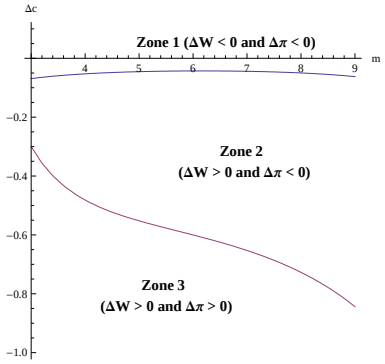

Figure 6: Zones for case A

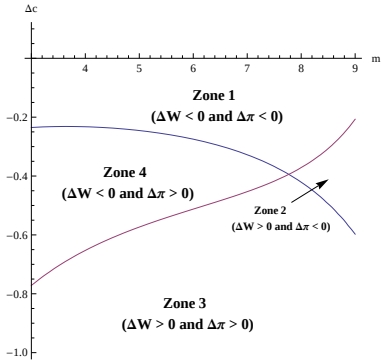

Figure 7: Zones for case B

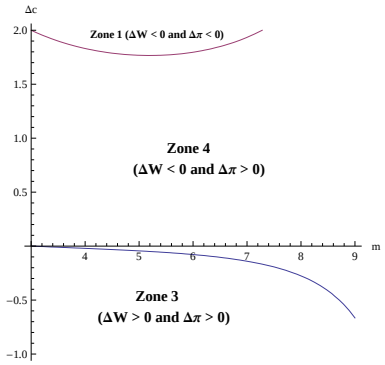

Figure 8: Zones for case C

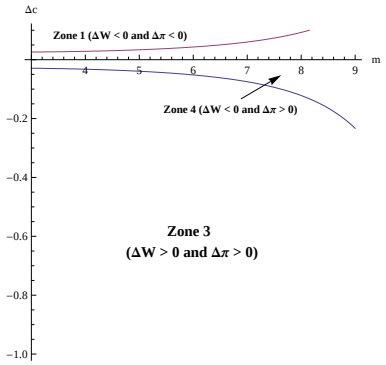

Figure 9: Zones for case D

Concerning the private incentive to merge, some interesting results come from the comparison of the merger's types. The threshold value of $\triangle c$ below which the merger is profitable decreases when the number of leaders increases in case A, contrary to the case B. Nevertheless the ceiling of cost for profitable merger increases due to the augmentation of the number of leaders when the coalition concerns the firms of different categories. Under the influence of redis-

tribution of roles, the relation between the ceiling cost and the number of leaders becomes complicated. $\triangle c_{sup}$ faces up to the trend of a change downward, if the industry is initially made up predominantly of followers, contrariwise when the leaders are dominant in terms of the proportion.

In case of the merger consisted of two firms deriving from the same clan in the absence of redistribution of roles, the welfare-raising merger is not always the profitable merger. Nevertheless when the merger stems from firms of different types or contains two firms followers resulting in a newly merged leader, all the welfare-raising mergers are profitable.

For case A, all profitable mergers constitute the welfare-enhancing merger. However, in other cases the profitable merger could negatively influence on social welfare.

6 Conclusion

This paper extends the strand of literature on horizontal mergers in an homogeneous oligopoly where some firms are market leaders. Our main objective in this paper is to point out that the behavior of firms (leaders or followers) engaged in the merging decision interacts with the issue of whether mergers will generate efficiency gains or losses. We find that the existence of at least one leader in the category of outsiders prevent from mergers with efficiency losses when the merger gather two leaders. If two followers merge, efficiency gains are necessarily obtained when at least one follower belongs to outsiders. When one leader and one follower decide to merge or when the merger between two followers give rise to a new leader, the distribution of roles among outsiders does not interact with the extent of cost variation in the post merger situation and some mergers can introduce some efficiency losses. It is when the merger concerns one leader and one follower that the exposure to efficiency losses is the highest. Concerning the impact of mergers on social welfare, when we impose restrictions on parameters in order to exclude the market monopolization, our model shows that profitable mergers are welfare enhancing when two leaders decide to merge. In the three other cases, the profitable merger can induce either an increase or a decrease in social welfare. Consequently this paper argues that Competition Authorities must supervise more closely bilateral mergers which are consisted of either one or two followers.

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