Screening divestitures: structural merger remedies with asymmetric information
(**preliminary version**)

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Abstract

This paper aims to contribute to the normative economic analysis of merger remedies by taking into account the possible efficiency gains for the design of divestitures. In the case of complementarity between the synergies and the capital held by the insiders, the optimal divestiture should obey the proportionality principle: a larger transfer will be requested from a less efficient merged firm than from a more efficient one. Consequently, the Competition Authority will require the merging firms to reveal their efficiency gains, so as to tailor the optimal remedy. Thus, the second objective of the paper is to shed light on the design of the optimal divestiture when the merging firms are better informed than the Competition Authority with respect to the synergy generated by merger. We propose a revelation mechanism combining the use of divestitures with the regulation of asset sale prices. Our results replicate the outcome of the negotiation between firms and the Competition Authority, to the extent where the first best, distortion and shut-down are all possible. The mechanism is robust whatever the Competition Authority's objective: maximizing Consumers' Surplus or Total Welfare.

Keywords: merger control, structural remedies, asymmetric information, revelation mechanism

JEL: L13, D4, D82

1. Introduction

Horizontal mergers yield a market power increase on behalf of every remaining firm. The main visible consequence is a price raise due to the merger. However, there may be positive effects following the merger, if the latter generates substantial efficiency gains. Faced with a potentially anticompetitive merger, the Competition Authority (CA) has basically the choice between three alternatives: rejecting it, accepting it if the efficiency gains are overwhelming, or accepting it provided that corrective remedies are adopted. Thanks to the recent (January 2004) European efficiency defense regulation, anticompetitive mergers may try to obtain approval by arguing substantial and overwhelming efficiency gains. Remember though that this 'efficiency defense' procedure can only apply if merger remedies are neither available nor possible. The latter fall into two categories: behavioral and structural[1]. Behavioral remedies lay out constraints for the merging firms under the form of compulsory engagements to take certain actions or to refrain from others. The credibility of these engagements and their implementability and monitoring in the post-merger stage represent serious drawbacks. Structural remedies are in turn supposed to be easier to apply, all the more so since they change the allocation of property rights within the industry, and therefore need no surveillance once implemented. Yet, their application and effects have often been subject to questioning, because "the fashioning of merger remedies is not materially governed by case law[...] in the absence of fact and law, the fashioning of merger remedies is subject to standards that are not well-defined or consistent" (see Blumenthal (2001)).

This paper aims to contribute to the normative economic analysis of merger remedies by taking into account the possible efficiency gains for the design of divestitures. A first crucial idea behind our model is this link between the amount of efficiency gains (under the form of synergy) that the merging partners can achieve and the amount of assets they will have to divest for the merger to be accepted. Such an idea is in line with the current consensus among competition policy practitioners, according to which the required divestiture should not exceed the competitive harm caused by the merger, nor prove insufficient to correct it (that is, both overfixing and underfixing should be avoided by the CA). Thus, the required divestiture should obey the proportionality principle: a larger transfer being requested from a less efficient merged firm than from a more efficient one. The important consequence is that the CA will require that merging firms reveal their efficiency gains, so as to tailor the optimal remedy. Yet, as suggested by Rey (2000), "Firms have privileged information about their motivation for the merger [...] which the authority should try to extract".

Hence the second objective of this paper is to shed light on the design of the optimal divestiture when the merging firms are better informed than the CA with respect to the

[1] See Motta (2004) and especially Motta et al. (2002) for comprehensive reviews.

synergy generated by merger. We propose a revelation mechanism combining the use of divestitures with the regulation of asset sale prices.

Our model builds on a simple framework. We consider a Cournot competition game with homogenous good and constant marginal costs in a three-firm fixed total capital stock industry. The marginal cost decreases with the amount of capital a firm holds. Following a two-firm exogenous merger, the merged entity enjoys cost savings due to its higher capital stock, but may also benefit from synergy, which will further lower its marginal cost. The CA requires in turn asset transfers to the outsider, so as to maximize its objective. Divestitures alter the distribution of capital assets between firms and therefore modify the cost structure of the industry. We look for the optimal transfer to implement according to the objective of the CA: here we focus on the divestiture maximizing Consumers' Surplus. Our essential assumption concerning the production technology of the merged firm is that the ability to make profitable use of synergies rises with the capital stock of the firm. Thus, when divestiture occurs, the merged entity will still able to benefit from some efficiency gains in spite of it, but to a lesser extent. We remind that competition policy specialists stress that "often, a more closely targeted remedy inevitably threatens the potential efficiencies from a merger" (Farrell, (2003)). An essential by-product of our assumption is that the optimal asset transfer will decrease with respect to the synergy level, meaning that larger divestitures will be required from less efficient mergers. But as the cost savings are private information for merging firms, the latter are likely to cheat when declaring the amount of synergy generated by the merger, either to be spared higher transfers or to extract higher revenues from the sale of divested assets. Thus the divestiture on its own will not be effective as a screening device.

The mechanism we provide here combines the asset transfer with the direct intervention of the CA on the asset sale price. Our revelation mechanism borrows from Farrell and Shapiro (1990,b) the intuition that merger regulation should be based on the analysis of merger external effects. Basically, the CA will exploit for regulation purposes the externality exerted by the insiders on the outsider. Our mechanism is quite flexible, since we allow for both positive and negative merger externalities. More precisely, whenever the outsider enjoys a positive merger externality, he will pay for the divested assets. In turn, should he be hurt by the merger, then the insiders can subsidize him so as to have the divestiture accepted. In our framework, information extraction will actually build on the industry firms' willingness to pay for the merger to take place. The mechanism proposed allows for First Best implementation, and also for a shut-down optimal response on behalf of the CA. We show also a type I error is inevitable with asymmetric information.

To our knowledge, there are very few papers dealing with structural merger remedies. Our model takes on Rey (2000) and Gonzalez (2003), who both take into account the possibility for divestitures, beside their corrective role, to be used for screening. As compared with Gonzalez (2003), whose incentive mechanism relies on the choice of the market where the divestiture will apply if accepted, we restrict the use of divestiture to the same market on which the competitive harm is witnessed, and propose a second revelation instrument: the regulated sale price[2]. We thus provide an answer to Rey's (2000) informal suggestion that "The firms could be asked to 'pay' [...] for any negative external effect of the merger, so as to ensure that only socially desirable mergers are proposed [...] the competition authority should try to screen merger proposals using transfers or quasi-transfers [...]". An important point of our model is the direct relationship between the level of divestiture and the type (amount of synergy) of the merger. Medvedev (2004) proposed the first basic formalization of the intuition that the amount of asset transfer necessary to remedy the competitive harm depends on the amount of efficiency gains. We improve his existence result by showing that the link between the two stems directly from the cost function assumptions, and also examine the monotonicity properties of this relationship. Our framework is derived from seminal papers dealing with the consequences on market performances of changes in the distribution of fixed-stock industry assets. Farrell and Shapiro (1990,a) for instance take up precisely the question of how capital transfers between Cournot oligopolists affect total industry profit or welfare. We take their analysis one step further, since we mix capital transfers and efficiency gains within the same cost structure. Compte et al. (2002) also look into the effects of asset transfers, but between Bertrand oligopolists with collusive behavior. In this paper the possibility for collusion is completely overlooked.

We present first the market equilibria both before and after merger, taking into account both efficiency gains and asset transfers. We then go on to present the game between firms and the CA. For the design of optimal remedies, we begin as usual by the symmetric information benchmark, then deal with the asymmetric information framework. Finally, we comment our results and conclude on their relevance. Technical proofs are grouped in the Appendix.

2. The model

We present first the pre-merger equilibrium as a benchmark and then the post-merger framework.

2.1. Pre-merger market equilibrium

We consider as starting point a homogenous good, three-firm perfectly symmetric industry with fixed capital stock. Firms are identical with constant marginal cost c, strictly decreasing and convex in the capital stock k as follows: $\frac{\partial}{\partial k}c(k) < 0$ and $\frac{\partial^2}{\partial k^2}c(k) >$

[2] It is worth mentioning that the idea of merger control being largely complicated by the information asymmetry was first to be found in Besanko and Spulber (1993).

0. Demand is linear: $P(Q) = a - Q$, where Q is total output. Firms are Cournot-Nash players, each maximizing individual profit. We denote Π the pre-merger individual profit.

2.2. Post-merger market framework

Since we only deal with exogenous market concentration, and that initially the three firms are identical, merger takes place between any two of them. We shall index the merged entity, i.e. the insiders by **M** and the outsider by **o** respectively.

Two types of cost savings may occur. First of all, for unchanged technology, the merger will alter the distribution of capital within the industry: the merged entity ends up with twice the capital a firm had before, whereas the outsider holds the same amount. As in Farrell and Shapiro (1990,b) and given the pre-merger technology, such a capital distribution change improves the merged entity's productive efficiency. Actually, given that firms' marginal costs are constant but decreasing with the individual stock of capital, the merged firm enjoys here increasing returns to scale. Insiders will therefore concentrate production within a single plant. Second, the merger means combining know-how, or patents, and therefore leads to some significant complementarity between the two insiders. This comes down to creating synergies for the new entity, and this will further decrease its marginal cost. In other terms, the merger modifies the merged firm's cost function. We denote by $c_M(k_M, \alpha)$ the marginal cost function of the merged firm, where k_M stands for its total capital stock and α is a parameter that captures inversely the magnitude of the synergies. We shall use a two-type framework, $\underline{\alpha}$ and $\overline{\alpha}$, with $\underline{\alpha} \leq \overline{\alpha}$, where $\overline{\alpha}$ stands for lack of synergy ($c(k, \overline{\alpha}) = c(k)$). The firm is of type $\underline{\alpha}$ with probability ρ and of type $\overline{\alpha}$ with probability $1 - \rho$.

We make the following assumptions on the merged cost function:

(i) $\frac{\partial}{\partial \alpha} c_M > 0$. This first hypothesis merely translates that the marginal cost of the merged entity is decreasing with the synergies generated by the merger. A decrease in parameter α stands for an increase in the magnitude of synergies.

(ii) $\frac{\partial^2}{\partial \alpha \partial k} c_M > 0$. This hypothesis deals with the combined effect of synergies and divestitures, and we assume a particular type of interaction between the two. Actually, we argue that there is a certain degree of *complementarity* between the two types of cost savings created by the merger: between the efficiency gains on capital and the synergies, meaning basically that the capacity to make profitable use of synergies rises with the capital stock of the firm.

2.3. Remedies as a screening device

Mergers have an ambiguous impact on the economy. On one hand, the market power increase raises the market price. On the other hand, the cost savings obtained through the two kind of efficiencies increase consumers surplus and total welfare. Divestitures are used by the CA to modify the post-merger market equilibrium so as to fulfill its own merger control objective. Divestitures occur when the CA requires the merged entity to sell off assets to a viable competitor. The latter can be either an outsider or an entrant on the market. In our setting, divestitures are transfers of assets to the outsider, whom we consider here to be the only possible buyer.

As far as the CA's objective goes, we model here the consumers' surplus maximization, so as to follow the current regulatory trend [3]. Our paper is intended though to build a normative analysis, so we have duly checked that all results are valid if total welfare maximization is chosen instead[4].

The game we consider between the firms and the CA is the following:

In the first stage of the game, the merging firms learn their synergies and submit a merger proposal to the CA.

In the second stage, the CA evaluates the consequences of the merger taking into account its own merger control objective (maximizing the consumers' surplus) and proposes a divestiture contract accordingly. Formally, the CA requires the merged firm to sell an amount Δ of its capital stock to the outsider.

In the third stage, the insiders accept or reject the divestiture. If they accept, assets will be sold to the outsider. If the latter refuses, the merger is prohibited.

In the last stage of the game, if the divestiture contract was accepted, the Cournot market equilibrium is determined taking into account the amount of asset transfer required by the CA.

We determine first the optimal divestiture when information on the merger type is symmetric, and then go on to study the role of asymmetric information for the design of the remedy.

2.3.1. Optimal divestitures with symmetric information

At the last stage of the game, firms play a standard Cournot game. Merger profit depends on its capital stock after divestitures ($k_M = 2k - \Delta$) as well as on its synergy level α. We denote by $\Pi^M(\Delta, \alpha)$ this profit. It is straightforward to show that this profit decreases with both type α and transfer Δ (see the Appendix for details). Likewise, the outsider's profit depends on its own capital stock $k_o = k + \Delta$, as well on the synergies

[3] Although theoretical arguments are also available supporting the choice of Consumers' Surplus standard instead of the Total Welfare one (see Neven and Roller (2001) for instance).

[4] Actually, we had the choice between formalizing on one hand a CA that forbids consumers' surplus or total welfare losses and accept consequently all mergers that either increase or keep them constant, or on the other hand consider a CA that actively maximizes consumers' surplus or total welfare. It turns out that the revelation is much more complex with a maximizing objective function. We have therefore focused on the richest framework, so as to be able to identify and comment all effects arising within such revelation problems.

of the merged firm. This profit is denoted by $\Pi^o(\Delta, \alpha)$. It increases with both Δ and α (it is straightforward to check it).

At the stage before, insiders accept the divestiture contract provided that they do not incur losses as compared with their joint profit before merger. As far as the outsider is concerned, the decision to accept to take over the divested assets depends on his willingness to pay for them.

At the second stage, whenever the CA observes the type of the merger submitted for approval, its programme writes as follows:

$$\max_{\Delta_j} CS\left(\Delta_j; \alpha_j\right) \tag{S}$$
$$\text{s.t. } \Pi^o\left(\Delta_j; \alpha_j\right) - P_j \geq \Pi$$
$$\Pi^M\left(\Delta_j; \alpha_j\right) + P_j \geq 2\Pi$$

where $\Delta_j \in \left\{\underline{\Delta}, \overline{\Delta}\right\}$, $\alpha \in \{\underline{\alpha}, \overline{\alpha}\}$, $P_j \in \left\{\underline{P}, \overline{P}\right\}$ with $CS\left(\Delta; \alpha\right) = \frac{1}{2} \cdot Q^2\left(\Delta, \alpha\right)$ and $Q(\alpha) = \frac{2a - c_M(2k-\Delta;\alpha) - c_o(k+\Delta)}{3}$. We will denote by $\Delta^{FB}\left(\alpha_j\right)$ the solution of this programme. Since information is symmetric, firms are free to settle the sale price between them as best they can.

We characterize the First Best asset transfer as follows:

Lemma 1. *There exists a threshold $\widehat{\alpha}$ such that for any $\alpha \leq \widehat{\alpha}$, merger is accepted with divestiture $\Delta^{FB}(\alpha_j)$, where $\Delta^{FB}(\alpha_j) = \arg\max_{\Delta} CS\left(\Delta_j; \alpha_j\right)$ with $\frac{\partial \Delta^{FB}(\alpha_j)}{\partial \alpha} > 0$. For any $\alpha > \widehat{\alpha}$, merger is rejected.*

See proof in the Appendix.

This lemma shows that our mechanism replicates the outcome of CAs' behavior to the extent where merger control decisions seem often to be taken on the basis of threshold criteria. Here, whenever the submitted merger does not generate enough synergy, the CA rejects it. The point that needs to be stressed is that for all acceptable mergers (from the CA's point of view), industry firms' participation is ensured (see the proof in the Appendix). In other words, in our framework there are no mergers that the CA might want to see submitted but that firms give up due to divestitures. As a result, assuming that industry firms anticipate the CA decision making, only efficient enough mergers will be proposed, and therefore all submitted mergers shall be accepted. Note that if $\underline{\alpha} > \widehat{\alpha}$, all mergers get rejected, or rather there are no mergers submitted. Therefore we shall assume that $\underline{\alpha} < \widehat{\alpha}$.

Note also that the monotonicity property of the optimal level of asset transfer is a direct consequence of the complementarity assumption on the marginal cost function of the merged firm. This hypothesis leads to the proportionality principle: for more efficient mergers (lower α), lower transfers are necessary. In fact, had we assumed instead a substitutability between the two types of cost savings, we would have obtained a monotonicity result on the optimal transfer contradicting this proportionality.

2.3.2. Optimal divestitures with asymmetric information: a simple revelation mechanism with regulated price

We consider that the CA no longer observes the level of synergies. The game with asymmetric information is basically the same as before, where the merger's true type is learned by the CA when the Cournot game is played. The outsider accepts or not the transfer chosen by the insiders after observing the menu of contracts proposed by the CA.

When information is asymmetric, the CA may no longer be able to maximize consumers' surplus because of the conflict of interests with the merged firm. Indeed, because the merger profit decreases with the divestiture, the insiders trivially choose always the lowest level of divestitures that is proposed. We expect therefore not to be able to screen the least efficient mergers through divestitures only, since they would always announce higher synergy levels so as to be spared higher asset transfers.

To make firms truthfully reveal the type of their merger, a second instrument appears to be necessary. The incentive contracts will thus contain a regulated sale price for the divested assets, fixed by the CA, and two Incentive Constraints (IC) will be added to the programme of the CA to reveal information.

Hence, the programme of the CA is:

$$\max_{\underline{\Delta},\overline{\Delta},\underline{P},\overline{P}} \rho CS\left(\underline{\Delta};\underline{\alpha}\right)+(1-\rho)\,CS\left(\overline{\Delta};\overline{\alpha}\right)$$

$$\text{s.t.}\left\{\begin{array}{c}\Pi^M\left(\underline{\Delta};\underline{\alpha}\right)+\underline{P}\geq\Pi^M\left(\overline{\Delta};\underline{\alpha}\right)+\overline{P}\\ \Pi^M\left(\overline{\Delta};\overline{\alpha}\right)+\overline{P}\geq\Pi^M\left(\underline{\Delta};\overline{\alpha}\right)+\underline{P}\\ \Pi^M\left(\underline{\Delta};\underline{\alpha}\right)+\underline{P}\geq 2\Pi\\ \Pi^M\left(\overline{\Delta};\overline{\alpha}\right)+\overline{P}\geq 2\Pi\\ \Pi^o\left(\underline{\Delta};\underline{\alpha}\right)-\underline{P}\geq \Pi\\ \Pi^o\left(\overline{\Delta};\overline{\alpha}\right)-\overline{P}\geq \Pi\end{array}\right.$$

Unlike a standard screening programme, there is no direct transfer between the regulated agent and the principal. Instead, a direct monetary transfer is introduced between the agent and a third party, namely the sale price of the divestiture, which the CA uses as an incentive device. Despite this particularity, we shall nevertheless obtain the usual results in terms of informational rents of the agents.

Proposition 1. *The optimal contract* $\left(\left(\underline{\Delta}^{SB},\underline{P}\right),\left(\overline{\Delta}^{SB},\overline{P}\right)\right)$ *solution of programme (AS) is such that there exist two thresholds* $\widehat{\alpha}_1$ *and* $\widehat{\alpha}_2$ *for which:*

(1) If $\overline{\alpha} \leq \widehat{\alpha}_1$*, the First Best is implemented:* $\underline{\Delta}^{SB} = \Delta^{FB}(\underline{\alpha})$, $\overline{\Delta}^{SB} = \Delta^{FB}(\overline{\alpha})$*, with* $\underline{P} = \Pi^o\left(\Delta^{FB}(\underline{\alpha});\underline{\alpha}\right) - \Pi$ *and* $\overline{P} = 2\Pi - \Pi^M\left(\Delta^{FB}(\overline{\alpha});\overline{\alpha}\right)$

(2) If $\widehat{\alpha}_1 \leq \overline{\alpha} < \widehat{\alpha}_2$*, distortion requires* $\underline{\Delta}^{SB} < \Delta^{FB}(\underline{\alpha})$ *and* $\overline{\Delta}^{SB} > \Delta^{FB}(\overline{\alpha})$*, with* $\underline{P} = \Pi^o\left(\Delta^{SB}(\underline{\alpha});\underline{\alpha}\right) - \Pi$ *and* $\overline{P} = 2\Pi - \Pi^M\left(\Delta^{SB}(\overline{\alpha});\overline{\alpha}\right)$

(3) If $\widehat{\alpha}_2 \leq \overline{\alpha}$, $\underline{\Delta}^{SB} = \Delta^{FB}(\underline{\alpha})$ *with*$\underline{P} = 2\Pi - \Pi^M\left(\Delta^{FB}(\underline{\alpha});\underline{\alpha}\right)$ *and shut-down on* $\overline{\alpha}$ *is optimal*

See proof in the Appendix .

We claim that three regimes are basically possible when information is asymmetric. When both types are rather efficient, the First Best is implementable with the regulation of sale prices. If the two types become more distant, distortion is needed to ensure revelation. However, the CA may give up distortion in favor of shut-down of the less efficient type. As compared with the symmetric information framework, shut-down on $\overline{\alpha}$ turns up earlier.

The intuition behind this result is relatively simple. The regulation of asset prices is a device used to give incentives to firms to accept the first best divestitures described in the lemma.

We need first to comment on the lack of any positivity constraint on the divested assets sale price. To put it short, both with symmetric and asymmetric information, we model positive as well as negative sale prices. In other words, the revelation instrument is quite flexible, since we allow for the case where M subsidizes the outsider to have the divestiture taken over and get the merger accepted. Basically, either the merger exerts a positive externality on the outsider, who pays consequently a positive price in exchange for the divested assets, or the merger exerts a negative externality on the outsider's profit, and the latter is subsidized by M to accept the divested assets.

An important consequence worth noticing is that the CA's relevant incentive device is actually the difference between the two prices $\overline{P} - \underline{P}$. To have firms accept the First Best divestiture, the CA must set the $\overline{P} - \underline{P}$ so that both incentive compatibility hold. This difference needs always to be positive to incite truth-telling, but if it is too large, it is no longer incentive compatible[5]. Therefore lower levels of this difference should be taken into account by the CA[6], and to give the first best incentive to the efficient merger, the price difference should leave it with a positive rent. Yet, divestitures must satisfy participation constraints of firms. On the one hand, the inefficient merger should remain profitable despite the high divestitures required, which puts an upper boundary

[5] Actually, this would be the case for $\underline{\alpha}$, who would be likely to cheat so as to obtain the higher $\overline{P}$; it would still be incentive compatible for $\overline{\alpha}$, because for any given level of divestiture, the profit of the efficient firm is higher

[6] If there were no constraints on transfers, given that the asset transfers have no social costs, it would be easy to implement first best divestitures by setting $\overline{P}$ low and $\underline{P}$ so that $\overline{P} - \underline{P}$ must be lower than $\Pi^M\left(\underline{\Delta};\underline{\alpha}\right) - \Pi^M\left(\overline{\Delta};\underline{\alpha}\right)$.

on $\overline{P}$. On the other hand, the outsider must accept to acquire assets despite potential negative externality exerted by the efficient merger, which puts a lower boundary on the rent granted to the efficient firm. Thus, the most incentive monetary transfers are given by $\overline{P} = 2\Pi - \Pi^M \left(\Delta^{FB}(\overline{\alpha}); \overline{\alpha}\right)$ and $\underline{P} = \Pi^o \left(\Delta^{FB}(\underline{\alpha}); \underline{\alpha}\right) - \Pi$. Note that here, the rent left to $\underline{\alpha}$ implies no cost for the regulator. The First Best regime that we obtain is characterized by the two types being relatively efficient. When the gap between the types increases, meaning that the $\overline{\alpha}$ represents really low synergies, the upper bound on $\overline{P}$ goes up again a,d therefore the price difference also. The incentive constraint for $\underline{\alpha}$ is likely to be contradicted, therefore distortion of asset transfers is needed so as to keep the price difference within the incentive compatible interval[7]. If the inefficient type is even more inefficient, the lemma showed that the CA should refuse such mergers. Therefore, when implementing distortion, the CA needs to balance the cost of distortion with that of shut-down on the less efficient type. This trade-off defines the threshold separating the regimes of revelation on both types and shut-down on $\overline{\alpha}$. We show in the appendix that this threshold is lower than the one defined by the lemma, so the CA starts rejecting inefficient mergers earlier than with symmetric information.

To sum up, asymmetric information prevents First Best implementation for a certain parameter interval, and moreover induces the CA to reject certain mergers that would have been accepted otherwise, meaning that a type I error characterizes the optimal merger control with asymmetric information.

Finally, the down-right price-setting may appear less interventionist if our mechanism is interpreted as follows. Basically, all merging-to-be firms have to pay for the merger to take place, but the payment comes in two forms: an asset transfer and a monetary transfer. The insiders may simply reveal themselves by choosing between the two following alternatives: divest a lower amount of assets, but prepare to pay the outsider to accept it, or divest more, and make a positive revenue form the sale of divested assets to the outsider. As a result, the efficient merger should prefer to pay a lump-sum transfer so as to avoid high divestitures that are distorsive in terms of profit, whereas the inefficient merger would be unable to pay this, therefore would rather divest more assets, allow a higher distortion of its profit but get paid in return by the outsider.

3. Conclusion

This paper is an attempt to further advance the economic analysis of merger remedies. Whereas the competitive damages caused by mergers have been widely studied and modeled, the literature dedicated to merger remedies is still limited and fragmented for the time being. The empirical studies dedicated to this topic suffer from the short historical experience in merger control and the corresponding limited number of reme-

[7] The CA increases $\overline{\Delta}$ and decreases $\underline{\Delta}$.

dies cases, as compared with the long history of industrial concentration. As far as the theoretical literature is concerned, things are even more complicated. On one hand, merger remedies represent an experimental industry restructuring, which corresponds to a somewhat uncertain ultimate policy goal (to restore the initial competitive framework or maybe go beyond that). On the other, the complexity of the analytical work has already been acknowledged, because the usual speculative prediction on a future merger's competitive harms is being now extended to a second degree prediction of the impact of proposed remedies on those identified consequences.

We take here a normative view and propose a revelation mechanism allowing the design of optimal merger divestitures when information is asymmetric between firms and the CA with respect to the synergy generated by the merger. Our revelation mechanism replicates the typical behavior of a CA, namely decision making based on thresholds of announced efficiencies. In our framework, shut-down of the least efficient type is possible. Basically, mergers will only be accepted if they generate enough synergies, and this is what the merger control practically aims at.

We acknowledge of course the modelling of a CA actively modifying the market structure, but then any structural merger remedy is precisely meant to do this. A first result of our paper is to show in turn that if merger control takes explicitly into account the externality generated by the merger, the CA can basically increase the number of its revelation instruments, and screening will be effective. Realizing that the outsider can be associated to the revelation mechanism because the merger can potentially benefit him is another relevant contribution of this paper.

References

Besanko, D. and D.F. Spulber (1993), "Contested Mergers and Equilibrium Antitrust Policy", Journal of Law, Economics and Organization, Vol. 9, No. 1, p. 1-29

Blumenthal W. (2001), "Reconciling the Debate over Merger Remedies: A Discussant's Proposed Decision Rule", George Washington Law Review Vol.69, No.5-6 October/December, p.978-95

Compte, O., Jenny F. and P. Rey (2002), "Capacity Constraints, Mergers and Collusion", European Economic Review, Vol.46, Issue 1, p. 1-29

Farrell, J. (2003), "Negotiation and Merger Remedies: Some Problems", University of California, Berkeley, Working Paper No.CPC03-41

Farrell J. and C. Shapiro (1990,a), "Asset ownership and market structure in oligopoly", RAND Journal of Economics, Vol.21, No.2, p.275-92

Farrell J. and C. Shapiro (1990,b), "Horizontal Mergers: An Equilibrium Analysis", American Economic Review, Vol. 80, No.1, p. 107-26

Gonzalez, A. (2003), "Divestitures and the Screening of Efficiency Gains in Merger Control", mimeo GREMAQ - Université de Toulouse

Journal Officiel de l'Union Européenne - Règlement (CE) N°139/2004 du Conseil du 20 janvier 2004 relatif au contrôle des concentrations entre entreprises

Lagerloff, J. and P. Heidhues (2003), "On the desirability of an efficiency defense in merger control", CEPR Discussion Paper No.3841

McAfee R.P. and M.A. Williams (1992), "Horizontal Mergers and Antitrust Policy", The Journal of Industrial Economics, Vol.40, No.2, p.181-7

Motta, M. (2004), "Competition Policy: Theory and Practice", Cambridge University Press

Motta, M., Polo, M. and H. Vasconcelos (2002), "Merger Remedies in the European Union: An Overview", Antitrust Bulletin, forthcoming

Medvedev, A. (2004), "Structural remedies in merger regulation in a Cournot framework", mimeo CERGE, Prague

Neven, D., Nuttal, R. and P. Seabright (1993), "Merger in Daylight: The Economics and Politics of European Merger Control", London CEPR

Neven, D. and L-H. Roller (2001), "Consumer Surplus vs. Welfare Standard in a Political Economy Model of Merger Control", CEPR Discussion Paper No.2620, London

Parker R and D. Balto (2000), "The Evolving Approach to Merger Remedies", Antitrust Report No.2, p.2-28

Rey, P. (2000) "Towards A Theory of Competition Policy", IDEI Working Paper

Roller, L-H., Stennek J. and F. Verboven (2000), "Efficiency Gains from Mergers", European Economy 5, p.32-127

Roller, L-H. and C. Wey (2002), "Merger Control in the New Economy", WZB Working Paper FS IV 02 - 02

Appendix

NB: Post-merger Cournot equilibrium:
individual outputs: $q_M(\Delta;\alpha) = \frac{a-2c_M(2k-\Delta;\alpha)+c_o(k+\Delta)}{3}$ and $q_o(\Delta) = \frac{a-2c_o(k+\Delta)+c_M(2k-\Delta;\alpha)}{3}$
individual profits: $\Pi_M(\Delta;\alpha) = \left(\frac{a-2c_M(2k-\Delta;\alpha)+c_o(k+\Delta)}{3}\right)^2$ and $\Pi_o(\Delta) = \left(\frac{a-2c_o(k+\Delta)+c_M(2k-\Delta;\alpha)}{3}\right)^2$
total output and price: $Q(\Delta;\alpha) = \frac{2a-c_M(2k-\Delta;\alpha)-c_o(k+\Delta)}{3}$ and $P_{aft}(\Delta;\alpha) = \frac{a+c_M(2k-\Delta;\alpha)+c_o(k+\Delta)}{3}$,
where we remind that $c_o(k+\Delta;\overline{\alpha}) = c_o(k+\Delta)$

NB: Marginal cost assumptions shall be used under the following equivalent form:
$\frac{\partial}{\partial k_M}c_M < 0 \Leftrightarrow \frac{\partial}{\partial \Delta}c_M > 0$, $\frac{\partial^2}{\partial k_M^2}c_M > 0 \Leftrightarrow \frac{\partial^2}{\partial \Delta^2}c_M > 0$, $\frac{\partial^2}{\partial \alpha \partial k_M}c_M > 0 \Leftrightarrow \frac{\partial^2}{\partial \alpha \partial \Delta}c_M < 0$, $\frac{\partial}{\partial k_O}c_o < 0 \Leftrightarrow \frac{\partial}{\partial \Delta}c_o < 0$, $\frac{\partial^2}{\partial k_o^2}c_M > 0 \Leftrightarrow \frac{\partial^2}{\partial \Delta^2}c_M > 0$

Proof of Lemma 1. Let $f(\Delta) = c_M(2k-\Delta;\alpha) + c_o(k+\Delta;1)$; we look for the variation of Δ^{FB} with α, where Δ^{FB} minimizes $f(\Delta)$.

As an interior solution, Δ^{FB} satisfies $\frac{\partial}{\partial\Delta}f(\Delta) = \frac{\partial}{\partial\Delta}c_M(2k-\Delta;\alpha)+\frac{\partial}{\partial\Delta}c_o(k+\Delta) = 0$.

We define $\widehat{\alpha}$ by the following equation: $c_M(2k-\Delta^{FB};\widehat{\alpha}) + c_o(k+\Delta;1) = 3c(k)$

The merger is accepted if $f(\Delta^{FB}) \leq 3c(k)$. This actually ensures that total output increases, and therefore the participation constraints of firms are always satisfied[8].

We differentiate the FOC and obtain:
$\frac{\partial^2}{\partial\alpha\partial\Delta}c_M(2k-\Delta;\alpha)\cdot d\alpha + \frac{\partial^2}{\partial\Delta^2}c_M(k-2\Delta;\alpha)\cdot d\Delta + \frac{\partial^2}{\partial\Delta^2}c_o(k+\Delta)\cdot d\Delta = 0$

Thus we have: $\frac{d\Delta}{d\alpha} = -\frac{\frac{\partial^2}{\partial\alpha\partial\Delta}c_M(2k-\Delta;\alpha)}{\frac{\partial^2}{\partial\Delta^2}c_M(2k-\Delta;\alpha)+\frac{\partial^2}{\partial\Delta^2}c_o(k+\Delta)}$ which is > 0 because $\frac{\partial^2}{\partial\alpha\partial\Delta}c_M(2k-\Delta;\alpha) < 0$. ∎

Proof. Monotonicity properties of the merged firm's profit

We have that $\frac{\partial}{\partial\Delta}\Pi_M(\Delta;\alpha) = \frac{2}{9}\cdot q_M \cdot \left(-2\frac{\partial}{\partial\Delta}c_M(2k-\Delta;\alpha) + \frac{\partial}{\partial\Delta}c_o(k+\Delta)\right) < 0$
since $\frac{\partial}{\partial\Delta}c_M(2k-\Delta;\alpha) > 0$ and $\frac{\partial}{\partial\Delta}c_o(k+\Delta) < 0$.

Thus the profit of the agent is decreasing with the required divestiture for a given level of synergy α.

Also, $\frac{\partial}{\partial\alpha}\Pi_M(\Delta;\alpha) = \frac{2}{9}\cdot q_M \cdot \left(-2\frac{\partial}{\partial\alpha}c_M(2k-\Delta;\alpha)\right) < 0$,
because $\frac{\partial}{\partial\alpha}c_M(2k-\Delta;\alpha) > 0$ (the profit of the merged firm is increasing with the synergy parameter).

[8] In the extreme case where $\overline{\alpha} = 1$, when total output is constant, total industry profit increases. Thus, $\Sigma\Pi\left(\Delta^{FB}(\overline{\alpha});\overline{\alpha}\right) > 3\Pi$ always$\Rightarrow$ $\Sigma\Pi\left(\Delta^{FB}(\underline{\alpha});\underline{\alpha}\right) > 3\Pi$ also
For the firms to accept the merger, $\Pi^o(\Delta;\alpha) - \Pi \geq P \geq 2\Pi - \Pi^M(\Delta;\alpha)$
$\Rightarrow \Sigma\Pi(\Delta;\alpha) \geq 3\Pi$ (a necessary condition).

Finally, we can infer the monotonicity property that will be used as single-crossing condition in order to screen the types of merger:

we have $\frac{\partial^2}{\partial\alpha\partial\Delta}\Pi_M(\Delta;\alpha) = \frac{2}{9}\cdot\left(-2\frac{\partial}{\partial\alpha}c_M(2k-\Delta;\alpha)\right)\cdot\left(-2\frac{\partial}{\partial\Delta}c_M(2k-\Delta;\alpha)+\frac{\partial}{\partial\Delta}c_o(k+\Delta)\right)$ $+\frac{2}{9}\cdot q_M\cdot\left(-2\frac{\partial^2}{\partial\alpha\partial\Delta}c_M(2k-\Delta;\alpha)\right) > 0$ because $\left(-2\frac{\partial}{\partial\alpha}c_M(2k-\Delta;\alpha)\right) < 0$, $\left(-2\frac{\partial}{\partial\Delta}c_M(2k-\Delta;\alpha)+\frac{\partial}{\partial\Delta}c_o(k+\Delta)\right) < 0$ and $\left(-2\frac{\partial^2}{\partial\alpha\partial\Delta}c_M(2k-\Delta;\alpha)\right) > 0$ with our initial monotonicity conditions. ■

Proof of Proposition. Note first of all that the programme has always a solution since we maximize a continuous function on a closed set.

Note also that:

- the incentive price difference needs to satisfy

$$\Pi^M(\underline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\underline{\alpha}) \geq \overline{P} - \underline{P} \geq \Pi^M(\underline{\Delta};\overline{\alpha}) - \Pi^M(\overline{\Delta};\overline{\alpha})$$

- the price difference compatible with the participation constraints should satisfy

$$\Pi^o(\overline{\Delta};\overline{\alpha}) + \Pi^M(\underline{\Delta};\underline{\alpha}) - 3\Pi \geq \overline{P} - \underline{P} \geq 3\Pi - \Pi^M(\overline{\Delta};\overline{\alpha}) - \Pi^o(\underline{\Delta};\underline{\alpha})$$

The solution of the programme will be characterized in two steps.

(1st step) Set $\underline{P} = 2\Pi - \Pi^M(\underline{\Delta},\underline{\alpha})$ and $\overline{P} = \Pi^o(\overline{\Delta},\overline{\alpha}) - \Pi$ and check whether $\Pi^o(\overline{\Delta};\overline{\alpha}) + \Pi^M(\underline{\Delta};\underline{\alpha}) - 3\Pi \geq \Pi^M(\underline{\Delta};\overline{\alpha}) - \Pi^M(\overline{\Delta};\overline{\alpha}) \Leftrightarrow$

$\Sigma\Pi(\overline{\Delta};\overline{\alpha}) - 3\Pi \geq \Pi^M(\underline{\Delta};\overline{\alpha}) - \Pi^M(\underline{\Delta};\underline{\alpha})$

This is always verified for the FB levels of transfers, therefore the Incentive Constraint for $\overline{\alpha}$ can always be satisfied.

In turn, we notice that for $\underline{\alpha}$ this is not the case:

$\Pi^o(\overline{\Delta},\overline{\alpha}) + \Pi^M(\underline{\Delta},\underline{\alpha}) - 3\Pi > \Pi^M(\underline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\underline{\alpha})$

$\Leftrightarrow \Pi^o(\overline{\Delta},\overline{\alpha}) + \Pi^M(\overline{\Delta};\underline{\alpha}) > 3\Pi$ always true for the FB levels of transfers.

Consequently, the relevant price difference is the minimal one - see below

(2nd step) Set $\underline{P} = \Pi^o(\underline{\Delta};\underline{\alpha}) - \Pi$ and $\overline{P} = 2\Pi - \Pi^M(\overline{\Delta};\overline{\alpha})$, and check whether $3\Pi - \Pi^M(\overline{\Delta};\overline{\alpha}) - \Pi^o(\underline{\Delta};\underline{\alpha}) \leq \Pi^M(\underline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\underline{\alpha}) \Leftrightarrow$

$\Leftrightarrow 3\Pi - (\Pi^o(\underline{\Delta};\underline{\alpha}) + \Pi^M(\underline{\Delta};\underline{\alpha})) + (\Pi^M(\overline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\overline{\alpha})) \leq 0$

Notice that for the FB levels of transfers, $3\Pi - (\Pi^o(\underline{\Delta};\underline{\alpha}) + \Pi^M(\underline{\Delta};\underline{\alpha})) < 0$ and $(\Pi^M(\overline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\overline{\alpha})) > 0$

Let be $g(\overline{\alpha}) = 3\Pi - (\Pi^o(\underline{\Delta};\underline{\alpha}) + \Pi^M(\underline{\Delta};\underline{\alpha})) + (\Pi^M(\overline{\Delta};\underline{\alpha}) - \Pi^M(\overline{\Delta};\overline{\alpha}))$

The FB is implementable whenever $g(\overline{\alpha}) \leq 0$

Note that $g(\overline{\alpha} = \underline{\alpha}) < 0$ and g increases with $\overline{\alpha}$

Define thus a threshold $\widetilde{\alpha}$ such that $g(\widetilde{\alpha}) = 0$

Consequently, for $\overline{\alpha} \leq \widetilde{\alpha}, g(\overline{\alpha}) \leq 0$ and the FB is implementable

In turn, for $\overline{\alpha} > \widetilde{\alpha}, g(\overline{\alpha}) > 0$, and we need to distort g downwards so as to satisfy the incentive constraint for $\underline{\alpha}$

For that, $\overline{\Delta}$ should increase (the difference $\left(\Pi^M\left(\overline{\Delta};\underline{\alpha}\right)-\Pi^M\left(\overline{\Delta};\overline{\alpha}\right)\right.$ decreases with $\overline{\Delta}$ because of $\frac{\partial^2\Pi^M}{\partial\alpha\partial\Delta}>0$). As for $\underline{\alpha}$, the direction of the distortion depends on whether $\Sigma\Pi$ increases or decreases with Δ: to satisfy in the limit the incentive constraint, we want $\left(\Pi^o\left(\underline{\Delta};\underline{\alpha}\right)+\Pi^M\left(\underline{\Delta};\underline{\alpha}\right)\right)$ to increase, so $\underline{\Delta}$ shall be distorted upwards (downwards) if $\Sigma\Pi$ increases (decreases)with Δ.

Having defined distortion, we look now into its optimality.

Define another threshold, $\widehat{\alpha}_2$, such that $\rho CS\left(\underline{\Delta}^{SB};\underline{\alpha}\right)+(1-\rho)\,CS\left(\overline{\Delta}^{SB}\left(\widehat{\alpha}_2\right);\widehat{\alpha}_2\right)=\rho CS\left(\underline{\Delta}^{FB};\underline{\alpha}\right)$

For $\overline{\alpha}>\widehat{\alpha}_2$, distortion is less profitable to the CA than simple shut-down for $\overline{\alpha}$ mergers.

Denote $\widehat{\alpha}_1=\min\left(\widehat{\alpha},\widetilde{\alpha}\right)$

Note that the following inequalities hold[9]: $\widehat{\alpha}_1<\widehat{\alpha}_2<\widehat{\alpha}$. ■

[9] Because at $\widehat{\alpha}$ begins the shut-down of $\overline{\alpha}$ and at $\widehat{\alpha}_1$ the First Best is possible for both types.