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Negotiating Remedies: Revealing the Merger Efficiency Gains

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Abstract

This paper contributes to the economic analysis of merger control by taking into account the efficiency gains for the design of structural merger remedies when the competition authorities do not observe the magnitude of efficiency gains. We show that whenever divestitures are necessary, the Competition Authority will need to extract from the merging partners their private information on the merger's efficiency gains. For this we propose a revelation mechanism combining divestitures with two additional tools, the regulation of the divestitures sale price and a merger fee. We show that an optimal combination of both instruments is effective: the most efficient merged firms are claimed to pay a merger fee while the less efficient divest asets at an upwards distorted sale price.

Keywords: merger control, structural merger remedies, asymmetric information
JEL: L41, D82, K21

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1 Introduction

Horizontal merger control requires the assessment of pro- and anti- competitive effects of the merger projects submitted. Among the former, the efficiency gains are crucial, since the merger may be cleared if the merging partners manage to persuade the competition authority of substantial enough cost reductions. Otherwise, due to the market power increase, leading to higher prices and even a lower welfare, the public authority may need to either prohibit the merger, or at least impose merger fixes or remedies. In short, either the merging firms are able to convince the competition authority of high enough efficiency gains, or they run the risk of merger remedies and even merger prohibition. Yet, the assessment of these efficiency gains leading to future cost savings raises an information issue. Practitioners acknowledge an important information asymmetry between merging firms and competition authorities. For instance, although the US Merger Guidelines ascertain that "mergers have the potential to generate significant efficiencies", they also warn that "efficiencies are difficult to verify and quantify, in part because much of the information relating to efficiencies is uniquely in the possession of the merging firms"[1]. This information asymmetry is all the more relevant that firms have strong incentives to declare high cost reductions so as to avoid merger remedies.

The objective of this paper is to shed light on the design of optimal merger divestitures when merging firms are better informed than the competition authority with respect to the merger's efficiency gains.

To cope with this issue, competition authorities would try to extract this private information on future efficiency gains. For that purpose, they may either call for a commitment from the merging firms regarding the post-merger price under the threat of future monetary penalties, and assess that commitment once the merger is completed (see Brodley (1996) for an example of such a contingent remedy procedure). Or they may propose, as a condition for clearing the merger, a menu of divestiture contracts meant to screen the different types of merger projects according to their welfare impact. We follow here the latter option, and *provide a revelation mechanism combining the use of divestitures with the regulation of their sale price and the payment of a merger fee to the competition authority.*

This idea requires a brief discussion of the opportunity to introduce new instruments in the merger control process.

To start with, the payment of a lump-sum fee is quite common in regulatory situations, where it is set by an industry regulator to regulate the access to scarce resources such as the mobile phone spectrum.

As for the sale price of divested assets, for the time being antitrust agencies do not tamper with it precisely because it is typically a regulator's instrument. In practice, merging parties

[1] See the Horizontal Merger Guidelines, available at http://www.usdoj.gov/atr/public/horiz_book/4.html

are always given first the opportunity to sell the remedy package at the best price and terms they are able to negotiate with a potential purchaser, subject though to final approval by the competition agency. If they cannot complete the divestiture during the specified sale period, an independent trustee is appointed to complete the sale at the best price and terms that, in the trustees' discretion, can be reasonably obtained to alleviate the competition concerns[2]. Various competition agencies argue that they should not interfere whatsoever in the pricing of assets to be divested, and go as far as making clear that the assets will have to be divested at whatever price, even if this means a very low one, even negative[3].

Notwithstanding all this, our arguments in favour of such instruments within merger control are twofold.

First, since divestitures alone may not suffice to screen merger proposals, it is natural to look for complementary screening devices that might prove effective. We examine here the very scope for distorting the pricing of the divested assets and also for using a merger fee.

Secondly, merger control is a mixed area of antitrust and regulation, where the Competition Authority is actually supposed to directly impact on the market structure by rejecting anti-competitive mergers (Motta et al. (2002), p.2). Moreover, the scope of instruments employed in merger control has constantly increased: the very structural remedies themselves have been actively and properly used as a merger policy tool starting only with the Hart-Scott-Rodino Act in 1976[4]. Furthermore, reactions from various competition authorities are not quite clear-cut regarding "What role, if any, should a competition authority play in the pricing of assets to be divested?"[5]. One competition agency in particular acknowledged its right to set a minimum price if the parties are not successful in their attempts at divesting[6]. The regulation of the asset divested price that we examine here would basically consist in explicitly adding a condition on the assets' price in the trustee's mandate. Finally, the competition agency would rather interfere with the price setting process, although maybe not quite ready to acknowledge it and in a different context: in the battle to force Microsoft to open up the market for media-playing software, the European Commission seemed to ponder ordering a lower price for Windows without Media Player[7]. More recently, in the telecoms industry, the European Commissioner Viviane Reding decided to cap the price of roaming mobile phone communications[8].

[2] See the FTC's 2002 "Study Needed to Assess the Effects of Recent Divestitures on Competition in Retail Markets".

[3] See the OECD report on Merger Remedies, DAF/COMP(2004)21, December 2004.

[4] See the Baer and Redcay (2001) comments on the implications of the Hart-Scott-Rodino Antitrust Improvements Act of 1976, Pub. L. No. 94-435, 90 Stat. 1390

[5] See the OECD report on Merger Remedies, DAF/COMP(2004)21, December 2004, p.33.

[6] This is the Norwegian National Competition Authority - see page 217 of the OECD report on Merger Remedies, DAF/COMP(2004)21, December 2004.

[7] The *Wall Street Journal Europe*, May 26, 2005.

[8] See the *Financial Times*, June 8, 2007

Overview of results

We consider a simple framework with a three-firm pre-merger industry. Individual profits depend on the capital stock. Following a two-firm exogenous merger, the resulting merged entity may enjoy cost savings. The latter stem from the synergies brought about by the merger, as well as from the increase in the capital stock of the merged entity. The level of synergies differs from one merger project to another. When presented with a merger project, the competition agency may require a merger fix in the form of an asset sale to the outsider so as to fulfill its objective. Such divestitures alter the distribution of capital assets between firms and thereby the costs, profits and industry price. We adopt a two-type framework, with an "efficient" merger project that can be cleared straightforwardly, and an "inefficient" merger project that requires asset divestitures from the point of view of the agency's objective. However, such a remedy reduces the profit of the merging entity, hence the conflict between the public authority and the inefficient merger type, which lacks incentives to reveal its true type.

We argue that a combination of a merger fee and a regulated asset price for the divested assets can be successfully employed as a screening device whenever both types of cost savings are complements. There is complementarity within the merger profit between synergies and the capital stock cost savings if the higher the synergy, the higher the rise in profit due to a marginal increase in capital. We show that the competition authority proposes to the merged entity a menu of two contracts. The *first contract consists of a no-divestiture merger combined with a merger fee paid to the CA*. The *second contract is an asset divestiture sold at a higher price* than the freely bargained price with symmetric information. To put it differently, the competition agency clears the merger provided the merged entity pays a "licence to merge". The optimal "licence" schedule takes two very different forms. It is either an asset divestiture, or the payment of a fee to the competition authority in exchange of a no-divestiture merger clearance.

Under the complementarity assumption, the efficient merged entity value its capital more than the inefficient one does. Hence the screening pair of contracts where the inefficient merger type accepts to divest assets in exchange of a high price rather than pay a merger fee and merge without structural remedies. The competition agency will make use of all three instruments. The asset divestiture deals with the negative welfare effect of the inefficient type merger, whereas the merger fee and the asset divestiture price regulation are used to increase the profitability of the merger with divestiture so as to induce the inefficient insiders to accept the divestiture. For that purpose, the competition authority exploits the positive externality the merger exerts on the outsider's profit when fixing the sale price and uses the merger fee whenever the manipulation of the asset price is not sufficient, due to the constraint raised by the outsider's maximum willingness to pay.

Finally, we examine the usefulness of the asset sale price regulation by comparing it with the optimal merger control with the merger fee only and without asset price regulation.

Related literature

Our model actually provides, to our knowledge, the only existing formal treatment available for the strictly informal intuition of Röller et al. (2001, p.216) who suggest to use merger license fees as a revelation mechanism. The asymmetric information problem for merger control has already been tackled though by Besanko and Spulber (1993) or Faulli-Oller and Corchon (1999). Yet neither of these articles allow for merger remedies.

To our knowledge, few papers do. Barros et al. (2007) show in an empirical study that the set of instruments used by a competition agency, including merger fixes, define the severity of the merger control policy and thus is likely to have a screening effect. Our model takes on Rey (2000), who suggests the possibility of divestitures, besides 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 occurs, and examine other revelation instruments.

The effectiveness of our screening mechanism comes from exploiting the externality that the merger conveys on the outsider. In that sense our paper is related to Fridolfsson and Stennek (2005). In their framework, the introduction of asset divestitures allows the merging firms to recover part of the outsider's hold-up rent through the divested assets sale price. Thus, they infer that such structural remedies may improve the welfare by hastening a profitable merger or even by making profitable an initially unprofitable merger.

Next we present the model and the competition framework. For the design of optimal remedies, we first define the symmetric information benchmark. Then we deal with the information asymmetry and perform the comparison between the asset price regulation and the merger fee. Finally, we discuss our results with respect to alternative assumptions. All technical proofs are grouped in the Appendix.

2 The model

We present first our general framework and basic assumptions. Then we develop an example satisfying these assumptions.

2.1 Framework

Take a very simple setting with three identical firms competing on a given market. Firms' profits depend on their capital or asset stock K (physical or immaterial capital, products, capacities,

etc.). Consider now exogenous horizontal concentration on this market. Index the merged entity, i.e. the insiders, by M, and the outsider by o, respectively. Following the merger, the insiders hold the double ($2K$) of the pre-merger capital stock. The outsider's capital holdings are unchanged.

In our model, owning more capital lowers the cost of the merging firms. In addition, insiders may also benefit from some merger-specific cost savings or "synergies", measured by a parameter denoted α.The parameter α measures the positive effect of an essential complementarity between the merger partners that allows them to further lower their common cost[9]. As Röller et al. (2001) argue, such synergies typically arise from the complementarity between technological or administrative capabilities of firms.

According to the law, merging firms need to submit their merger project for appraisal to the public agency in charge of the merger policy, the competition authority (CA henceforth). Thus, the post-merger market structure may be modified through the CA's decisions and intervention. Explicitly, the CA may require remedies under the form of asset divestitures in order to fulfil its own merger control objective, which is taken here to be total welfare maximization. In our setting, the divestitures will consist of asset transfers to the outsider, whom we suppose here to be the only possible buyer. Moreover, we consider that the feasible asset divestiture is unique[10]. Equivalently, we assume here that only Δ units of capital can be divested to the outsider (with $\Delta < K$). Denoting δ the asset divestiture, this means that $\delta \in \{0, \Delta\}$. We denote $\Pi^M(\delta, \alpha)$ and $\Pi^o(\delta, \alpha)$ the firms' profits respectively when asset transfers apply. For simplicity, we use a two-type model, with the synergy parameter $\alpha \in \{\underline{\alpha}, \overline{\alpha}\}$, where $\overline{\alpha}$ stands for the high cost entity and $\underline{\alpha}$ for the low cost merged entity ($\underline{\alpha} > \overline{\alpha}$, since α measures the synergies). The objective probabilities are ρ for the $\underline{\alpha}$ type and $1-\rho$ for the $\overline{\alpha}$ type respectively. Denote by $CS(\delta, \alpha)$ the consumers' surplus after the merger. Thus total welfare after merger equals $W(\delta, \alpha) = CS(\delta, \alpha) + \Pi^o(\delta, \alpha) + \Pi^M(\delta, \alpha)$.

2.2 Assumptions

The following assumptions hold:

H0: $\Pi^M(0, \alpha) \geq 2\Pi$ for $\alpha = \underline{\alpha}, \overline{\alpha}$, i.e. any merger without asset divestiture is profitable.

H1: $\frac{\partial}{\partial \alpha}\Pi^M(\delta, \alpha) > 0, \frac{\partial}{\partial \alpha}\Pi^o(\delta, \alpha) < 0$, meaning that higher synergies benefit the insiders but hurt the outsider.

H2: $3\Pi \leq \Pi^M(\Delta, \overline{\alpha}) + \Pi^o(\Delta, \overline{\alpha}) \leq \Pi^M(0, \overline{\alpha}) + \Pi^o(0, \overline{\alpha})$, so that the asset transfer from the merged firm to the outsider leads to a decrease in the total industry profit. Thus, following the

[9] For an explicit example of modeling cost savings through the use of complementary assets by merger partners see Bensaid et al. (1994).

[10] In this we follow among others Motta et al. (2002), Vasconcelos (2005), and basically the European Commission guidelines on remedies that stress that an asset divestiture must be a viable set of activities.

merger, there is no additional asset transfer likely to improve the profit of both firms remaining on the market. This assumption justifies that the merger without divestiture is the most profitable. Otherwise, there would exist a price for the asset divestiture that would jointly increase both profits.

H3: $\frac{\partial^2 \Pi^M(\delta,\alpha)}{\partial\delta\partial\alpha} < 0$, which stands for the complementarity assumption between synergies and capital cost savings: the higher the synergies, the higher the rise in profit due to a marginal increase in capital. Equivalently, the higher the synergies, the costlier the asset transfer.

H4: $\frac{\partial}{\partial\alpha}W(\delta,\alpha) > 0$, meaning that the merger synergies improve social welfare.

H5: $W(\Delta,\overline{\alpha}) > W > W(\overline{\alpha},0)$ and $W(0,\underline{\alpha}) > W(\Delta,\underline{\alpha})$ where W is the level of total welfare if the merger is not carried-out. To avoid trivial cases, we only consider the cases where asset divestitures prevent the welfare loss from an inefficient merger[11].

To sum up, horizontal mergers possibly lead to two opposite effects: market power increase on the one hand, but higher cost efficiency on the other. Divestitures might be used by the CA to modify the post-merger market equilibrium to make it more compatible with the CA's objective function. These divestitures would depend on the synergies as well as on the CA objective, and their design is studied in the next section.

2.3 An example

Here is an example satisfying all five previous assumptions. Consider a homogenous good, three-firm perfectly symmetric industry with linear demand $P(Q) = 1 - Q$, where P is the market price and Q the total output. Firms maximize individual profit and compete *à la* Cournot. We consider an individual cost function developed by Vasconcelos (2005). Individual total cost depends on the capital stock as follows: $q \cdot c(k)$, where q denotes the level of production and $c(k)$ is the marginal cost with $c'(k) < 0$ and $c''(k) > 0$. The total cost function of the merged entity satisfies the following: $q \cdot c^M(k,\alpha)$, where α measures the amount of synergies. The marginal cost $c^M(k,\alpha)$ satisfies the following: first, it is a decreasing and convex function of the capital stock ($\frac{\partial c^M(k,\alpha)}{\partial k} < 0$ and $\frac{\partial^2 c^M(k,\alpha)}{\partial k^2} > 0$). Secondly, an increase in α reduces the marginal cost ($\frac{\partial c^M(k,\alpha)}{\partial \alpha} < 0$). Finally, the cost reduction due to synergies increases with the capital stock ($\frac{\partial^2 c^M(k,\alpha)}{\partial k\partial\alpha} \leq 0$). Such a cost function satisfying these assumptions is $c^M(k,\alpha) = c(k) - \alpha$ with $\alpha \in [0, c(2K)]$ .We show in the appendix that in this case, H1 to H5 are satisfied whenever the level of synergy $\underline{\alpha}$ is sufficiently high and that of synergies $\overline{\alpha}$ is sufficiently low. Indeed, following Farrel and Shapiro (1990), in a Cournot model the divestiture reduces the price and thus increases the consumer surplus, but also increases the insiders' cost. Thus, there are cases where due to very high synergies, the insiders' output is so high that the asset divestiture decreases the total

[11] For simplicity we assume also that asset divestiture is better than no asset divestiture: $\rho W(\Delta,\underline{\alpha}) + (1-\rho)W(\Delta,\overline{\alpha}) \geq \rho W(0,\underline{\alpha}) + (1-\rho)W(0,\overline{\alpha})$.

welfare.

2.4 Merger control objective and instruments

We assume that the CA examines the merger projects based on the total welfare maximization standard[12].

In addition to the asset divestiture, we suppose that the public agency may charge a monetary fee from the merged firms to allow them to merge. We denote F such a fee, which is assumed to be costly, with one euro transferred to the CA costing the merging firms $1+\lambda$ euros ($\lambda > 0$). The parameter λ captures the distortion implied by the financing of that monetary transfer.

Hence, the total welfare net of monetary transfer F to the CA following a merger of type α with an asset transfer equal to δ becomes $W(\delta, \alpha) - \lambda F$.

2.5 Timing of the game

Given the screening stand we take in our model, the game we consider between the firms and the CA is the following:

At the first stage, the merging firms learn their synergy level α and submit a merger proposal to the CA. When information is symmetric α is also observed by the CA, but later on we assume that parameter α is private information of the merging firms.

At the second stage, the CA evaluates the consequences of the merger taking into account its own merger control objective. It proposes a divestiture contract accordingly, if such a contract exists; if not, it rejects the merger. The divestiture contract will consist of an asset divestiture δ, a merger fee F, and possibly a sale price P for the divested assets.

At the third stage, the insiders accept or reject the divestiture. If they accept, assets will be transferred to the outsider. If the CA regulates the sale price of divested assets, then the transfer takes place for this price. Otherwise, it obeys the following bargaining rule: with probability β the merged firm makes a take-it-or-leave-it sale proposition to the outsider, and with the complementary probability it is the outsider that makes an acquisition offer on a take-it-or-leave-it basis.

At the last stage, conditional on the divestiture contract being accepted, the market equilibrium is determined taking into account the amount of asset transfer required by the CA. The merger is abandoned whenever one of the parties rejects the contract.

This last assumption is quite in line with the current unfolding of a divestiture negotiation process. Basically, for a divestiture to take effect, it needs first gain approval of all involved parties: the divesting firms, the buyer, and the CA. The failure of such a three-party negotiation

[12] See Lyons (2002) and Neven and Röller (2005) for a discussion of the CA's objective function.

typically results either in the appointment of a trustee to carry out the divestiture, or in the merger itself falling through.

3 Optimal divestitures with symmetric information

We examine here the case of symmetric information between firms and the CA, meaning that the merger's synergy level is public information. Hence at the second stage, the CA proposes a divestiture contract according to the type of the merger. It consists of an asset divestiture ($\underline{\delta}$ for type $\underline{\alpha}$ and $\overline{\delta}$ for type $\overline{\alpha}$) as well as a monetary fee ($\underline{F}$ for type $\underline{\alpha}$ and $\overline{F}$ for type $\overline{\alpha}$). The CA can also reject the merger.

We determine next the subgame perfect equilibrium of the game defined above.

At stage three, if the insiders commit to divest assets, then the outsider's decision to accept to take over the divested assets depends on his maximum willingness to pay for them, equal to $\Pi^o(\Delta;\alpha) - \Pi$. By the same token, the minimum willingness to receive for the insiders is equal to $\Pi^M(\Delta,\alpha) - 2\Pi$. Thus, the expected price of divestiture by an insider of type α is equal to $\beta(\Pi^o(\Delta;\alpha) - \Pi) + (1-\beta)(2\Pi - \Pi^M(\Delta,\alpha))$. In other words, with probability β the insiders make a sale offer for the maximum willingness to pay of the outsider, whereas with probability $1-\beta$ the outsider makes offers to buy the assets for the minimum willingness to receive of the insiders. The parameter β captures the bargaining power of the insider.

At the second stage, since the CA observes the type of the merger submitted for approval, it makes its decision based on the following programme:

$$\begin{aligned} \max_{\substack{\{\delta,F\} \\ \delta\in\{0,\Delta\},\ F\geq 0}} \quad & W(\alpha,\delta) - \lambda F \\ \text{s.t. } & \Pi^M(\delta,\alpha) + \Pi^o(\delta,\alpha) - F \geq 3\Pi \end{aligned} \tag{1}$$

According to the constraint, the asset divestiture must increase the profit of both the insider and the outsider with respect to the non merger configuration. This constraint ensures the participation of both firms since the profit increase leads both firms to set a price compatible with an increase in both profits with respect to the non merger configuration.

The following lemma provides the solution of the game described above.

Lemma 1 *Let* $(\underline{\delta}^{FB}, \underline{F}^{FB}), (\overline{\delta}^{FB}, \overline{F}^{FB})$ *be the solution of the programme (S):*

- *for* $\alpha = \underline{\alpha}$*, the merger is accepted without divestiture,* $\underline{\delta}^{FB} = 0$*, and without a merger fee,* $\underline{F}^{FB} = 0$*.*
- *for* $\alpha = \overline{\alpha}$*, the merger is accepted with divestiture,* $\overline{\delta}^{FB} = \Delta$*, and with no fee,* $\overline{F}^{FB} = 0$*. The expected price of asset divested is* $P^{FB} = \beta(\Pi^o(\Delta;\overline{\alpha}) - \Pi) + (1-\beta)(2\Pi - \Pi^M(\Delta,\overline{\alpha}))$*.*

Basically, given our assumption that the inefficient merger decreases the level of welfare unless assets are transferred to the outsider, the optimal policy for the CA is to accept such a merger conditionally on the asset divestiture. In turn, since we assume that the divestiture reduces the welfare for the efficient merger, the CA optimally clears it unconditionally. Finally, since the CA observes the type of the merger, there is no reason to ask for a distorting merger fee.

We now turn to the case where the CA does not observe the level of synergy α.

4 Optimal divestitures with asymmetric information: should asset sale prices be regulated?

If the CA proposes the same couple of contracts as with symmetric information, we can show that both types may prefer the no-divestiture contract. Explicitly, we derive the following lemma:

Lemma 2 *There exists a threshold* $\widehat{\beta}(\alpha) \in [0,1]$ *such that* $\Pi^M(0,\alpha) - \underline{F}^{FB} > \Pi^M(\Delta,\alpha) + P^{FB} - \overline{F}^{FB}$ *iff* $\beta \leq \widehat{\beta}(\alpha)$.

The choice of the divestiture contract leads to two opposite effects on the insiders profit. According to H2, the asset divestiture lowers the industry profit. Yet, the sale of the divested assets allows the insider to capture, to a certain extent, the outsider's profit and thus to recover some of the externality exerted by the merger. The extent of the externality capture depends on the insiders' bargaining power of the insider, hence the threshold $\widehat{\beta}(\alpha)$. In our Cournot example, there may be cases where $\widehat{\beta}(\alpha) = 1$, which means that despite the insiders having all the bargaining power, there are still not enough incentives to make them divest assets.

Hereafter we focus on the case where $\beta \leq \widehat{\beta}(\overline{\alpha})$, although there may be cases where the first best contracts may lead to self-selection.

The inefficient type's incentives not to divest make the CA either impose asset transfers to both types or to broaden up the range of merger control instruments. We explore this latter option next.

4.1 Optimal divestiture contracts with regulated asset sale prices

We propose here to endow the CA with two additional tools besides the asset divestiture in order to improve the merger control in those cases where the symmetric information contract is not incentive compatible. Explicitly, to clear mergers the CA will both set the price of the assets divested and require a monetary fee[13].

[13] We should note here that the payment following the sale of assets by the insiders to the outsider, is neutral. We assume this to avoid that the total welfare depends on the bargaining process between firms. Nevertheless,

The game with asymmetric information is thus basically the same as before, only taking into account the changes due to the inobservability of the merger type and the new tools available to the CA. The common priors of the CA and of the outsider on the insiders type are given by the objective probabilities on $\underline{\alpha}$ type (probability ρ) and on $\overline{\alpha}$ type (probability $1-\rho$).

At stage four, the outsider observes the menu of contracts proposed by the CA, as well as the contract chosen by the merged entity, and thus revises its prior beliefs.

Following the revelation principle we restrict to truthful direct revelation mechanisms, and look for a separating perfect Bayesian equilibrium of the game.

The incentive contract fixed by the CA will thus contain a merger fee F, an amount of divested assets δ and a price P for the asset divestiture if it is positive. Two Incentive Constraints ($\underline{IC}$ for type $\underline{\alpha}$ and $\overline{IC}$ for type $\overline{\alpha}$) are added to the programme of the CA to induce revelation of information. Hence, the programme of the CA writes:

$$\max_{\substack{\left\{(\underline{\delta},\underline{P},\underline{F}),(\overline{\delta},\overline{P},\overline{F})\right\} \\ \underline{\delta},\overline{\delta}\in\{0,\Delta\},\ \overline{P},\ \underline{P},\ \overline{F}\geq 0,\underline{F}\geq 0}} \rho\left[W(\underline{\alpha},\underline{\delta})-\lambda\underline{F}\right]+(1-\rho)\left[W(\overline{\alpha},\overline{\delta})-\lambda\overline{F}\right] \qquad \text{(AS)}$$

$$\text{s.t.}\begin{cases} \Pi^M(\underline{\delta};\underline{\alpha})+\underline{P}-\underline{F}\geq\Pi^M\left(\overline{\delta};\underline{\alpha}\right)+\overline{P}-\overline{F} & (\underline{IC}) \\ \Pi^M\left(\overline{\delta};\overline{\alpha}\right)+\overline{P}-\overline{F}\geq\Pi^M(\underline{\delta};\overline{\alpha})+\underline{P}-\underline{F} & (\overline{IC}) \\ \Pi^M(\underline{\delta};\underline{\alpha})+\underline{P}-\underline{F}\geq 2\Pi & (\underline{PC}^M) \\ \Pi^M\left(\overline{\delta};\overline{\alpha}\right)+\overline{P}-\overline{F}\geq 2\Pi & (\overline{PC}^M) \\ \Pi^o(\underline{\delta};\underline{\alpha})-\underline{P}\geq\Pi \ \text{ if } \ \underline{\delta}=\Delta & (\underline{PC}^o) \\ \Pi^o\left(\overline{\delta};\overline{\alpha}\right)-\overline{P}\geq\Pi \ \text{ if } \ \overline{\delta}=\Delta & (\overline{PC}^o) \end{cases}$$

where the contracts $(\underline{\delta},\underline{P},\underline{F})$ and $(\overline{\delta},\overline{P},\overline{F})$ are destined for types $\underline{\alpha}$ and $\overline{\alpha}$ respectively. The last four constraints are the participation constraints of the outsider for both contracts ($\overline{PC}^o$ and $\underline{PC}^o$) as well as those of both types of insiders ($\overline{PC}^M$ and $\underline{PC}^M$). Since the contract we look for induces information revelation, in equilibrium the priors of the outsider necessarily coincide with his revised beliefs.

To achieve screening, the revealing contracts need to reconcile the often conflicting objectives of the insiders and of the outsider, so as to ensure both industry firms' participation. Thus the above programme is actually designed to make the industry parties involved agree on the incentive-compatible sharing of their total profit.

Before presenting the optimal contracts we give the following lemma:

Lemma 3 *Under H3,* $\Pi^M(\delta_1;\underline{\alpha})-\Pi^M(\delta_2;\underline{\alpha})>\Pi^M(\delta_1;\overline{\alpha})-\Pi^M(\delta_2;\overline{\alpha})$ *for any* $\delta_1<\delta_2$

we will show that the merger fee is useful despite this asymmetry between the monetary transfers to the CA or among firms.

This inequality stands for the standard single crossing condition. It states that the efficient merged entity benefits more from a lower asset divestiture than the inefficient one. In other words, the efficient merged firm values capital more than the inefficient one. This result derives from the complementarity between synergies and capital assumed in H3, according to which the higher the synergy, the costlier the divestiture.

As in any standard Principal-Agent model, this lemma makes room for screening. We can therefore derive the optimal contracts summarized in the following proposition:

Proposition 1 *Denote* $\left(\underline{\delta}^R, \underline{P}^R, \underline{F}^R\right)$, $\left(\overline{\delta}^R, \overline{P}^R, \overline{F}^R\right)$ *the divestiture contracts proposed with asymmetric information, solution of the programme (AS). Under H1 to H5 and for* $\beta \leq \widehat{\beta}(\overline{\alpha})$*, the following hold:*

There exists a threshold $\widehat{\lambda}$ *such that:*

(i) For $\lambda < \widehat{\lambda}$*, we have* $\underline{\delta}^R = 0$ *and* $\overline{\delta}^R = \Delta$*. Prices and corresponding fees are* $\overline{P}^R = \Pi^o(\Delta;\overline{\alpha}) - \Pi$, $\underline{P}^R = \overline{F}^R = 0$ *and* $\underline{F}^R = Max(\Pi^M(0;\overline{\alpha}) - \Pi^M(\Delta;\overline{\alpha}) - \overline{P}^R, 0)$.

(ii) For $\lambda > \widehat{\lambda}$*, we have* $\underline{\delta}^R = \overline{\delta}^R = \Delta$, $\underline{F}^R = \overline{F}^R = 0$ *as long as* $\Pi^M(\Delta;\overline{\alpha}) + \rho(\Pi^o(\Delta,\underline{\alpha}) + (1-\rho)\Pi^o(\Delta;\overline{\alpha}) \geq 3\Pi$*. Otherwise, the merger is always prohibited.*

This proposition states that as long as the social cost of the monetary transfer is low enough, the CA optimally uses both additional tools at her disposal. In this case, the optimal contracts have two main characteristics. First, as compared with the symmetric information case, the divestiture is not distorted and the merger approval decision is unchanged. Second, the efficient merger pays a merger fee, whereas the price of assets divested by the inefficient merger is upwards distorted ($\overline{P}^R > P^{FB}$). To sum up, the efficient insiders pay a fee in order to merge, whereas the inefficient insiders are granted an upward sale price distortion.

The intuition behind the design of these contracts goes in three steps.

So as to fulfill the CA's objective, the CA can either request that asset divestiture whatever the level of synergies claimed by the firms, or induce the inefficient merger to divest the assets.

Secondly, it must be shown that the asset price distortion together with a merger fee makes both firms choose the optimal divestitures given in Lemma 1. According to Lemma 3, a given divestiture is more distorting for the efficient merged firm than for the inefficient one. Thus, the willingness to pay in order to avoid a given asset divestiture is higher for the efficient merged entity than for the inefficient one. By the same token, the willingness to receive following the asset sale is lower for the efficient entity. Hence, to induce the inefficient insiders to give up the no-asset transfer contract, the CA ought to set a positive fee for this no-divestiture contract and increase to the maximum the price in case of asset sale. Accordingly, it is enough to increase the asset price to equal the willingness of the outsider, and set a positive merger fee, so as to provide the right incentives. To sum up, our screening mechanism partly relies on the transfer

of the merger externality from the outsider to the insiders through the asset price regulation. Moreover, whenever this externality is not substantial enough, the CA must complement the asset price regulation with the merger fee.

Finally, we need to show that the preceding contracts are more efficient from the CA's point of view than applying divestiture for all merger projects. The social cost of the contracts described above comes from the merger fee paid by the efficient entity while the social cost of a pair of contracts requiring divestiture for both types is that of applying the asset divestiture to the low-cost merged entity. Therefore, whenever the cost of public transfers is not too high, it is more efficient to have the efficient merger pay a merger fee rather than resort to an even more distorting asset divestiture.

Our proposition suggests that regulating the sale price of divested assets and requesting a merger fee comes down to firms paying a kind of licence to merge, where the actual payment varies according to the level of synergies. Basically, inefficient insiders pay by giving up assets, whereas the efficient ones pay through a monetary fee to the CA. Hence, one way to interpret our result is to consider that the CA offers the insiders the choice between a monetary fee and the appointment of a divestiture trustee that will enjoy full authority in the bargaining process and only sell the assets at the highest possible price.

Note also that our result does not depend on the initial assumptions on the social cost of merger fees and the neutrality of money transfers between firms[14]. Indeed, despite this potential bias against the use of merger fees, we show that the optimal merger control induces the CA to use this costly monetary transfer towards the CA, since the regulation of the asset price alone does not make the inefficient insiders accept the divestiture.

Finally, Proposition 1 raises the issue of the best instruments to address the anticompetitive effects of mergers. We argue that while price distortion is considered as highly interventionist, and prohibited in an orthodox view of competition policy, within merger control the most distorting tool is more likely to be the divestiture itself, rather than a lump-sum monetary transfer between industry firms. Indeed, whereas the monetary transfers do not affect the firms' production decisions, the amount of divested assets does.

We have discussed here the case where the CA regulates both the sale price of the asset divestiture and the merger fee. In Proposition 1, the optimal merger fee could be strictly positive. This means that without such an instrument the optimal merger control would be less

[14] The absence of cost for the monetary transfers between firms impacts on the optimal regulated price. Nevertheless, we can easily show that even if the price gap with respect to the freely negociated price is costly, the asset price regulation by the CA remains optimal. For instance, if the efficient merger type is the most likely, it is less costly to use the asset price regulation for the efficient type rather than the merger fee payment by the efficient type.

efficient and would require the distortion of the asset transfer. One remaining question is the usefulness of the other regulatory tool for the merger control. Unsurprisingly, the lack price regulation, will lower the merger control efficiency since the regulated asset price is distorted. Nevertheless, this setting is still worth examining, because with asymmetric information the sale price has a signalling dimension and thus inefficiencies may be enhanced.

4.2 Optimal divestiture contracts without regulated asset sale prices

We examine the outcome of merger control without regulation of the asset price and we assess its efficiency. As before mentioned, whenever the price is proposed by the insiders, this price has a signalling dimension. Therefore, at the last stage the outsider updates his prior beliefs according to the chosen contract as well as the price offered by the insiders.

We examine the Perfect Bayesian Equilibrium of this game and we show the following proposition.

Proposition 2 *In any Perfect Bayesian Equilibrium (PBE) of the unregulated price game, the following hold:*

(i) The expected asset price P^{UR} *is such that* $P^{FB} \geq P^{UR}$ *and the corresponding optimal merger fees are the following:* $\overline{F}^{UR} = 0$ *and* $\underline{F}^{UR} = Max(\Pi^M(0;\overline{\alpha}) - \Pi^M(\Delta;\overline{\alpha}) - P^{UR}, 0) \geq \overline{F}^R$.

(ii) The expected welfare is reduced as compared with the asset price regulation case.

Lack of asset sale price regulation reduces the expected welfare. The inefficiency stems from the unregulated asset price being lower than the regulated one. As a result, in order to induce the inefficient merger to accept the asset divestiture, the CA is constrained to offset this lower price by a higher merger fee if the firm chooses not to divest assets. Moreover, the asset sale price can be even lower than its symmetric information level, meaning that the current inefficiency is not merely due to an asset price unchanged with respect to the symmetric information situation. The asymmetric information combined with the lack of asset price regulation amplify the inefficiency of the merger control.

The asset price is now lower than the regulated price on account of two reasons.

First, the bargaining position of the insiders prevents them from capturing the whole willingness to pay of the outsider, as the CA does through price regulation.

Secondly, there are equilibria where the asset sale price is even lower than the symmetric information level. This is due to the asymmetric information between the outsider and the insiders. If that for the symmetric information price level the outsider believes that the assets are sold by an efficient firm, then the outsider does not buy them. Thus the insiders are constrained to sell at a lower price, and therefore the corresponding merger fee needs to be higher.

We show in the appendix that such beliefs are not reasonable according to the Cho and Kreps (1987) criterion. Nevertheless, the regulation of the sale price turns out to be the best way for the CA to induce the outsider to agree on a sale price that allows the lowest merger fee, and this is more efficient from the welfare point of view.

Note that both instruments, if employed alone within merger control, lead to an extra cost w.r.t. the case where both are used simultaneously. Hence the comparison between these instruments comes down to a comparison of their relatives costs: distortion of the asset transfer if the sale price is regulated but no fee is used, and a merger fee raise if the sale price is not regulated.

5 Optimal merger control under alternative assumptions

We discuss in this section the robustness of our main result displayed in Proposition 1 with respect to our main assumptions.

The objective of the CA.

We adopted in the present paper a total welfare objective. Yet the literature hosted a sharp debate on the actual objective of the CA for merger control.

If the CA adopts a consumer surplus criterion to clear a merger, the contract described in proposition 2 would still be optimal to the extent that the asset divestiture improves the consumer surplus for the inefficient merger only. A second possible decision rule is based on the lexicographic criterion. It consists in maximizing the profit of the merging firms, provided that the consumer surplus is not reduced[15]. Again, as long as the asset divestiture prevents a consumer surplus decrease for the inefficient merger, the optimal contract is the same as the one in Proposition 1. First, the CA gives incentives to the inefficient merger type to divest assets, and then it sets the merger fee to the minimum and the asset price to the maximum, which leads to the maximization of the merging firms' total profit.

Substitutability between capital and synergies

Assumption H3 states that the higher the synergies, the higher the profit gain due to a marginal increase in capital. The single crossing condition in Lemma 3 derives from that assumption. Assume instead that capital and synergies are substitutes: the higher the synergies, the lower the marginal impact of capital on profit. Then the willingness to pay in exchange for the no-divestiture contract is higher for the inefficient type than for the efficient one. Therefore,

[15] See Lyons and Medvedev (2007) for this objective function, which is basically the translation of both the EU and US merger guidelines.

if the inefficient type is induced to divest assets, then the efficient firm is also induced to do so, following our Lemma 2. This yields a non responsiveness case (Laffont and Martimort (2001)), where the CA's objective to provide divestiture incentives only to the inefficient insiders conflicts with their merger gains. As a result, the optimal contract pools both types and consists in requiring the asset divestiture with no price regulation and no merger fee whatever the level of synergies.

Information and merger control.

In order to implement the optimal contract in Proposition 1, the CA needs to know the whole model, and in particular the profits of both the insiders and the outsider. We only assume that the insiders' post-merger synergy level is not perfectly observed.

Yet one can easily imagine that the outsider's willingness to pay for the divested assets depends on the own level of efficiency of that outsider, and as such it is not publicly known. But then the merger would not take place if the CA sets a price so high that the merger is not profitable for the outsider. As a result, the CA would have to leave a rent to the most efficient outsider. Again, this lower asset price will lead the CA to increase the merger fee so as to still satisfy the incentive constraint of the inefficient insiders. In other words, the asymmetric information between the CA and the outsider would make the CA rely even more on the merger fee. Sale price regulation remains nevertheless relevant to ensure that the target insiders divest assets, although allowing now only a partial capture of the outsider rent.

6 Conclusion

The choice of optimal asset divestitures for merger control is likely to face informational issues concerning the level of merger synergies. We examine here the possibility for the CA to use additional instruments: a merger fee paid to the CA as well as the price regulation for the divested assets. We show that these instruments complement each other. More precisely, the more efficient merger project is induced not to divest assets but will pay a positive merger fee, while the inefficient merger project is on the contrary given incentives to divest assets by means of an upwards distortion of the sale price of divested assets, with no merger fee. We also assess the efficiency of the merger control based on the merger fee only, as would be the case if the CA is reluctant to use the asset price regulation instrument.

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7 Appendix

7.1 Assumptions H0 to H5 in the Cournot example

- **The merger without asset divestitures**

In the Cournot model with constant marginal cost and linear demand, we can easily show the following properties:
(i) Total welfare $W(0,\alpha)$ increases with the level of synergies α
(ii) The profit of the outsider decreases with α, the profit of the insiders increases with α and the industry profit increases with α.
(iii) There exits a unique level of synergies α_1 such that for any $\alpha > \alpha_1$ we have $\Pi^M(0,\alpha) > 2\Pi$ (the merger is profitable) and $\Pi^M(0,\alpha) + \Pi^o(0,\alpha) > 3\Pi$ (total profit in the industry increases).
(iv) There exists unique level of synergies $\alpha_2 > \alpha_1$ such that for any $\alpha > \alpha_2$, total welfare increases: $W(0,\alpha) > W$
Hence for any $\underline{\alpha} > \alpha_2 > \overline{\alpha} > \alpha_1$ our assumptions H0, H1 and H4 are satisfied.

- **The impact of asset divestitures on profits and total welfare**

- Asset divestitures and firms profits.
According to assumption H2, the asset divestitures reduce the industry profit. The impact of asset divestitures on total profits is equal to

$$\frac{\partial\left(\Pi^M(\delta,\alpha)+\Pi^o(\delta,\alpha)\right)}{\partial\delta} =$$

$$R'(\delta)\underbrace{-\left(q^o c'(K-\delta) - q^M\frac{\partial c^M(2K-\delta,\alpha)}{\partial k}\right)}_{A}\underbrace{-\left(\frac{\partial q^o(\delta,\alpha)}{\partial\delta}c(K-\delta)+\frac{\partial q^M(\delta,\alpha)}{\partial\delta}c^M(2K-\delta,\alpha)\right)}_{B}$$

where $q^M(\delta,\alpha) = \frac{1-2c^M(2K-\delta,\alpha)+c(K-\delta)}{3}$ is the quantity produced by the insiders, $q^o(\delta,\alpha) = \frac{1-2c(K-\delta)+c^M(2K-\delta,\alpha)}{3}$ is the quantity produced by the outsider. The term $R(\delta)$ is the total revenue of the industry $(q^M(\delta,\alpha)+q^o(\delta,\alpha))P(q^M(\delta,\alpha)+q^o(\delta,\alpha))$ and $A+B$ assesses the impact of the divestiture on total cost. Basically A assesses the effect of the divestitures on the total cost for unchanged allocation of production and B captures the impact of the reallocation of production on the total cost. Let us determine the sign of each term:
-Term $R'(\delta)$: if $c^M(k,\alpha) = c(k) - \alpha$, total revenue decreases with δ since the price decreases with δ. We have $R'(\delta) < 0$.
-Term A: we have always $q^M(\delta,\alpha) > q^o(\delta,\alpha)$, because of cost advantage of firm M. Thus there always exists a function $c(k)$ such that $\left(q^o c'(K-\delta) - q^M \frac{\partial c^M(2K-\delta,\alpha)}{\partial k}\right) > 0$. Hence $A < 0$.
-Term B: we have: $c(K-\delta) > c^M(2K-\delta,\alpha)$ and $\frac{\partial q^o(\delta,\alpha)}{\partial \delta} > -\frac{\partial q^M(\delta,\alpha)}{\partial \delta}$. Therefore $B < 0$. Asset divestitures increase the level of production in the least efficient firm and thus the impact is negative.

According to assumption H3 ($\frac{\partial^2 \Pi^M(\delta,\alpha)}{\partial\delta\partial\alpha} < 0$), the higher α, the higher the distorsive impact of asset divestitures on the insiders profit. We can show that as long as $\frac{\partial^2 c^M}{\partial\alpha\partial k} < 0$, H3 is satisfied. Indeed we have: $\frac{\partial^2 \Pi^M(\delta,\alpha)}{\partial\delta\partial\alpha} = \frac{4}{3} q^M \frac{\partial^2 c^M}{\partial\alpha\partial k} - \frac{4}{3}\frac{\partial q^M}{\partial\delta}\frac{\partial c^M}{\partial\alpha}$.

- Asset divestitures and the total welfare

According to assumption H5, the asset divestitures (i) reduce the total welfare for the most efficient merger type ($\underline{\alpha}$) i. e. $W(\Delta,\underline{\alpha}) < W(0,\underline{\alpha})$ and (ii) increase total welfare above the pre-merger level for the least efficient merger type ($\overline{\alpha}$) i. e. $W(\Delta,\overline{\alpha}) > W$.

(i) The marginal impact of asset divestiture on the welfare is equal to
$\frac{\partial W(\delta,\alpha)}{\partial\delta} = \frac{1}{3}\left[c'(K+\delta)(3q^o+q^M) - \frac{\partial c^M(2K-\delta,\alpha)}{\partial k}(q^o+3q^M)\right]$
As explained by Farrell and Shapiro (1990), the divestiture has two opposite effects. On the one hand, it reduces the sum of marginal costs and thus tends to increase the welfare. On the other, it increases the marginal cost of the insiders that produce more than the outsider, and this tends to decrease the welfare. Therefore, the higher the level of synergies, the lower $q^o(\delta,\alpha)$ and the higher $q^M(\delta,\alpha)$ and thus the likelier the negative total effect of the divestiture on the welfare. Therefore for $\underline{\alpha}$ high enough, we have $\frac{\partial W(\delta,\alpha)}{\partial\delta} < 0$, meaning $W(\Delta,\underline{\alpha}) < W(0,\underline{\alpha})$.

(ii) Any asset divestitures do not ensure a welfare increase above the pre-merger level for the least efficient merger type. However, we show here that there exists an asset divestiture Δ that ensures such an increase. Let us consider that Δ leads the price unchanged after the merger. Such Δ exists whenever $\frac{1-c^M(2K-\Delta,\overline{\alpha})-c(K-\Delta)}{3} = \frac{1-3c(K)}{4}$. In that case the consumer surplus is unchanged with respect to the pre-merger level. The total profits increase since total revenue are unchanged and both marginal costs decrease: for the outsider $c(K+\Delta) < c(K)$ and

for the insiders $c^M(2K-\Delta,\alpha) < c(K)$.

7.2 Proof of Lemma 1

Lemma 1 is a direct consequence of assumption H5 according to which $W(\Delta,\underline{\alpha}) < W(0,\underline{\alpha})$ and $W(\Delta,\overline{\alpha}) > W$. Hence the optimal divestiture is asset divestitures for the type $\overline{\alpha}$ merger i. e. $\overline{\delta}^{FB} = \Delta$ and no divestiture for the type $\underline{\alpha}$ i. e. $\underline{\delta}^{FB} = 0$. Moreover, since any transfer to the CA is costly, the optimal merger fees are both equal to zero: $\underline{F}^{FB} = \overline{F}^{FB} = 0$. Finally, from the discussion preceding the lemma, the expected price for the asset divestiture by the inefficient merger type is $P^{FB} = \beta(\Pi^o(\Delta;\overline{\alpha}) - \Pi) + (1-\beta)(2\Pi - \Pi^M(\Delta,\overline{\alpha}))$.

7.3 Proof of Lemma 2

(i) Existence of $\widehat{\beta}(\alpha)$.
$\Pi^M(0,\alpha) - \underline{F}^{FB} > \Pi^M(\Delta,\alpha) + P^{FB} - \overline{F}^{FB}$ is equivalent to $\beta < \frac{\Pi^M(0,\alpha)-2\Pi}{\Pi^o(\Delta;\alpha)+\Pi^M(\Delta,\alpha)-3\Pi}$.
We define $\widehat{\beta}(\alpha) = Min(1, \frac{\Pi^M(0,\alpha)-2\Pi+\Pi^M(\Delta,\alpha)-\Pi^M(\Delta,\overline{\alpha})}{\Pi^o(\Delta;\alpha)+\Pi^M(\Delta,\alpha)-3\Pi})$. Note that according to H0 and H2, $\widehat{\beta}(\alpha) > 0$.

(ii) Level of $\widehat{\beta}(\overline{\alpha})$ in the Cournot example
We show that in the Cournot example $\widehat{\beta}(\overline{\alpha}) = \frac{\Pi^M(0,\overline{\alpha})-2\Pi}{(\Pi^o(\Delta;\overline{\alpha})+\Pi^M(\Delta,\overline{\alpha})-3\Pi)}$ could be equal to 1.
Consider, for instance, the case where the asset divestiture applied to the merger of type $\overline{\alpha}$ leads to a price unchanged with respect to the pre-merger configuration.
If we denote by q the pre-merger quantity produced by any one firm, then:
$\Pi^M(\Delta,\overline{\alpha}) + \Pi^o(\Delta,\overline{\alpha}) = 3qP(3q) - \left(2qc^M(2K-\Delta,\overline{\alpha}) + qc(K+\Delta)\right)$
Moreover, $\Pi^M(0,\overline{\alpha}) + \Pi \geq 3qP(3q) - \left(2qc^M(2K,\overline{\alpha}) + qc(K)\right)$
If the total production cost increases with δ (it is the case for instance in the Cournot example developed above where $A < 0$), we deduce that:
$\left(2qc^M(2K,\overline{\alpha}) + qc(K+\Delta)\right) \leq \left(2qc^M(2K-\Delta,\overline{\alpha}) + qc(K+\Delta)\right)$ and thus that:
$\Pi^M(0,\overline{\alpha}) + \Pi > \Pi^M(\Delta,\overline{\alpha}) + \Pi^o(\Delta,\overline{\alpha})$.
As a result: $\widehat{\beta}(\overline{\alpha}) > 1$.

7.4 Proof of Lemma 3

Assumption H3 implies that $\frac{\partial\Pi^M(\delta;\overline{\alpha})}{\partial\delta} - \frac{\partial\Pi^M(\delta;\underline{\alpha})}{\partial\delta} > 0$.
Hence for any δ we have also $\frac{\partial}{\partial\delta}\left(\Pi^M(\delta;\overline{\alpha}) - \Pi^M(\delta;\underline{\alpha})\right) < 0$.
Therefore $\Pi^M(\delta_1;\underline{\alpha}) - \Pi^M(\delta_2;\underline{\alpha}) > \Pi^M(\delta_1;\overline{\alpha}) - \Pi^M(\delta_2;\overline{\alpha})$, for any $\delta_1 < \delta_2$.

7.5 Proof of Proposition 1

We first determine the best separating contract, then we compare it with the best pooling contract and we deduce the optimal contract. We focus here on $\beta < \widehat{\beta}(\overline{\alpha})$ since otherwise the first best contract satisfies the incentive constraints.

- **The best separating contract**

The best separating contract requires an asset divestiture for the type $\overline{\alpha}$ and no divestiture for the type $\underline{\alpha}$. The contracts proposed by the CA are thus $(0, \underline{F}, 0)$ for the efficient type and $(\Delta, \overline{F}, \overline{P})$ for the inefficient type.

Therefore, the constraints become:
$$\begin{cases} \Pi^M(0;\underline{\alpha}) - \underline{F} \geq \Pi^M(\Delta;\underline{\alpha}) + \overline{P} - \overline{F} & (\underline{IC}) \\ \Pi^M(\Delta;\overline{\alpha}) + \overline{P} - \overline{F} \geq \Pi^M(0;\overline{\alpha}) - \underline{F} & (\overline{IC}) \\ \Pi^M(0;\underline{\alpha}) - \underline{F} \geq 2\Pi & (\underline{PC}^M) \\ \Pi^M(\Delta;\overline{\alpha}) + \overline{P} - \overline{F} \geq 2\Pi & (\overline{PC}^M) \\ \Pi^o(\Delta;\overline{\alpha}) - \overline{P} \geq \Pi & (\overline{PC}^o) \end{cases}$$

Total welfare decreases with F and does not depend on P. Therefore, optimal distortions must be such that:

(i) $\overline{P}$ must be set at its maximum provided that $(\overline{PC}^o)$ is satisfied i. e.: $\overline{P}^{PR} = \Pi^o(\Delta;\overline{\alpha}) - \Pi$

(ii) $\underline{F}$ and $\overline{F}$ must be set at their minimum provided that $(\overline{IC})$ is satisfied i. e. $\overline{F}^{PR} = 0$ and $\underline{F}^{PR} = Max(\Pi^M(0;\overline{\alpha}) - \Pi^M(\Delta;\overline{\alpha}) - \overline{P}^{PR}, 0)$

The participation constraint $(\underline{PC}^M)$ is satisfied since we have $\Pi^M(0;\underline{\alpha}) - \underline{F}^{PR} \geq \Pi^M(\Delta;\underline{\alpha}) + \overline{P}^{PR} \geq 2\Pi$.

For that optimal screening contract, the resulting expected total welfare is equal to:

$$\rho\left[W(0,\underline{\alpha}) - \lambda Max\left(\Pi^M(0;\underline{\alpha}) - \Pi^M(\Delta;\underline{\alpha}) - \Pi^o(\Delta;\overline{\alpha}) + \Pi, 0\right)\right] + (1-\rho)W(\Delta,\overline{\alpha})$$

- **The best pooling contract**

The best pooling contract consists in requiring asset divestiture since we assumed (footnote 14) that the expected welfare is maximized with asset divestiture rather than without divestiture. Here there are no incentive constraints. Hence merger fees are equal to 0: $\underline{F} = \overline{F} = 0$. The asset price P must satisfy the participation constraint of the inefficient type merger, $\Pi^M(\Delta,\overline{\alpha}) + P \geq 2\Pi$, as well as the participation of the outsider: $\rho\Pi^o(\Delta,\underline{\alpha}) + (1-\rho)\Pi^o(\Delta,\overline{\alpha}) - P \geq \Pi$

This is possible as long as $\Pi^M(\Delta;\overline{\alpha}) + \rho(\Pi^o(\Delta,\underline{\alpha}) + (1-\rho)\Pi^o(\Delta;\overline{\alpha}) \geq 3\Pi$. Otherwise, the CA is to prohibit the merger.

- **The optimal contract**

So as to determine the optimal contract we compare the expected welfare with the best separating contract and the best pooling contract. The expected total welfare for the separating contract decreases with λ. Moreover, by assumption the separating contract leads to a higher expected welfare for $\lambda = 0$. Hence the existence of a threshold $\widehat{\lambda}$ on this parameter such that below $\widehat{\lambda}$ the separating contract maximizes the expected welfare.

In short:

- for $\lambda \leq \widehat{\lambda}$, the optimal contracts are: $\overline{P}^R = \Pi^o(\Delta;\overline{\alpha}) - \Pi$, $\overline{F}^R = 0$, $\overline{\delta}^R = \Delta$, $\underline{P}^R = 0$, $\underline{\delta}^R = 0$ and $\underline{F}^R = Max\left(\Pi^M(0;\overline{\alpha}) - \Pi^M(\Delta;\overline{\alpha}) - \Pi^o(\Delta;\overline{\alpha}) + \Pi, 0\right)$.
- for $\lambda > \widehat{\lambda}$, the optimal contracts are $\overline{P}^R = \underline{P}^R$, $\overline{F}^R = \underline{F}^R = 0$ and $\overline{\delta}^R = \underline{\delta}^R = \Delta$ with $\underline{P}^R$ satisfying the participation constraints. Such a price exists as long as $\Pi^M(\Delta;\overline{\alpha}) + \rho(\Pi^o(\Delta,\underline{\alpha}) + (1-\rho)\Pi^o(\Delta;\overline{\alpha}) \geq 3\Pi$.

7.6 Proof of Proposition 2

We first prove points (i) and (ii) of proposition 2. Then we apply the Cho and Kreps (87) criterion to the equilibria.

- **Existence of Perfect Bayesian equilibria with $P^{UR} < P^{FB}$**

The CA proposes two contracts: $(\Delta, \overline{F})$ and $(0, \underline{F})$. The price of assets divested is set according to the bargaining rule. The expected price, denoted by P^{UR}, is equal to $P^{UR} = \beta P^M + (1-\beta)P^o$ where P^o denotes the price proposed by the outsider and P^M the price proposed by the merged firm. If the price is proposed by the insiders, the beliefs of the outsider on the merger type depend on the contract chosen as well as on the price proposed by the insiders. We denote by $\gamma(\delta, F, P^M)$ the probability that the insiders are of type $\underline{\alpha}$ if the insiders propose a price P^M and $\gamma(\delta, F)$ otherwise.

Let us describe an equilibrium where $P^{UR} < P^{FB}$.

Consider a threshold x lower than the outsider's willingness to pay for the assets if the insiders are of type $\overline{\alpha}$ and higher than the willingness to pay if the insiders are of type $\underline{\alpha}$: $\Pi^o(\Delta,\underline{\alpha}) - \Pi < x < \Pi^o(\Delta,\overline{\alpha}) - \Pi$, and consider the following beliefs:

- for any price P^M with $P^M > x$, the outsider believes the assets are divested by the efficient type: $\gamma(\Delta, \overline{F}, P^M) = 1$.
- for any price P^M with $P^M \leq x$, the outsider believes the assets are divested by the inefficient type: $\gamma(\Delta, \overline{F}, P^M) = 0$.

We look for a separating equilibrium where only the type $\overline{\alpha}$ divest assets and therefore at the equilibrium we have $\gamma(0, \underline{F}) = 1$ and $\gamma(\Delta, \overline{F}) = 0$.

Determination of P^{UR}

For the beliefs described above, the optimal price proposed by the insiders, P^M, is x.

The outsider proposes a price P^o that satisfies the participation constraint of the insiders: $P^o = 2\Pi - \Pi^M(\Delta, \overline{\alpha}) + \overline{F}$. We have then $P^{UR} = \beta(2\Pi - \Pi^M(\Delta, \overline{\alpha}) + \overline{F}) + (1-\beta)x$.

The type $\overline{\alpha}$ incentive constraint:

If the insiders of type $\overline{\alpha}$ choose the contract $(0, \underline{F})$, the profit earned is $\Pi^M(0; \overline{\alpha}) - \underline{F}$

If the insiders of type $\overline{\alpha}$ choose the contract $(\Delta, \overline{F})$, the profit earned is $\Pi^M(\Delta; \overline{\alpha}) + P^{UR} - \overline{F}$.

The CA optimally sets $\overline{F}^{UR} = 0$ and $\underline{F}^{UR}$ that satisfies the incentive constraint of the insiders of type $\overline{\alpha}$: $\Pi^M(\Delta, \overline{\alpha}) + P^{UR} = \Pi^M(0, \overline{\alpha}) - \underline{F}^{UR}$.

The type $\underline{\alpha}$ incentive constraint:

If the insiders of type $\underline{\alpha}$ selects the contract $(0, \underline{F})$, the profit earned is $\Pi^M(0; \underline{\alpha}) - \underline{F}$

If the insiders of type $\underline{\alpha}$ selects the contract $(\Delta, \overline{F})$, the profit earned is $\Pi^M(\Delta; \underline{\alpha}) + P^{UR} - \overline{F}$

By lemma 3, the insiders of type $\underline{\alpha}$ are induced not to divest assets.

We conclude that the initial beliefs are consistent since the insiders of type $\underline{\alpha}$ never divest assets and the type $\overline{\alpha}$ proposes a price x.

We deduce that at the equilibrium: $P^{UR} < \beta(2\Pi - \Pi^M(\Delta, \overline{\alpha})) + (1-\beta)(\Pi^o(\Delta, \overline{\alpha}) - \Pi) = P^{FB} < \overline{P}^R$.

As a result, because of the social cost of F, the expected welfare is lower than with asset price regulation.

- **Equilibria with $P^{UR} < P^{FB}$ and the intuitive criterion**

We apply the Cho and Kreps (87) "intuitive criterion" on out-of-equilibrium beliefs that support equilibria where $P^{UR} < P^{FB}$.

Consider the equilibrium fully described in the above paragraph. For any price P^M higher than the equilibrium price x, beliefs must be such that $\gamma > 0$ in order to prevent the deviation of the inefficient merger type. However, as far as the efficient merger type is concerned, to divest assets at a price slightly higher than x is not profitable. In other words, even though the insiders of type $\underline{\alpha}$ could sell the assets at a price higher than x, the deviation is not profitable. According to the Cho and Kreps (1987) criterion, any reasonable beliefs must be such that $\gamma = 0$.