Remedies vs. Extreme Options in Merger Control*

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Abstract

We analyze how remedies in merger control affect information acquisition by an antitrust agency which is imperfectly informed about the merger's type. The legislator ("principal") and the agency share the same objective function (e.g., consumer surplus standard) but the agency must bear (non-contractible) information costs. When remedies are not feasible, then the agency's incentive to acquire information is relatively strong as a false decision has relatively large adverse effects. Allowing for remedies introduces an "intermediate" option into the agency's action set which can frustrate the agency's incentive to acquire information. This finding, however, depends on the institutional environment. While our results fit well this an inquisitorial system, we show that under an adversial system information acquisition incentives are not per se lower when remedies become feasible.

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1 Introduction

Remedies are typically seen as a means to improve merger decisions of an antitrust agency.[1] For instance, the EU Remedy Notice states that "the most effective way to restore effective competition, apart from prohibition, is to create the conditions for the emergence of a new competitive entity or for the strengthening of existing competitors via divestiture" (EU, 2008, Article 22). While the use of remedies in merger control has profound effects on the post-merger market outcome, at the same time, the option to clear a merger subject to remedies changes the action space of the authority itself. Without the remedy option at hand, the authority is left with the extreme options of approving or blocking the merger proposal altogether. Clearing a merger subject to remedial conditions is a compromising decision which avoids an extreme decision of either allowing or blocking the entire proposal.

We examine how the remedy choice affects an antitrust agency's information acquisition.[2] Our approach critically depends on the observation that the agency's (costly) information acquisition is not contractible, while the legislator's ("principal") and the agency's objective function are fully aligned otherwise. The possibility to clear a merger conditional on a remedial action changes the agency's action space which in turn affects its incentives to gather information about the merger at hand. We present a principal-agent setting, in which the information level of the antitrust agency is endogenously determined and critically depends on its action set which may or may not include a remedy choice. We show that a remedial option can reduce the agency's incentives to gather information

[1]The US Horizontal Merger Guidelines and the EU Merger Regulation allow for remedial offers to address competitive concerns (see DOJ, 2010, and EU, 2004, respectively). Remedies have become increasingly important in merger control (see, for instance, Seldeslachts et al., 2009, Fig. 1).

[2]The issue of information acquisition by law enforcement institutions was already discussed in Tullock (1971). Tullock emphasizes the public good nature of information and takes a gloomy view of overcoming the incentives problem. See also Stephenson (2010) for a more recent study along a similar line of reasoning.

about a merger case which can impair consumer surplus.[3]

We analyze the effects of a remedy option on the agency's merger decisions when the efficiency level of a merger proposal is private information of the merging parties. The antitrust agency can undertake costly effort to obtain information about the true efficiency level. We invoke a "remedy favoring" assumption which says that the remedial option is optimal given only the a priori information about the merger efficiency. We focus on the case that the remedy, however, is only ex ante, but not ex post optimal (i.e., after information acquisition).

Quite generally, an intermediate option (that is, allowing a merger conditional on remedies) represents a compromising choice which limits the negatve effect of a false decision. Because of this, allowing for remdies can negatively influence the agency's efforts to obtain information about the true type of the merger. In contrast, in a scenario in which only extreme options are implementable, a false decision tends to have stronger negative effects which induces the agency to acquire more information in order to avoid such negative consequences. It follows that it can be optimal to force the agency to make extreme decisions by banning remedies in merger proceedings.

The optimality of extreme options depends on the shape of the information cost function. An extreme options regime is optimal, whenever information costs are at a moderate level. If remedies are feasible, then the agency has too little incentives to acquire information as the outright use of the remedy option performs relatively good. If, in contrast, remedies are not feasible, then the agency acquires much more information which may make consumers better off. If the information costs are either very low or very high, then information acquisition does not change much depending on whether or not remedies are feasible. In those cases, it is optimal to allow for a remedy which is the best choice in the absence of information. While our main analysis refers to the two-type case, where

[3]Remedies have also been criticized for often being ineffective in practice; see, Heyer (2012), Papandropoulos and Tajana (2006),Davies and Lyons (2008), and Davies and Olczak (2010).

mergers are either consumer surplus-increasing or decreasing, we show that our results are robust when considering a continuous type distribution.

We apply our basic setting to specific industrial organization models of horizontal and vertical mergers. First, our results hold for structural remedies in typical Cournot-markets under reasonable parameter constellations. Second, our insights also apply to behavioral remedies for vertical mergers in Bertrand-markets á la Telser (1960), where competition might result in an underprovision of a public good. In all those setups, a removal of the (ex ante optimal) remedial option can benefit consumers whenever information costs are at a moderate level.

Finally, we analyze remedies when the government implements a social welfare standard. Adjusting the assumption of our basic setting accordingly, our main insight remains largely valid. That is, taking a social welfare perspective, the remedial option may induce suboptimal information acquisition since the agency may tend to implement remedies excessively.

Assuming a social welfare standard allows us to contrast the inquisitorial enforcement system with a system of advocates. Under a welfare standard the interests of consumers and firms have to be weighted against each other. In an inquisitorial system this is done by a single (nonpartisan) institution, while advocates perform this task in an adversial system. In the latter case, there is a plaintiff and a defendant (i.e., an advocate for each side) in front of a neutral judge.[4]

We find that our main result depends critically on the underlying institutional environment (inquisitorial or adversial). Under a system of advocates, quite generally, information acquisition incentives are not lower when a remedial option is feasible. One advocate wants to block the merger and the other one wants to get the merger approved, while the remedial choice serves as the default option of the neutral judge. Thus, in

[4]Neven (2006) argues that the inquisitorial merger control system is incorporated in the European Union while the adversial system is adopted in the US.

equilibrium both advocates gather information in order to prove the agency that not the remedial option, but a full or no merger, respectively, maximizes social welfare. If the remedial option is not feasible, then the agency's decision in the absence of information (either denial or approval) perfectly serves the interests of one of the parties. In this case, only the counterparty engages in information acquisition, so that banning the remedial option tends to reduce information acquisition under an system of advocates.

Our approach builds on Szalay (2005) who examines a principal-agent model in which the agent collects information and then chooses a verifiable action. The agent's effort is not contractible and the principal cannot design an incentive compatible contract based on ex post outcomes. The critical step in his analysis is to focus on the incentives resulting from designing the agent's action set properly. It is shown that it can be optimal to remove the intermediate choices from the agent's action set to increase the agent's incentives to acquire information.[5]

The merger model we incorporate is built on Cosnita-Langlais and Tropeano (2012) who analyze how remedies and efficiency claims of the merging parties are interrelated when the efficiency level is endogeneous. In this setting remedies can be used by the merging parties to signal their efficiency type.

We contribute to the analysis of remedies in competition policy. Remedies are increasingly used by antitrust agencies in the US and EU to clear merger proposals which are otherwise subject to serious anticompetitive concerns (see FTC, 1999, EU, 2006, and OECD, 2011, for recent remedy reviews). Our work is complementary to a small but growing literature which take a more critical stance on remedies. Theoretical literature has shown that divestitures can be harmful to competition (Fridholfsson and Stennek,

[5]Interestingly, Szalay (2005) already refers to merger control as an application of his model, however, without noticing the remedial option. Precisely, he states that "Competition authorities must sometimes take a stand on whether or not a proposed merger is detrimental to consumers' welfare. 'On the one hand, ... but ...' is not an admissible answer. The advantage is that these authorities think harder before they take a position."

2005; Farrell, 2003; Cabral, 2003). Remedies may fail, for example, if the buyer is not a vigorous competitor (Davies and Lyons, 2008).[6] Recent empirical studies have challenged the effectiveness of remedies. Duso et al. (2011) and Kwoka and Greenfield (2013) find evidence which questions that remedies effectively counter anticompetitive merger effects. Duso et al. (2011) and Kwoka and Moss (2011) argue that this holds for structural divestitures and for behavioral remedies.

We also contribute to the institutional comparison of an adversial law enforcement system with an inquisitorial one. Dewatripont and Tirole (1999) argue in favor of advocates by showing that information acquisition incentives are generally lower under an inquisitorial regime. In their model the inquisitorial system decides too often for an extreme option which is stark contrast to our model. That difference is due to their key assumption that the obtained information can be conflicting. The inquisitorial authority has insufficient incentives to gather a second piece of information which might stand in conflict with the initially obtained information. In our setup, in contrast, the agency already has too little incentives to obtain the very first piece of information, so it decides too often for the intermediate, relatively safe option. In a similar manner to Dewatripont and Tirole (1999), Shin (1998) proves the strict superiority of the adversial system over the inquisitorial one if information is noisy and thus potentially conflicting. Similar to our study, Froeb and Kobayashi (2001) assume that the court is uneducated and incorporates a simple decision rule, and they find that neither regime dominates the other one.

We proceed as follows. We present our basic model in Section 2, the main analysis in Section 3 and some applications in Section 4. In Section 5, first, we extend our insights towards a continuum of merger efficiencies. Second, we consider a social welfare standard and contrast an inquisitorial regime with a system of advocates. Finally, Section 6 concludes.

[6]The role of structural remedies in horizontal mergers is examined in Cabral (2003), Medvedev (2007), Vergé (2010), Vasconcelos (2010), and Dertwinkel-Kalt and Wey (2012).

2 The Model

We assume that the legislator (the "principal") uses competition policy (in particular, merger control) to protect consumers against monopolizing mergers (below we also consider a social welfare standard).[7] The legislator delegates the enforcement of merger control to the antitrust agency (in short: the "agency"). The legislator's and the agency's objectives are aligned, with the only exception that the agency also considers the information cost it has to bear.[8] Thus, while the principal maximizes consumer welfare, the agency maximizes consumer surplus minus its information acquisition costs.

We suppose asymmetric information between the merging firms and the agency. Mergers differ in the efficiencies, e, which they generate. The prior distribution of efficiencies is common knowledge, while the specific efficiency level of a particular merger is private information of the merging firms. A merger may have a high efficiency level, $\bar{e}$, or a low efficiency level, $\underline{e}$, with probabilities $q \in [0,1]$ and $1-q$, respectively. The agency can acquire information about a merger's efficiency level by exerting costly effort to observe the true efficiency type with probability $\beta \in [0,1]$.[9] If the agency picks a particular value β, then it learns the true efficiency type with probability β and does not obtain any information about the merger type with counter probability $1-\beta$.[10]

[7] Recent Industrial Organization literature takes the consumer surplus standard for granted. For instance, Whinston (2007) states that the agency's "enforcement practice in most countries (including the US and the EU) is closest to a consumer surplus standard." For a discussion of the issue which standard is appropriate see also Farrell and Katz (2006).

[8] It is a common assumption that bureaucrats are intrinsically motivated to serve the principal's objectives (Besley and Gathak, 2005; Prendergast, 2007). Long-run motivation of the bureaucrats may also be provided by the fear of their institution's restructuring in the case of its failure. Direct financial incentives, however, are almost unfeasible as bureaucrats are not paid according to their performance.

[9] Similar specifications are used in Szalay (2005) and Cosnita-Langlais and Tropeano (2012).

[10] We consider a setting in which gathered information is always correct. We note that our results hold also in case acquired information is false with some probability. See also Sorgard (2009) for an analysis of optimal merger policy in the presence of type I and type II errors.

We investigate the agency's choice of β under two regimes: NR (*no-remedy regime*) and R (*remedy regime*). Under NR the agency can only approve or prohibit the merger altogether. Under regime R besides approving or prohibiting the merger proposal, the agency can condition its approval on a remedial proposal by the merging parties. We assume that a unique remedy exists for every merger proposal (Cosnita-Langlais and Tropeano, 2012).[11]

Let X indicate the agency's merger decision, $X \in \{M, NM, R\}$, which can be an approval ($X = M$), a prohibition ($X = NM$), or an approval conditional on a remedy ($X = R$). Given a merger of a certain efficiency type e, let $CS^X(e)$ denote the change in consumer surplus when the agency adopts decision X. It follows that $CS^M(e)$ is the difference of consumer surplus after the merger minus consumer surplus before the merger. In case a merger is prohibited, consumer surplus does not change; i.e., $CS^{NM} = 0$. Given the prior distribution of the efficiency level, the expected change of consumer surplus if decision X is adopted is given by $CS^X := qCS^X(\bar{e}) + (1-q)CS^X(\underline{e})$. In the same way, we can define $W^X(e)$ and W^X as the change in social welfare following decision X. Furthermore, Π^X denotes the expected change in the merging firms' profits depending on the agency's decision X. We invoke the following assumptions concerning the objectives of the legislator and the agency.

A1: *The legislator's objective is to maximize consumer surplus.*

[11] In case of structural remedies only a specific business unit or production plant may qualify as a remedial divestiture (Vasconcelos, 2010). Moreover, legal requirements reduce the set of possible remedies. For example, the remedy must be easily applicable and a divestiture only qualifies as a potential remedy if it is a "viable business" which can "operate on a stand-alone basis" (EU, 2008). Thus, wider packages may be required in order to satisfy viability (Motta et al., 2003; Davies and Lyons, 2008). In case of behavioral remedies, standard obligations in vertical mergers not to foreclose outsiders and to supply them at a reasonable price quite naturally single out a remedy for a merger proposal (Paas, 2008; De Valois Turk, 2012). Finally, even if several remedies exist, not all of them are equally effective, so that the agency chooses the remedy it expects to be most effective in protecting consumer interests.

A2: *The agency's objective is to maximize consumer surplus minus its information acquisition costs.*

These differences in the legislator's and the agency's objective functions give rise to a principal-agent problem. The legislator has delegated merger control to the agency without taking care of the fact that the agency must bear information costs to make optimal merger decisions.[12] The principal-agent problem arises if the agency does not exert enough effort in order to maximize the legislator's objective.

The next assumption specifies the functional form of the information acquisition costs of the agency.

A3: *The information acquisition cost function* $C(\beta)$ *fulfills the Inada-conditions* $C(0) = 0, C'(\beta) > 0, C''(\beta) > 0, \lim_{\beta \to 1} C(\beta) = +\infty$.[13]

Next, we impose the following assumptions on the pre- and the post-merger market structures.

A4: *Both, a full merger and a merger involving a remedy, are profitable for all efficiency types. However, the full merger is more profitable for the merging firms than a merger with remedies; i.e.,* $\Pi^M(e) > \Pi^R(e) > 0$.

Due to the profitability assumption A4, each merger type has an incentive to propose a full merger. However, a merger conditional on a remedy requirement is still profitable.[14]

[12]This assumption could be relaxed in the sense such that the government takes the costs of information acquision also into consideration, however, to a lesser degree than the agency. For instance, the government's objective could be assumed to equal the consumer surplus minus a multiple of the information costs that is smaller than one. In this case, our results remain vaild qualitatively.

[13]The Inada-conditions represent standard assumptions imposed on production functions (Inada, 1963) and are also used in Szalay (2005) and Cosnita-Langlais and Tropeano (2012). They ensure uniqueness of the level of information acquired in equlibrium. Prominent examples of cost functions exhibiting these properties are $C(\beta) = \alpha\beta/(1-\beta)$ or $C(\beta) = \alpha \ln(1/(1-\beta))$ for $\alpha > 0$.

[14]Given our purpose to analyze the principal-agent problem under the different regimes, the assumption

Next, we invoke several assumptions concerning the consumer surplus change depending on the merger type and whether or not a remedy is required to clear the merger proposal.

A5: *If a merger is efficient, then the merger proposal should not be blocked always; i.e.,* $\min\{CS^M(\bar{e}), CS^R(\bar{e})\} > 0$.

A6: *If a merger is inefficient, then the merger proposal should not be approved always; i.e.,* $CS^M(\underline{e}) < \max\{0, CS^R(\underline{e})\}$.

Assumptions A5 and A6 ensure that the agency's optimal decision depends on the merger's efficiency type. If this were not the case, then the agency's optimal decision would be independent of the efficiency type and information acquisition would be redundant.

A7: *If the agency has to decide on a merger only with knowledge of the prior distribution of efficiencies, then an approval conditional on a remedy is preferred; i.e.,* $\max\{CS^M, CS^{NM}\} < CS^R$.

Assumption A7 is a strong assumption in favor of remedies. With no more knowledge than the prior distribution of efficiencies, it is on average optimal to approve any merger proposal conditional on a remedy. Assumption A7 mirrors one motivating observation to interpret the decision to approve a merger conditional on remedies as an *intermediate option* which is optimally chosen if no information is available (Szalay, 2005). In contrast, extreme decisions as the unconditional approval or the outright prohibition of the merger bear the risk of making a "large" mistake with substantial consumer welfare losses. Hence, in the absence of any additional information, the remedy option represents a relatively "safe" choice.

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that all merger types are profitable is necessary due to the following reasoning. If a full merger is profitable only for either $\bar{e}$ or $\underline{e}$, then only one type would propose a merger in equilibrium. Thus, the agency would be perfectly informed about a merger's type without any information acquisition, so that the principal-agent problem would disappear. If a merger with a remedy is not profitable for the efficient type, it cannot be profitable for the inefficient type. Thus, if the profitability condition does not hold for $\bar{e}$, firms never agree to implement a merger with a remedy, so that remedies would never be used.

3 Main Analysis

We solve the following game by backward induction for subgame perfect Nash equilibria. In the first stage, the legislator decides on the agency's action space; i.e., it decides whether remedies are feasible (regime R) or not (regime NR). In the second stage, a merger is proposed. In the third stage, the agency decides on the quality of information β it acquires. Finally, in the fourth stage, the agency makes its final judgement about the merger proposal.[15]

The agency's decision in the fourth stage depends on the merger control regime and the information β it has acquired in the third stage. If the agency holds information that the merger proposal is of type $\bar{e}$, a situation which occurs with probability $q\beta$, the merger is approved either fully or with a remedy if this is feasible and if it yields a higher consumer surplus (see A5). Then, the change in consumer surplus equals $\max\{CS^M(\bar{e}), CS^R(\bar{e})\}$ if remedies are feasible, and $CS^M(\bar{e})$ otherwise.

If the agency holds the information that the proposed merger is of type $\underline{e}$, a situation which occurs with probability $q(1-\beta)$, the proposal is either blocked or approved conditional on a remedy (see A6). It follows that the change in consumer surplus equals $\max\{0, CS^R(\underline{e})\}$ if a remedy is feasible, and zero otherwise. In case the agency does not obtain additional information, which happens with probability $1-\beta$, the agency implements, if possible, a merger with a remedy (see A7). In contrast, under regime NR, the agency's decision implies the realization of $\max\{CS^M, 0\}$.

In the third stage, the agency decides about the level of information acquisition. The agency chooses $\beta \in [0,1]$ in order to maximize the expected change in consumer surplus minus its information acquisition costs, which gives rise to the first-order condition

$$q \times \max\{CS^M(\bar{e}), CS^R(\bar{e})\} + (1-q) \times \max\{CS^R(\underline{e}), 0\} - CS^R = C'(\beta). \qquad (1)$$

[15] A fifth stage, in which firms can either accept the agency's decision or decide to abandon the merger can be ignored as each decision by the agency (either with or without remedies) will be accepted by the proposing firms (see A2).

under regime R and to

$$qCS^M(\bar{e}) - \max\{CS^M, 0\} = C'(\beta), \tag{2}$$

if a remedy is not feasible. To characterize the equilibrium information level chosen by the agency, we have to distinguish four possible cases concerning the optimality of remedies for each merger's type:

Case I: If $CS^M(\bar{e}) < CS^R(\bar{e})$ and $0 < CS^R(\underline{e})$, then a remedy is optimal for both merger types.

Case II: If $CS^M(\bar{e}) > CS^R(\bar{e})$ and $0 > CS^R(\underline{e})$, then a remedy is never optimal for both merger types.

Case III: If $CS^M(\bar{e}) > CS^R(\bar{e})$ and $0 < CS^R(\underline{e})$, then a remedy is only optimal for the inefficient type.

Case IV: If $CS^M(\bar{e}) < CS^R(\bar{e})$ and $0 > CS^R(\underline{e})$, then a remedy is only optimal for the efficient type.

Given the merger control regime, the equilibrium information acquisition levels chosen by the agency in cases I-IV are unique (for a proof, see Appendix A) and denoted by $\beta^*_{r,i}$, where $r \in \{R, NR\}$ indicates the regime and $i \in \{I, II, III, IV\}$ denotes the respective case.

We focus on the agency's optimal information decisions in cases I and II to single out most clearly the trade-off associated with the remedial option.[16] In case I a merger with remedies is always optimal, so that information acquisition is useless. It follows

[16]Whereas cases I and II allow for clear conclusions about differences in information acquisition under regimes R and NR, the outcomes in cases III and IV depend strongly on the probability distribution of efficiencies and the degree to which remedies are optimal in either scenario. Thus, these cases yield intermediate results concerning the effects of remedies on the agency's information incentives. Therefore, we consider cases I and II to be the most interesting cases and we restrict our analysis in the paper's main part accordingly. Cases III and IV are fully analyzed in Appendix A.

that the legislator's and the agency's objectives are aligned. The agency does not acquire additional information and makes the optimal merger decision. If remedies are feasible, then the merger is cleared conditional on a remedy. If remedies are not feasible, then the optimal merger decision is not possible with the consequence of a lower consumer surplus level. Thus, the legislator chooses regime R in the first stage, because allowing for an intermediate option (i.e., a remedy) induces optimal merger decisions by the agency. This result mirrors the often expressed view that remedies tend to improve decision making by competition authorities (see EU, 2004/2008).

In case II the optimal merger decision critically depends on information about the exact merger type. Most importantly, an approval of a merger conditional on a remedy is never optimal for any merger proposal. The acquisition of additional information is, therefore, a serious issue in this case.[17] In order to maximize consumer surplus, the legislator would opt for the highest information level, i.e., $\beta = 1$. This level, however, is never chosen by the agency due to its information acquisition costs. Thus the legislator wants to provide correct incentives in order to guarantee that the agency exerts sufficient effort. The agency's incentives can be influenced by the legislator's choice of a regime. If remedies are not optimal for any type (case II), then the removal of the intermediate option increases the agency's incentives to acquire information. This result is driven by the following intuition. If remedies are feasible, it may be optimal for the agency to exert very little effort and to apply remedies as the potential error going along with this decision is limited. If, however, remedies are not feasible, then the potential error associated with an extreme decision might be so high that exerting more effort, i.e., acquiring better information, is optimal for the agency. With better information at hand, the agency limits the potentially high costs associated with a false decision.

Besides this positive incentive effect of a removal of the remedy option, it also creates

[17] This is also true in cases III and IV, but to a somehow lesser extend as the remedy choice is for one of the merger types optimal.

a real cost because the remedy is optimal on average (i.e., in the absence of concrete information concerning a proposal's type). By acquiring more information, remedies become less important since the range where they are optimal (i.e., the number of no-information scenarios) shrinks. In equilibrium, the positive surplus effect of an improved information level may over-compensate surplus-losses resulting from the removal of the remedial option. In that case, the legislator optimally decides to remove the remedy option from the agency's action space.[18]

Proposition 1. *i) In case I (remedies are optimal for every type), there is no incentive problem and the agency implements the first best solution, i.e.,* $\beta = 0$. *The legislator chooses regime R.*

ii) In case II (remedies are never optimal for any type), the agency acquires a higher information level under regime NR than under regime R. Consumer surplus is higher under NR if and only if the higher level of information is sufficient to counterbalance the detrimental effects of the remedy's removal in the no-information scenario, i.e.,

$$(\beta^*_{NR,2} - \beta^*_{R,2}) \times (qCS^M(\bar{e})) > (1 - \beta^*_{R,2}) \times CS^R - (1 - \beta^*_{NR,2}) \times \max\{CS^M, 0\}.$$

Proof. See Appendix A.

The optimality of the extreme option regime NR depends on the exact shape of the information cost function C. If information is relatively cheap to obtain (C is flat), then the additional incentives arising from a restriction in the action set may not suffice to induce an overall positive effect on consumer surplus. This follows from the fact that a relatively large amount of information is already acquired when remedies are feasible. Similarly, if information is quite costly (C is steep), the agency's information level is relatively low under both regimes. However, regime NR is most likely to dominate regime R from a consumer point of view if the difference in information acquisition is sufficiently high between the regimes.

[18]This preference of the legislator for extreme options mirrors the central finding of Szalay (2005).

The removal of the remedial option tends to be optimal whenever information costs are at an intermediate level (C being neither too step nor too flat). In those instances, much more information is acquired by the agency in the absence of the remedy option because it wants to avoid the possibly costly errors associated with an extreme decision (either prohibition or unconditional approval). In other words, if remedies are feasible and information costs are neither too low nor too high, then the agency may abstain from acquiring information as the use of remedies tends to limit the costs associated with a false decision. Under those circumstances the removal of the remedial option is attractive for the legislator to spur the information acquisition incentives of the agency.

4 Applications

In this section, we analyze specific merger scenarios involving structural or behavioral remedies to show that the introduction of remedies may reduce the agency's information incentives and, by that, also causes consumer surplus losses.[19] First, we consider the case of a structural remedy in case of a horizontal merger. Structural remedies are used to restore effective competition when the merging parties have considerable market power (Heyer, 2012; Motta et al., 2003). Second, we analyze a vertical merger scenario in which a behavioral remedy can be applied to prevent foreclosure.

4.1 Horizontal Mergers

We consider two examples of horizontal mergers to highlight the possibility that the introduction of remedies can reduce the agency's information acquistion incentives. As a consequence, remedies can also be detrimental to consumer welfare even though they are the best choice in the absence of any information acquisition. Referring to our main analysis,

[19] A structural remedy refers to a change in property rights of the divested assests while a behavioral remedy does not change such property rights (Motta et al., 2003).

we focus on parameter ranges where case II applies. Example 1 builds on Dertwinkel-Kalt and Wey (2013) and provides a numerical analysis of a Cournot oligopoly model while Example 2 reconsiders the example presented in Cosnita-Langlais and Tropeano (2012). In the former example the divested assets are sold to a new entrant firm while in the latter example the structural remedy is acquired by an existing competitor.

Example 1. Consider a merger in a homogenous good Cournot oligopoly model. Initially, there are n symmetric firms and the inverse demand is given by $p = 1-X$, where p stands for the market price and X is the sum of firms' individual outputs x_i. The pre-merger cost function is given by $c(x_i, K_i) = q_i^2/K_i$, where $K_i = 1$ is the stock of productive assets each firm holds. We assume that each firm runs two equally sized production plants where each is indivisible. Selling a single production plant (which represents a capital stock of $1/2$) is, therefore, the only candidate for a structural remedy.[20] A merger between two firms i and j leads to cost savings, first because of a higher amount of available capital, and second due to the realization of a synergy parameterized by $e \in [0, 1]$. Accordingly, the post-merger cost function is assumed to be $c(x_i, K_i, e) = (1-(1-\Delta)e)x_i^2/(K_i+\Delta K_j)$, where Δ indicates the share of firm j's capital stock which is divested during the merging process. Therefore, $\Delta = 0$ denotes an entire approval while $\Delta = 1/2$ indicates that the agency makes the clearance of the merger conditional on a remedy. In case a remedy is required, it is assumed to be sold to a new firm which enters the market without additional capital. Furthermore, the merging firms can make take-it or leave-it offers to potential buyers, so that they can extract the entire profit an entrant may earn with the divested assets.

There are two types of mergers depending on the merger synergy level. Either a merger generates a high synergy level, $e = 0.75$ (which occurs with probability q), or a low synergy level, $e = 0.25$ (which occurs with counter probability $1 - q$). An easy

[20] We follow Vasconcelos (2010) who also assumes indivisible assets. This gives rise to a single structural remedy.

computation shows that for the low-efficiency type $0 > CS^R(\underline{e}) > CS^M(\underline{e})$ holds, whereas for the efficient type the opposite ordering holds, i.e., $0 < CS^R(\bar{e}) < CS^M(\bar{e})$.

We consider a concrete numerical example (the detailed analysis is presented in Appendix B). Let four firms be active in the market, i.e., $n = 4$, and let both merger types occur with the same probability $q = 1 - q = 1/2$. Information costs are given by the aforementioned function $C(\beta) = k \ln(1/(1-\beta))$, with $k > 0$. To exclude corner solutions with no information acquisition, we restrict attention to parameter values $k < k^*$, with $k^* \approx 0.0029739$. We can show that there exists a critical value k', such that for all $k < k' \approx 0.002258$ consumer surplus is higher if a remedy is feasible. In those instances, information acquisition is relatively cheap so that the detrimental effect of a removal of remedies is not equalized by the beneficial effect of a higher information level. However, if $k > k' \approx 0.002258$, then consumer surplus is indeed lower if remedies are feasible, since the higher level of information acquisition under regime NR overcompensates for the removal of remedies. For example, for $k = 0.0023$, the equilibrium information acquisition level is given by $\beta^*_{NR,2} = 0.55143$ in case remedies are not feasible, but it comes down to $\beta^*_{R,2} = 0.2266$ whenever remedies are allowed. The example shows that the legislator may want to restrict the agency's action space to increase the agency's information acquisition to ultimately maximize the expected consumer surplus of the merger control regime.

Example 2. We refer to the example provided in Cosnita-Langlais and Tropeano (2012) and show how our insights apply. Consider a symmetric Cournot market with three firms, in which each firm holds k assets for production and produces a homogeneous good at a constant marginal cost rate $c(k)$. The inverse demand function is given by $p = 1 - X$. Two types of horizontal mergers are possible: an efficient and an inefficient one, which occur with probabilities q and $1 - q$, respectively. A merger affects the production costs of the merged entity in two ways. First, an increased asset stock lowers marginal production costs; i.e., $c(k_1) < c(k_2)$ for $k_1 < k_2$. Second, a merger's efficiency lowers marginal production costs, where the efficient merger ($\bar{e}$) enjoys lower production costs

than the inefficient type $\underline{e}$, given the same number of held assets. A structural remedy consists of the divestiture of Δ assets to the remaining competitor.

We specify the parameter range such that case II applies. A full merger is beneficial from a consumer surplus point of view if $c^M(2k, e) < (5c(k) - a)/4$ holds. In order for a merger with remedies to be consumer-surplus increasing, the cost function of the merged entity, $c^M(2k - \Delta, e)$, and the cost function of the incumbent, $c(k + \Delta)$, have to fulfill $c^M(2k - \Delta, e) + c(k + \Delta) < (9c(k) - a)/4$. Thus, Assumptions 5 and 6 are met if both relations hold for $e = \bar{e}$, and if they are reversed for $e = \underline{e}$. In order for case II to hold, we require that for the efficient type, the sum of the two firms' production costs is lower under the full merger than under the merger with remedies, i.e., $c^M(2k, e) + c(k) < c^M(2k - \Delta, e) + c(k + \Delta)$ for $e = \bar{e}$, and vice versa for the inefficient merger type.[21] In this setting, for the efficient type a merger approval represents the agency's optimal and a denial the agency's worst decision, while the opposite holds for the inefficient type. Thus, there is a range of distributions for which the remedial option is on average optimal, i.e., Assumption 7 is fulfilled. We conclude that this setting fits exactly case II of our analysis, such that information acquisition incentives are higher under regime NR than under R.[22]

4.2 Vertical Mergers

If a vertical merger is proposed, behavioral remedies are increasingly applied to counter anticompetitive foreclosure incentives (Heyer, 2012; Motta et al., 2003). Again, the agency typically has to focus on a certain available remedy (e.g., in form of an obligation to deliver a critical input at reasonable terms) which fits our assumption of an exogenously given remedy instrument. In the following we provide an example in which foreclosure may

[21] The profitability constraints can be assumed to hold. Indeed, they are fulfilled if synergies are sufficiently large, if fixed costs are reduced through the merging process or due to earnings from selling the divestiture.

[22] In order to decide whether or not regime NR is optimal, concrete numerical values have to be considered.

be optimal. Here, foreclosure protects the merged firm's incentive to provide a public good, which is otherwise challenged by the free-riding incentives of a rival downstream firm. Our example, therefore, builds on Telser's (1960) argument in favor of a vertical restraint to overcome the underprovision in case of a public good-like service. An example for this is informative advertising which has a public good property by expanding market demand for all downstream firms ("retailers"). In such an environment, an effective way to increase the provision of the public good is a vertical merger in combination with the foreclosure of downstream competitors. Consequently, a behavioral remedy in the form of an obligation to deliver at reasonable terms can eliminate the vertical merger's positive effects on the provision of the public good. We may then face a situation as in our examples above, in which the remedy not to foreclosure may be optimal in the case of efficient mergers, whereas inefficient mergers are to be banned from a consumer surplus point of view. Hence, the removal of the intermediate option may be optimal.

Let us consider one (upstream) manufacturer U which sells its brand to two downstream retailers 1 and 2 at a non-discriminatory wholesale price w and faces own marginal production costs of $c \geq 0$. Products are perfect substitutes and retailers compete in prices, so that the retailer with the lower price gains the entire market. If retail prices are equal, each retailer gains half of the entire demand in the market. Consumer demand is given by the linear function $D(p) = (v+e)-p$, where p is the market price and e is the public good provided by both retailers, i.e., $e := e_1 + e_2$, where e_i is the public good offered by retailer i, with $i = 1, 2$. Retailer i's costs are $C(q_i, e_i) = wq_i + \mu e_i^2/2$, with $\mu \in (0, 1)$ and q_i stands for the output of retailer i. The term $\mu e_i^2/2$ mirrors the total costs of the provision of the public good service ("advertising") of retailer i. The manufacturer's profit is denoted by π_U and retailer i's profit by π_i.

We consider three different market structures: *i)* separation (NM), *ii)* vertical integration without a remedy (M), and *iii)* vertical integration with a remedy (R). In the latter case, the integrated firm is obliged by application of a remedy to supply the competing

retailer at reasonable terms which we interpret to be cost-based under the allowance of a small profit margin $\varepsilon > 0$.[23]

We analyze the following game. In the first stage, manufacturer U sets the (non-discriminatory) wholesale price w. In the second stage, the retailers set the prices p_i and effort levels e_i simultaneously.

A vertical merger is assumed to realize a fixed cost saving, which is essential to make the merger profitable. We consider two merger types. First, the inefficient type realizes an increase in the brand's marginal production costs by $s > 0$ (with $\nu > c + s$). Second, the public good's production costs rise from μ to $\alpha\mu$, with $\alpha > 1$. The efficient type does not realize any extra costs of vertical integration and thus operates with marginal costs of c for the brand and μe_i for the public good (i.e., $s = 0$ and $\alpha = 1$). The feasible remedy which might be implemented by the agency is the prohibition to foreclose; i.e., the provision of the manufacturer's good at a "cost-plus" level. The analysis for all three market structures is relegated to the Appendix B.

For the efficient type (*eff*), a comparison of the equilibrium outcomes yields the unambiguous ordering $CS^M_{eff} > CS^R_{eff} > CS^{NM}_{eff}$. Even though a merger goes along with the foreclosure of the outsider, it benefits consumers due to the higher equilibrium provision of the public good. For the inefficient type ($s > 0$ and $\alpha > 1$, denoted *ineff*), the opposite, $CS^{NM}_{ineff} > CS^R_{ineff} > CS^M_{ineff}$, holds as long as inefficiencies are relatively large; i.e., if $s + \varepsilon > (v - c)/2$ and α sufficiently large. Thus, the remedial option is for both merger types neither the best nor the worst, but an intermediate choice. Depending on the distribution of efficiency types, remedies may, however, represent the agency's optimal choice in the absence of any additional information. Profitability for all merger types with and without remedies is ensured by a sufficiently large saving in fixed costs.

Finally, we provide a numerical example which fits case II. This is provided by the

[23]Similar cost-based approaches, which strictly limit the integrated firm's ability to increase prices, were applied, for instance, by the UK competition authority (see Davies and Lyons, 2008).

the parameter values $\nu - c = 1$, $\mu = 1$, $s = 1/2$, $\varepsilon = 1/10$, and $\alpha = 2$.

In this example, remedies represent the agency's optimal decision in the absence of information for a wide range of distributions. Such a distribution is for example a chance of one fifth that the merger is efficient and a chance of four fifths that the merger is inefficient. As shown in Proposition I, allowing for remedies may frustrate the agency's information acquisition incentives even in a consumer surplus-lowering way.

5 Extensions

We present two extensions. First, we consider a continuous distribution of efficiency types and show that our main result remains valid in this more general setting. Second, we consider the case where the legislator follows a social welfare standard which allows us to contrast two institutional frameworks: one based on a advocate system and the other one on an inquisitorial regime (see Dewatripont and Tirole, 1999).

5.1 Continuous Efficiencies

We generalize our model by allowing for a continuous range of potential merger efficiencies. The distribution of efficiencies is given by the density function $f(e)$ on the interval $e \in [\underline{e}, \bar{e}]$, where $\underline{e}$ denotes the lowest and $\bar{e}$ the highest possible efficiency level. We maintain our previous Assumptions 1-7, where $CS^X = \int_{\underline{e}}^{\bar{e}} CS^X(e) f(e) de$ denotes the expected change in consumer surplus depending on the merger decision $X \in \{M, NM, R\}$.

The natural generalization of our setup to a continuous efficiency range is the following. First, we assume that $CS^X(e)$ is continuous and strictly monotonically increasing in e for all $X \in \{M, NM, R\}$. Second, there exist unique threshold values $\underline{e} \leq e_1 \leq e_2 \leq \bar{e}$, so that -from a consumer perspective- a prohibition of the merger is optimal for $\underline{e} \leq e < e_1$, remedies are optimal for $e_1 \leq e < e_2$, and a full merger is optimal for $e_2 \leq e \leq \bar{e}$. Third, we assume that there exists a unique threshold value $e_1 < \hat{e} < e_2$, so that for

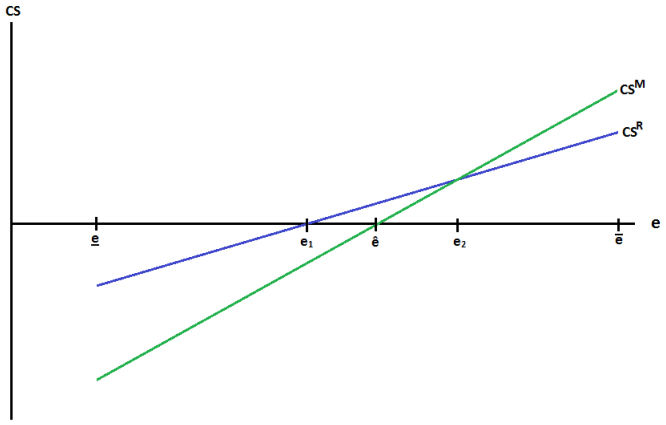

Figure 1: *Thresholds concerning CS for a continuous distribution of merger efficiencies*

$e < \hat{e}$ no merger is better than a full merger and for $e > \hat{e}$ a full merger is better than no merger, again, from a consumer surplus perspective. The latter threshold value is critical for regime NR.

Those assumptions mirror the following market features. A prohibition is optimal if the merger is relatively inefficient, whereas for a relatively efficient merger, an approval of the full merger is optimal. For mergers with an intermediate efficiency level (i.e., $e_1 < \hat{e} < e_2$) the remedial option is the best choice. This setting is illustrated in Figure 1. Furthermore, we assume for notational convenience that $0 > CS^M$, which does not influence our results qualitatively.

Proposition 2. *The results of the binary-type case carry over to the continuous-type case. The removal of the remedial option increases the agency's information acquisition if*

$$\int_{[\underline{e},\bar{e}]\setminus[e_1,e_2]} f(e)CS^R(e)de + \int_{\hat{e}}^{e_2} f(e)CS^M(e)de > 0.$$

In particular, if remedies do not represent the optimal decision for any efficiency type, then the agency's equilibrium information acquisition level is higher if the remedial option is removed from the agency's action space.

The second integral in the inequality of Proposition 2 is always positive, whereas the first integral could be either positive or negative. However, the first integral is only

negative if the negative impact of the remedial option for mergers with efficiencies in $[\underline{e}, e_1]$ outweighs the remedy's positive impact on consumer surplus for mergers with efficiencies in $[e_2, \bar{e}]$. Thus, information acquisition is likely to be higher under regime NR. Whether or not the additionally acquired information gives also rise to an increase in consumer surplus, depends (like in the binary setting) on the interplay between consumer surplus losses due to the removal of remedies and the gains in consumer surplus due to the higher information acquisition level. Consequently, in the continuous-type case the remedy option can unfold negative effects on information acquisition and consumer surplus in such a way as in the binary-types case.

5.2 Welfare Standard and Comparison of Institutional Environments

Assuming a social welfare standard allows us to contrast the inquisitorial enforcement system which we have analyzed so far with a system of advocates (see Dewatripont and Tirole, 1999). The difference between the inquisitorial legal system and the adversial legal system is that, in the former case, one institution gathers both evidence and counterevidence for a legal case. The inquisitorial system can be seen as an approximation of the antitrust agency's role in Continental Europe and Japan (Neven, 2006; Posner, 1999). Christiansen (2006) argues that the EU merger control system corresponds to an inquisitorial regime due to the concentration of various functions within the European Commission. In our basic setup, we impose this inquisitorial system in which all information gathering is bundled in the hand of the agency. In an adversial legal system, there is a plaintiff and a defendant, i.e., an advocate for both sides, in front of a neutral judge. This framework can be seen as representing the US system, where the antitrust agencies (Department of Justice and Federal Trade Commission) act as a plaintiff in front of a neutral court (Neven, 2006).

If enforcement is inquisitorial, both information acquisition and the merger decision

are bundled in the hand of the agency which acts as a nonpartisan authority. In contrast, if the legislator aims at maximizing social welfare, we can re-interpret the role of the agency as an advocate of consumers. Under a system of advocates where a court (which fully internalizes the legislator's social welfare standard) decides on the basis of information it was provided with, firms themselves become active players by building up countervailing advocacy. A firm hires an advocate (which fully internalizes the firm's objective) to which it delegates the task of gathering and presenting information. While the agency as the consumers' advocate wants to prevent the merger, the advocate of the merging firms tries to achieve the opposite outcome. The game we analyze is very similar to the game we analyzed in Section 3, in which only the agency was responsible for gathering information.

Our setup in this section is as follows. We suppose that the legislator's objective is to maximize social welfare instead of consumer surplus.[24] We modify the Assumptions 3-7 into 3'-7' by substituting consumer surplus (CS) by social welfare (W) in each case. We restrict the analysis to case II, in which remedies are welfare-optimal only in the absence of information.

A3': *The information acquisition cost function C is given by the Inada-conditions.*

A4': *Profitability holds; i.e.,* $\Pi^M(e) > \Pi^R(e) > 0$ *for all* e.

A5': *For type* $\bar{e}$*, mergers are best and denials are worst, i.e.* $W^M(\bar{e}) > W^R(\bar{e}) > 0$.

A6': *For type* $\underline{e}$*, mergers are worst and denials are best, i.e.* $W^M(\underline{e}) < W^R(\underline{e}) < 0$.

A7': *In the absence of information, the remedy is best, i.e.,* $\max\{W^M, 0\} < W^R$.

Since welfare-maximization requires the optimal balancing of two countervailing interests, consumer surplus and gains, two institutional frameworks are conceivable. First,

[24]It is interesting to consider this case since the largest part of the economic literature which analyzes existing industry structures has considered the total welfare standard (Farell and Katz, 2006). Also, a weighted sum of consumer surplus and firms' gains, with a higher weight on the former than on the latter, (Armstrong et al., 1994) may represent an adequate objective for the legislator.

a system in which interests are bundled and balanced within one authority, and second, a system comprising countervailing advocates for countervailing interests. Thus, we distinguish between two institutional environments, the inquisitorial and the adversial one. In the following, we investigate if our main insight that the remedial option may distort information acquisition incentives is robust to changes in the institutional system, i.e., if we face not a nonpartisan authority, but advocates.

Inquisitorial Regime. In the inquisitorial regime, the agency is a nonpartisan authority which gathers information to optimally counterbalance firms' and consumers' interests and to maximize social welfare minus its own costs. Thus, we impose

$A2^{inq}$: *The agency's objective is the maximization of welfare minus its information acquisition costs.*

Here, our main insight from Section 4 still holds, which says that information acquisition incentives are lower under regime R than under regime NR.

Advocates. In the adversial environment, however, two advocates are involved, one advocate of the consumers who gathers information in order to maximize consumer surplus minus its costs, and the other one gathering information in order to maximize firms' gains minus its costs. We call the former the consumers' advocate (AC) and the later the firms' advocate (AF).[25]

$A2^{adv}$: *The AC's objective is the maximization of consumer surplus minus its information acquisition costs, and the AF's objective is the maximization of firms' gains minus its information acquisition costs.*

A system of advocates does not mean that institutions are actually doubled. Instead, advocates represent countervailing interests. In order to obtain a sharp difference between the consumers' and the firms' objectives, we impose additionally the following assumption. *A8': For consumers, for both efficiency types a denial is optimal, a remedy intermediate*

[25] We can assume that the antitrust agency represents the advocate of the consumers (Whinston, 2007).

and a full merger worst, i.e. $CS^M(e) < CS^R(e) < 0$.

The advocate of the firms (AF) wants to maximize profits minus its information acquisition costs, so that according to *A4',* she will prefer the pure merger over the remedy over the denial. In contrast, the consumers' advocate (AC) wants to maximize consumer surplus respective of its costs, which means that a denial is preferred over the remedy over the full merger. Information acquisition follows the same mechanism as in the basic setting and both advocates are assumed to face the same cost function.[26] Information is concealable, but not forgeable, i.e., advocates could hide, but nor forge information. As information is not noisy, the two advocates cannot hold conflicting information. At the final stage, a court as the deputy of the legislator's interests decides on a proposal based on the information provided by the advocates. If no information is submitted to the court, it is assumed to have priors $\beta_\Pi = \beta_{CS} = 0$ and therefore to decide for what is best on average.[27] This setting is as similar as possible to the inquisitorial setting, with the only difference that advocates with countervailing objectives instead of a nonpartisan authority are responsible for the information acquisition.

We consider the following game: First, the legislator decides about a regime, either NR or R. Second, a merger of type e is proposed. Third, both advocates decide simultaneously about their information level β_Π resp. β_{CS} and observe either e or nothing. Forth, each advocate decides if to give her piece of information to the court. Fifth, a court as a representative of the legislative decides on each proposal in order to maximize welfare. If it receives signal e, it will decide for action X for which $W^X(e)$ is largest. Without any signal, it implements decision X for which the average effect on welfare, i.e., W^X, is largest.

[26]This assumption may be weakend. Then, however, results depend on the relative information acquisition costs of the advocates.

[27]Usually in adversial systems, the court represents a neutral instance without expertise concerning the litigation. Therefore, it decides according to a simple decision rule (Froeb and Kobayashi, 2001; Dewatripont and Tirole, 1999).

For this game, we compare the levels of information the court receives at the last stage under the two regimes and solve the game by backward induction. At the final stage, due to assumption *A7',* the remedial option will be chosen in the absence of information; else the decision is straightforward. At the forth stage, each advocate decides if to give its information to the court, which could induce the legislator to implement either NM or M. Due to assumptions *A4'* and *A8'*, AF will reveal information on $\bar{e}$, but conceal information on $\underline{e}$, whereas the reverse is true for the AC.[28] We denote $\hat{X} = R$ under regime R and $\hat{X} = \arg\max_{X \in \{NM,M\}}\{W^X\}$ under regime NR. At stage three, AF chooses β_Π to maximize

$$E\left(1_{\{e=\bar{e}\}}(e) \times (\beta_\Pi \Pi^M(\bar{e}) + (1-\beta_\Pi)\Pi^{\hat{X}}(\bar{e})) + 1_{\{e=\underline{e}\}}(e) \times (1-\beta_{CS})\Pi^{\hat{X}}(\underline{e})|\beta\right) - C(\beta_\Pi)^{29}$$

and the agency chooses β_{CS} to maximize

$$E\left(1_{\{e=\bar{e}\}}(e) \times (\beta_\Pi CS^M(\bar{e}) + (1-\beta_\Pi)CS^{\hat{X}}(\bar{e})) + 1_{\{e=\underline{e}\}}(e) \times (1-\beta_{CS})CS^{\hat{X}}(\underline{e}))|\beta\right) - C(\beta_{CS}).$$

Under R, this yields the first order conditions

$$q \times (\Pi^M(\bar{e}) - \Pi^R(e)) = C'(\beta_\Pi) \quad \text{and} \quad (1-q) \times (-CS^R(\underline{e})) = C'(\beta_{CS})$$

and under NR it yields

$$q \times (\Pi^M(\bar{e}) - \Pi^{\hat{X}}(\bar{e})) = C'(\beta_\Pi) \quad \text{and} \quad (1-q) \times (-CS^{\hat{X}}(\underline{e})) = C'(\beta_{CS}).$$

[28] If AF holds $\underline{e}$, it would pass this information to the government only if it would deny the merger anyway. In that case, passing information is redundant. Thus, without loss of generality, we may assume that AF passes information if and only if it is $\bar{e}$. A similar logic applies to AC.

[29] Here, $1_{\{e=\bar{e}\}}(e)$ is the indicator variable which is 1 if the proposed merger is of the high type and 0 otherwise (analogously, for $1_{\{e=\underline{e}\}}(e)$). In case the advocate AF faces the high type, the probability the proposed merger will be fully approved equals β_Π as held information will be passed and therefore induce the court to implement the merger, independent of the other advocate's action. In case the advocate AF faces the low type, she will never report to the court and the probability for a denial of the merger depends only on the choice of information by AC, i.e., β_{CS}.

Given NR, only one advocate will exert effort, whereas under R both will exert effort, however, to a lower extend. The level of information the court receives is $q\beta_{\Pi} + (1 - q)\beta_{CS}$. If $0 > W^M$, then the information gathering is higher under NR if and only if $q \times (\beta_{\Pi}^{NR} - \beta_{\Pi}^{R}) > (1 - q) \times \beta_{CS}^{R}$.[30] If $W^M > 0$, then it is higher under NR if and only if $(1 - q) \times (\beta_{CS}^{NR} - \beta_{CS}^{R}) > q\beta_{\Pi}^{R}$. Thus, our main insight, that information acquisition is weakened by the introduction of the remedial option if this represents only intermediate, but never the best option, does not hold anymore if we alter the institutional environment.

Proposition 3. *Let the legislator adopt a welfare standard. If the remedial option is never optimal, but in each case the intermediate, the information acquisition by a nonpartisan authority is lower if remedies are feasible. However, the information acquisition by two countervailing advocates is not likely to be lower if remedies are feasible, i.e. only if* $q \times (\beta_{\Pi}^{NR} - \beta_{\Pi}^{R}) > (1 - q)\beta_{CS}^{R}$, *provided* $0 > W^M$, *and* $(1 - q) \times (\beta_{CS}^{NR} - \beta_{CS}^{R}) > q\beta_{\Pi}^{R}$, *provided* $W^M > 0$.

Consequently, the remedial option does not distort information acquisition in general in an adversial system (like in the US) as compared to an inquisitorial system (as in the EU). Thus, we qualify the finding by Szalay (2005) in case there is not one unbiased agent, but in case there are several agents with countervailing interests, each of whom represents other determinants of the principal's objective. Our result is in the spirit of Dewatripont and Tirole (1999), even though the underlying mechanism is entirely different. Dewatripont and Tirole (1999) argue that an inquisitorial regime has less information acquisition incentives due to its aversion against producing two countervailing piece of evidence, thus stopping acquisition too early. In our setup, this result is driven by the fact that the inquisitorial regime considers the remedial option as the ex ante optimal de-

[30]Furthermore, information is more balanced under regime R. On the contrary, if the court gets only information from one advocate, its decision will be biased on average. However, we will not extend this analysis here, but stick to the court's decision rule at the fifth stage. If we assume that the court have rational beliefs concerning the distortedness of information it gets, a Nash equilibrium of the advocates and the court in pure strategies does not exist.

cision, which is not the case for any agent in an adversial setting. Concluding, we consider intermediate options as more valuable in an adversial setup than in an inquisitorial.

Example. The preceding analysis applies to the following setup, which fulfils assumptions *A2*^{adv} *and A3'-A8'*. We consider a symmetric Cournot-duopoly with two firms, each of which holds two production plants. Firm i produces quantity q_i at costs $C_i(q_i) = e_i \cdot q_i^2/K_i$, where K_i denotes the firm's capital stock and e_i denotes the firm i's production efficiency. Initially, both firms have $K_i = 2$ and $e_i = 1$. The inverse demand function is given by $p = 1 - Q$ with $Q = q_1 + q_2$. Now, the two firms may merge to a monopolist holding four production plants, where a synergy as given by e may be realized. Two types of mergers are feasible, either highly efficient ones ($e_{M,h} = 0.5$) or lowly efficient ones ($e_{M,l} = 0.7$). If the merger is subject to a remedy, then the merged entity sells one production plant to an entrant. However, the remedial obligation lowers created synergies so that $e_{R,h} = 0.8$ for the highly efficient merger type and $e_{R,l} = 0.9$ for the less efficient merger type. The remedy is sold by the merged entity to an entrant via take-it or leave-it offers, so it could extract the entrant's entire profits. Each merger type is equally likely, so that the chance that an arbitrary merger generates a high synergy is 50%. In this setting, in the absence of precise information on a merger's type, the implementation of a merger with the remedy is the social planner's optimal decision. For consumers and firms, the remedial option is neither the optimal, nor the worst decision, but the intermediate one. Whereas consumers strictly prefer the merger's entire denial over the remedial option, which is preferred over the entire approval, the firm's preference ordering is reversed for both merger types (see Table 1).

6 Conclusion

In practice, the general view towards remedies is a positive one. The European legislation, for instance, describes remedies as an effective way to restore competition (EU, 2008, Article 22). Whereas in practice ex ante most mergers are cleared without a re-

	CS	W	Π	$E(W)$
no merger	.1250	.3125	.1875	.3125
M, high	.0988	.3210	.2222	.3121
M, low	.0905	.3033	.2128	.3121
R, high	.1232	.3162	.1930	.3132
R, low	.1197	.3101	.1904	.3132

Table 1: *Values of consumer surplus* [CS]*, social welfare* [W] *and firms' profits* [Π] *for both merger-synergies* [*high/ low*] *and both merger implementations* [*full/ with remedy*]*. In the last column, the expected social welfare if the merger-synergy is unknown is stated.*

medial obligation in Phase I, we could apply our insights to the important merger cases involving large market shares, which often proceed to Phase II. Even though about 50% of Phase II merger decisions are cleared under a remedial obligation, Davies and Lyons (2008) conclude that more Phase II investigations are needed. We, however, suspect that remedies are applied excessively in the truly important merger cases.

Compared to the existing, remedy-critical literature, our angle is a very different one. We show that even if remedies are optimal ex ante, the introduction of remedies may be problematic. In settings in which extreme options are optimal, the introduction of intermediate options may become a problem if this frustrates the agency's incentives to acquire to such an extend that the remedy's negative effects overweigh its positive effects from a consumer surplus point of view. This conclusion, however, relies heavily on the underlying institutional environment. It is true for an inquisitorial regime which we typically find in the EU, whereas it does not generally hold under an adversial regime like in the US.

In order to test our predictions empirically, data on the relative success of remedial obligations is needed and factual market outcomes are to be compared with counterfactual no-remedy scenarios. While such an analysis bears practical problems, our model suspects that on average remedies' implementation tends to be more careful and successful in the

US than in the EU.

Appendix A: Proofs

Uniqueness of equilibrium information levels for cases $I - IV$:

The agency's first order condition's left hand side, given by (2) or (1), is constant, but strictly positive. It is strictly monotonically increasing in β on the right hand side. Thus, either an interior solution exists or the unique corner solution applies with $\beta = 0$.

Proposition 1 (extended version for cases I-IV): In case I (*remedies are optimal for both efficiency types*), there is no incentive problem and the agency implements the first best solution. In case II (*remedies are not optimal for any efficiency type*), the agency acquires more information under regime NR than under regime R. Consumer surplus is higher under NR if and only if the degree of information acquisition is sufficiently higher under NR, i.e., $(\beta^*_{NR,2}-\beta^*_{R,2})\times qCS^M(\bar{e}) > (1-\beta^*_{R,2})\times CS^R-(1-\beta^*_{NR,2})\times\max\{CS^M,0\})$. In cases III and IV (*remedies are either only for inefficient or only for efficient merger types optimal*) the removal of remedies is optimal concerning the principal's objective if and only if information acquisition incentives are lower under regime R, i.e., $qCS^R(\bar{e}) - \max\{CS,0\} > 0$ in case III and $q(CS^R(\bar{e}) - CS^M(\bar{e})) + CS^R - \max\{CS^M,0\} > 0$ in case IV, and if additionally under regime NR gains in consumer surplus due to a higher information level outweigh consumer-surplus losses from scenarios where remedies would have been the optimal decision, i.e., $(\beta^*_{3,NR} - \beta^*_{3,R}) \times (qCS(\bar{e})) > CS^R - \max\{CS^M,0\} + \beta^*_{3,NR}\times\max\{CS^M,0\}-\beta^*_{3,R}\times qCS^R(\bar{e})$ in case III and $\beta^*_{NR,4}\times qCS(\bar{e})-\beta^*_{R,4}\times qCS^R(\bar{e}) > CS^R - \max\{CS^M,0\} + \beta^*_{NR,4}\times\max\{CS^M,0\} - \beta_{R,4}\times CS^R$ in case IV.

Proof of Proposition 1. In case I, the left hand side of (1) reduces to $qCS^R(\bar{e}) + (1-q)\times CS^R(\underline{e})) - (qCS^R(\bar{e}) + (1-q)\times CS^R(\underline{e})) = 0$, so that the agency chooses the minimal information level $\beta^*_{R,1} = 0$. Since remedies are optimal anyway, information acquisition is not welfare-increasing. Thus, the principal's and the agent's interests are

aligned. If remedies are not feasible, the optimal result, i.e., the remedial option, can never be implemented. Thus, spite of a higher information acquisition level, i.e., $\beta^*_{NR,1} > 0$, consumer surplus is strictly higher under regime R and both the legislator and the agency prefer the introduction of remedies.

In the remaining three cases, the agency's decision is the better the higher β is, so that $E(CS^X|\beta)$ is increasing in β for a given regime X. In the third and the fourth case, the optimality of the regime depends on the interplay of efficiency parameters and probabilities.

In case II, the left hand side of (1) reduces to $qCS^M(\bar{e}) - (qCS^R(\bar{e}) + (1-q)CS^R(\underline{e}))$. Due to assumption $A5$, this term is smaller than the left hand side of (2), which proves $\beta^*_{R,2} < \beta^*_{NR,2}$. Consumer surplus is higher under regime NR if and only if

$$(\beta^*_{NR,2} - \beta^*_{R,2}) \times (qCS^M(\bar{e})) > (1 - \beta^*_{R,2}) \times CS^R - (1 - \beta^*_{NR,2}) \times \max\{CS^M, 0\}). \quad (3)$$

Under which regime consumer surplus is higher depends on the relation between the gain in surplus due to higher information acquisition under NR (left hand side of (3) and the loss in consumer surplus due to the removal of the remedial option in the no-information scenario (right hand side of (3)).

In case III, the left hand side of (1) reduces to $qCS^M(\bar{e}) + (1-q)CS^R(\underline{e}) - (qCS^R(\bar{e}) + (1-q)CS^R(\underline{e})) = q(CS^M(\bar{e}) - CS^R(\bar{e}))$ under regime R, and to $qCS^M(\bar{e}) - \max\{CS^M, 0\}$ under regime NR. Thus, the first necessary condition for NR to be optimal is a higher level of information acquisition. Due to $C'''(0) > 0$, this condition is equivalent to $qCS^M(\bar{e}) - \max\{CS^M, 0\} - q(CS^M(\bar{e}) - CS^R(\bar{e})) = qCS^R(\bar{e}) - \max\{CS^M, 0\} > 0$. This is true either if $0 > CS^M$ or if $q(CS^M(\bar{e}) - CS^R(\bar{e})) < -(1-q)CS^M(\underline{e})$. The second necessary condition is that the increase in consumer surplus due to a higher degree of information acquisition overcompensates surplus losses due to the removal of the remedial option, i.e.,

$$(\beta^*_{NR,3} - \beta^*_{R,3}) \times qCS^M(\bar{e}) > CS^R - \beta^*_{R,3} \times qCS^R(\bar{e}) - (1 - \beta^*_{NR,3}) \times \max\{CS^M, 0\}$$

In case IV, the left hand side of (1) reduces to $qCS^R(\bar{e}) - CS^R$ under regime R, and to $qCS^M(\bar{e}) - \max\{CS^M, 0\}$ under regime NR. Thus, the first necessary condition for NR to be optimal is a higher level of information acquisition, i.e., $q(CS^M(\bar{e}) - CS^R(\bar{e})) + CS^R - \max\{CS^M, 0\} > 0$. The second necessary condition is that the increase in consumer surplus due to a more information outweighs surplus losses due to the removal of the remedial option, i.e.

$$\beta^*_{NR,4} \times qCS^M(\bar{e}) - \beta^*_{R,4} \times qCS^R(\bar{e}) > (1 - \beta^*_{R,4}) \times CS^R - (1 - \beta^*_{NR,4}) \times \max\{CS^M, 0\}.$$

Proof of Proposition 2. If the remedial option is feasible, then the equilibrium level of information acquisition β_R is given by the maximization of $\beta(\int_{\underline{e}}^{e_1} f(e)CS^{NM}(e)de + \int_{e_1}^{e_2} f(e)CS^R(e)de + \int_{e_2}^{\bar{e}} f(e)CS^M(e)de) + (1-\beta)CS^R - C(\beta)$.

Under regime NR, the equilibrium level β_{NR} is given by the maximization of

$\beta(\int_{\underline{e}}^{\hat{e}} f(e)CS^{NM}(e)de + \int_{\hat{e}}^{\bar{e}} f(e)CS^M(e)de) + (1-\beta)\max\{0, CS^M\} - C(\beta)$. Thus, β_{NR} and β_R are given by the following first order conditions,

$\int_{e_1}^{e_2} f(e)CS^R(e)de + \int_{e_2}^{\bar{e}} f(e)CS^M(e)de - CS^R = -\int_{\underline{e}}^{e_1} f(e)CS^R(e)]de + \int_{e_2}^{\bar{e}} f(e)[CS^M(e) - CS^R]de = C'(\beta_R)$ and by

$-\int_{\underline{e}}^{\hat{e}} f(e)\max\{0, CS^M(e)\}]de + \int_{\hat{e}}^{\bar{e}} f(e)[CS^M(e) - \max\{0, CS^M(e)\}]de = C'(\beta_{NR})$.

We discuss under which circumstances the agency exerts more effort under regime R, i.e., when $-\int_{\underline{e}}^{\hat{e}} f(e)[\max\{0, CS^M(e)\}]de + \int_{\hat{e}}^{\bar{e}} f(e)[CS^M(e) - \max\{0, CS^M(e)\}]de > -\int_{\underline{e}}^{e_1} f(e)[CS^R(e)]de + \int_{e_2}^{\bar{e}} f(e)[CS^M(e) - CS^R]de$ holds. For computational convenience, we assume that $\max\{0, CS^M(e)\} = 0$. Thus, we obtain $\int_{\hat{e}}^{\bar{e}} f(e)CS^M(e)de > -\int_{\underline{e}}^{e_1} f(e)CS^R(e)]e + \int_{e_2}^{\bar{e}} f(e)[CS^M(e) - CS^R(e)]de$, which gives

$$\int_{[\underline{e},\bar{e}]\setminus[e_1,e_2]} f(e)CS^R(e)de + \int_{\hat{e}}^{e_2} f(e)CS^M(e)de > 0.$$

Appendix B: Examples

Example 1. We provide the calculations of Example 1. We assume a Cournot model with $n = 4$ firms. The post-merger cost function is given by $c(x_i, K_i, e) = (1 - (1 -$

$\Delta) \cdot e)x_i^2/(1+\Delta)$. Furthermore, we consider two types $\underline{e} = 0.25$ and $\bar{e} = 0.75$, where each types occurs with probability 1/2. The first derivative of the agency's information cost function is $C'(\beta) = k/(1-\beta)$. We define $F^R := qCS^M(\bar{e}) - CS^R$ and $F^{NR} := qCS^M(\bar{e}) - \max\{CS^M, 0\}$. Thus, $\beta^*_{NR,2} = (F^{NR} - k)/F^{NR}$ and $\beta^*_{R,2} = (F^R - k)/F^R$. According to case II of Proposition 2, consumer surplus is higher under regime NR if

$$((F^{NR} - k)/F^{NR} - (F^R - k)/F^R)(qCS^M(\bar{e})) >$$

$$CS^R - \max\{CS^M, 0\} + (F^R - k)CS^R/F^R - (F^{NR} - k)\max\{CS^M, 0\}/F^{NR}.$$

We then obtain $CS^M(\bar{e}) = \frac{906}{67\,081}$, $CS^M(\underline{e}) = -\frac{1110}{108\,241}$ and thus $CS^M \approx 0.0016256$. Furthermore, $CS^R(\bar{e}) = \frac{125\,697}{15\,523\,592}$, $CS^R(\underline{e}) = -\frac{10\,887}{20\,199\,368}$ and thus $CS^R \approx 0.0037791$. Therefore, $F^R \approx 0.0029739$ and $F^{NR} \approx 0.0051274$. We restrict attention to $k < 0.0029739$ to focus on interior solutions. We solve the condition for k and find that regime NR is preferable if $k > 0.002258$. For $k = 0.0023$ for example, we obtain the equilibrium values $\beta^*_{NR,2} = (0.0051274 - 0.0023)/0.0051274 = 0.55143$ and $\beta^*_{R,2} = (0.0029739 - 0.0023)/0.0029739 = 0.2266$. Thus, equilibrium information acquisition differs significantly under the two regimes and consumer surplus is higher if the legislator selects regime NR which does not allow for a remedy.

Vertical Mergers: Example. We provide the parts of the analysis which were missing in the main part. First, we focus on the equilibrium outcomes in all three possible market structures.

i) Under separation, the situation is as follows. Since goods are perfect substitutes, a price above w is not sustainable, so that $p_i = w$ must hold for $i = 1, 2$, and hence, $e_{1,se} = e_{2,se} = 0$. The manufacturer then solves

$$\max_w \ (w - c)(v - w),$$

which gives the standard solutions

$$w_{NM} = \frac{v+c}{2},$$
$$\pi_{U,NM} = \frac{(v-c)^2}{4}, \text{ and } CS_{NM} = \frac{(v-c)^2}{8}.$$

ii) Next, we consider the equilibrium outcome under vertical integration of the manufacturer and retailer 1. If the integrated firm forecloses retailer 2, its maximization problem becomes

$$\max_{p,e_1} \ (p-c-s)(v+e_1-p) - \alpha\mu\frac{e_1^2}{2},$$

which yields the first order conditions

$$p = \frac{1}{2}(v+e_1+c+s) \text{ and } e_1 = \frac{1}{\alpha\mu}(p-c-s)$$

Thus, in equilibrium we obtain

$$\begin{aligned}
p_M &= \frac{\alpha\mu(v+c+s)-c-s}{2\alpha\mu-1}, \\
e_{1,M} &= \frac{v-c-s}{2\alpha\mu-1}, \text{ (and } e_{2,M}=0) \\
q_{1,M} &= \frac{\alpha\mu\,(v-s-c)}{2\alpha\mu-1}, \text{ (and } q_{2,M}=0) \\
PS_M &= \pi_M = \frac{\mu(v-c-s)^2}{2(2\alpha\mu-1)} + \Delta,\ CS_M = \frac{\mu^2\,(v-c-s)^2}{8(\alpha\mu)^2-8(\alpha\mu)+2}.
\end{aligned}$$

This outcome proves that foreclosure is always optimal for the integrated firm. If firm 2 was supplied, the integrated firm's maximum profit was the monopoly profit by either selling the good itself or extracting firm 2's entire profits. This, however, is lower than the profit under foreclosure since the public good could never be delivered without foreclosure: if firm 2 delivered the public good e_2, then the integrated firm could always cut p_2 slightly to steal firm 2's entire market share; if firm 2 was active in the market, also firm 1 would not deliver the public good. We obtain $CS^M > CS^{NM}$ for all $\mu > 0.5$ and for all $s \in [0, (v-c)/2\mu)$, so that consumers prefer the merger over no merger for the efficient type, but not for the inefficient type if its inefficiency s exceeds $(v-c)/2\mu$.

iii) Finally, we consider the case of vertical integration with a remedy. Here, the available remedy means that the vertically integrated firm must serve the competing retailer 2 at a cost-based level ("obligation to supply"). In order to allow the firm to earn some profits, however, prices may be set ε above marginal costs, where ε is a small, further specified positive number. That is, we suppose $w = c + s + \varepsilon$ (" cost-based"), which assures that retailer 2 is active. Note also that $e_1 = e_2 = 0$ must hold, since otherwise the freerider-problem explained in the preceding paragraph means that the public good provider loses its entire market share. According to Proposition 1, a removal of the remedial option may be optimal for consumers even though the remedy is harsh and it restricts the integrated firms' profits strictly. We obtain

$$\begin{aligned} q_{U,R} &= v - c - s - \varepsilon \\ \pi_{U,R} &= PS_{re} = \Delta + \varepsilon(v - c - s - \varepsilon);\ CS_R = \frac{(v - c - s - \varepsilon)^2}{2}. \end{aligned}$$

Inserting the parameters $\nu - c = 1$, $\mu = 1$, $s = 1/2$, $\varepsilon = 1/10$ and $\alpha = 2$ yields $CS^{NM} = 0.125$, $CS^M_{ineff} = 1/18 \approx 0.056$, $CS^M_{eff} = 0.5$, $CS^R_{ineff} = 0.08$, and $CS^R_{eff} = 0.405$.

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