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Remedies vs. Extreme Options in Merger Control*

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Abstract

We investigate how remedies in merger control affect information acquisition by an antitrust agency. We identify conditions under which an “extreme options” regime which does not allow for remedies improves information acquisition by the agency which increases consumer surplus. The legislator (“principal”) and the agency share the same objective function with the only exception that the latter must bear information costs. When remedies are not feasible, then the agency’s incentive to acquire information is relatively large as a false decision tends to have large adverse effects. When remedies are feasible, the intermediate option does not involve such risks, so that incentives to acquire information decreases. However, our results depend crucially on the institutional environment. In the case of an adversarial system, information acquisition incentives are not per se lower if remedies are feasible.

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1 Introduction

Remedies are typically seen as a means to improve merger decisions of an antitrust agency.¹ Clearing a merger subject to remedial conditions is an intermediate decision positioned between the extreme options of either allowing or blocking the entire proposal altogether. 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).²

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.

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. Most importantly, the antitrust agency can undertake costly effort to obtain information about the efficiency level.

Clearing a merger with remedies is an intermediate option from a consumer perspective, as it is neither the worst nor the best option. If the efficiency level is relatively high, then (ex post) clearance of the entire merger proposal is optimal, followed by an approval conditional on remedies and a prohibition (in that order). For inefficient merger types, the reverse order holds, where again the remedy option ranges in between.

In our analysis we invoke a “remedy favoring” assumption which says that the remedial

¹The US Horizontal Merger Guidelines and the EU Merger Regulation allow for remedial offers to address competitive concerns (see DOJ, 2010, and EU, 2004, respectively).

²Remedies have become increasingly important in merger control (see, for instance, Seldeslachts et al., 2009, Fig. 1).

option is optimal given the a priori information about the merger. However, since the choice of the intermediate option represents a compromise which limits errors in either direction, its feasibility may negatively influence the agency's effort. In contrast, through the agency's possibly much higher errors, an extreme options scenario may sharpen the agency's incentive to provide effort. By choosing the remedial option, the agency limits the effects of decision errors. This means that the availability of the remedial option may frustrate the agency's incentives to gather costly information since the choice of the remedial option cannot be a very bad decision.

Our focus is on identifying conditions under which an extreme options regime (without the remedial option) may perform better than current competition policy regimes which allow for (and make heavy use of) remedies to clear merger proposals. Because of the negative effect of the remedial option on the agency's incentive to collect information about the merger proposal, remedies may be used much too often with detrimental effects on the agency's quality of merger decisions. In an extreme options scenario, however, in which mergers can be only fully approved or entirely denied, false decision may have much more severe consequences, so that the agency acquires more costly information in order to avoid such severe errors. Hence, the exclusion of the ex ante optimal decision may make consumers better off due to the enhanced quality of the agency's decision.

The optimality of extreme options depends on the shape of the information cost function. If information costs are at a moderate level, an extreme options scenario may indeed be optimal. If information costs are neither too low nor too high, then the agency may abstain from acquiring information as a straight use of the remedy option tends to limit the costs associated with a false decision. If remedies are not feasible, however, the agency will acquire much more information, which may even make consumers better off.

Finally, we analyze remedies when the government implements a social welfare standard. Adjusting the assumption of our basic setting accordingly, we obtain that our insights remain 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 we have analyzed so far with a system of advocates since a welfare standard involves the counterbalancing of two interests, consumer surplus and gains, which may either be represented by a single, nonpartisan institution, or by two advocates. In the former, one institution gathers both evidence and counterevidence for a legal case whereas in the latter, there is a plaintiff and a defendant, i.e., an advocate for both sides, in front of a neutral and passive judge. Whereas the inquisitorial merger control system is incorporated in the European Union, the adversarial system is adopted by the US, where the agency or the Department of Justice acts as a plaintiff in front of a federal law (Neven, 2006).

We find that our main result, the frustration of the agency's incentives through the remedial option relies heavily on the underlying institutional environment. Under a system of advocates, quite generally, information acquisition incentives are not lower when a remedial option is feasible. If the remedial option serves as a default in the absence of information, incentives are likely to be even higher under a regime with remedies since both parties engage in equilibrium in information acquisition. That is since whereas for the inquisitorial regime remedies were ex ante optimal, the advocates have either an interest in the realization of a merger or in its entire denial. Thus, in equilibrium both advocates gather information in order to prove the agency that not the remedial option, but a full (resp. no) merger maximizes 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 other, rivaling party has to engage in information acquisition.

We proceed as follows. In Section 2, we introduce the related literature, before we present our basic model in Section 3, and the analysis and our main results in Section 4. In Section 5, we apply our basic setting to specific industrial organization models of

horizontal and vertical mergers. We find that our results hold for structural remedies in typical Cournot-markets under fairly reasonable parameter constellations. Furthermore, our insights apply with respect to behavioral remedies and vertical integration in Bertrand-markets á la Telser (1960), i.e., if competition might result in an underprovision of a public good. In Section 6, we extend our insight towards a continuum of merger efficiencies. Next, we consider a social welfare standard and contrast an inquisitorial regime with a system of advocates. Finally, Section 7 concludes.

2 Related Literature

We build on Szalay (2005) who studies 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 principle (which is the legislator in our model) cannot design an incentive compatible contract based on ex post outcomes.³ The critical step in the analysis is to focus on the incentives resulting from designing the agent’s action set properly. The principle and the agent are assumed to share the same objective function with the only difference that the agent enjoys to laze around instead of gathering information. It is shown that it can be optimal to remove the intermediate choices from the agent’s action set to spur incentives to acquire information.⁴

³The latter assumption is motivated in Szalay (2005) by the agent’s infinite risk aversion. In our setup, the absence of financial incentives appears to be natural as the legislator is not able to design incentive schemes for bureaucrats of single agencies (exceptions as the “banker bonus” for central bankers basically confirm this rule). Payment levels are often more or less exogenous and the salary structure holds for all employees (and civil servants) in the public sector.

⁴Interestingly, 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.”

We apply Szalay’s (2005) approach to the realm of merger control.⁵ We contribute to the industrial organization literature which analyzes merger and market outcomes when remedial divestitures are possible. 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). Besides other things, those works show that the scope for profitable and approvable mergers tends to increase with remedies under a consumer surplus standard. Vasconcelos (2010) notes the possibility of an over-fixing problem in which case the agency uses the remedial divestitures to optimally restructure the industry which may deter desirable merger proposals in the first place.⁶ Closely related to our paper is Cosnita-Langlais and Tropeano (2012). They also assume that the merger’s efficiency level is private information. Using a mechanism design approach, they show that the agency needs additional tools (in particular, transfer payments) besides remedial divestitures to separate high efficiency mergers from low efficiency mergers.

Recent law literature reveals a critical view on remedies. Hayer (2012) argues that remedies might “risk making a bad situation even worse” or that remedies may be “worse than the disease”. Papandropoulos and Tajana (2006) list various reasons why structural remedies may do a poor job. Davies and Lyons (2008) state that behavioral remedies may limit strategies like price discrimination which may be potentially beneficial (see for instance Dertwinkel-Kalt et al., 2013) or restrict a firm’s ability to adjust according to changing market conditions. Snelders and Genevaz (2006) discuss a variety of examples and see remedies also critical. An instance, in which remedies worsened the situation, is the merger between Nestle/ Perrier in 2002, which is analyzed in Compte et al. (2002).

⁵Stephenson (2010) discusses the results by Szalay with respect to information acquisition by institutions and points out that concerning institutional design, it may be preferably to rule out the ex ante preferred option. We specify the underlying mechanism formally with respect to merger control.

⁶The increasing use of remedies has also triggered empirical research concerning the effectiveness of merger control in general (see Duso et al., 2011, and Duso et al., 2013, for the EU and Clougherty and Seldeslachts, 2012, for the US).

As Davies (2010) argues, “Allowing the merger [between Nestle and Perrier] without remedy would have been preferable”, since remedies have created a more symmetric market structure which facilitates tacit collusion. Blanc and Shelanski see a “bias towards wide structural remedies”⁷, at least in the telecommunications industry and provide examples where these have not worked out as intended. Heyer (2012) argues that especially structural remedies may lead to foregone merger efficiencies, which is according to Paas (2008) especially true for small countries.

This paper adds to the growing remedy-critical economics literature. Theoretical literature depicts that divestitures can be harmful to competition in various setups (Fridolfsson and Stennek, 2005; Farrell, 2003; Cabral, 2003); even if entire viable businesses are divested, remedies may fail, for example if the buyer is not a vigorous competitor (Davies and Lyons, 2008). Also empirical studies challenge the effectiveness of remedies. Duso et al. (2011) and Kwoka and Greenfield (2013) find that in comparison with a rigorous denial, remedies may not be well-suited to countervail anticompetitive effects arising from a merger. Davies (2010) tackles the adequacy of remedies especially in case the pre-merger market structure could already give rise to competitive concerns. Also behavioral remedies often fail to eliminate competitive concerns, as Duso et al. (2011) and Kwoka and Moss (2011) find.

Since our remedy-critical results are qualified under advocacy in the sense of Dewatripont and Tirole (1999), we add also to the literature in favor of advocates. Dewatripont and Tirole argue in favor of advocates by stating that information acquisition incentives are lower under an inquisitorial regime. The main driver of these findings is, however, the existence of countervailing information, which does not exist in our framework. The non partisan authority gathers less information than the advocates since it refrains from producing both evidence and counterevidence, which would result in the decision for the

⁷Structural remedies are usually seen as simple and relatively easy to administer (DOJ, 2011; Leveque, 2003). This arguing is in line with our paper, that the agency prefers decisions which do not need much effort.

status quo. Thus, the inquisitorial system decides too often for an extreme decision. As opposed to this, in our setup the inquisitorial regime does not decide often enough for the extreme option. The difference is due to the key mechanism in Dewatripont and Tirole (1999) that information can be conflicting so that the inquisitorial regime refrains from looking for a second piece of information which might countervail the first piece. However, in our setup, the agency refrains already from obtaining 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 adversarial system over the inquisitorial one if information can be noisy and thus conflicting. However, contrary to our setup and similar to Dewatripont and Tirole, he assumes that information may be noisy. Even though in our setup misleading information is not feasible, our results are in favor of advocates. 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.

3 The Model

We assume that the legislator (the “principal”) uses competition policy (in particular, merger control) to protect competition as a safeguard to consumer interests which are challenged by firms’ monopolizing incentives. Formally, the legislator designs incentives to maximize consumer welfare.⁸ The legislator delegates merger control to the antitrust agency (in short: the “agency”). The legislator’s and the agency’s objectives are aligned,

⁸Recent Industrial Organization literature (e.g., Nocke and Whinston, 2010) 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).

with the only exception that the agency also considers the information cost it has to bear.⁹ Thus, the agency maximizes consumer surplus minus its own information acquisition costs.

We consider a model with asymmetric information between the merging firms and the agency. Mergers differ in the efficiencies, e , they generate. The prior distribution of efficiencies is common knowledge, while the specific efficiency level of a particular merger is private information. 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 concerning a merger's efficiency level by choosing a costly effort level to observe the true efficiency type with probability $\beta \in [0, 1]$.¹⁰ 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 $1 - \beta$.¹¹

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 action by the merging parties. We assume that a single remedy exists for every merger proposal (as in Cosnita-Langlais and Tropeano, 2012).¹²

⁹It is a common assumption that bureaucrats are to some extent intrinsically motivated to serve the principal's objectives (Prendergast, 2007; Besley and Gathak, 2005). Long-run motivation of the bureaucrats may also be provided by the fear of their institution's restructuring in the case of its failure, which may lead to lower income or the replacement of the staff. Direct financial incentives, however, are unfeasible since bureaucrats are neither paid according to success of their institution nor can the legislator influence the bureaucrats' payment.

¹⁰Similar specifications are used in Szalay (2005) and Cosnita-Langlais and Tropeano (2012).

¹¹We 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.

¹²In 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.

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 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 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.*

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 the agency must bear information costs to make optimal

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 (for instances see Paas, 2008, or 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 protection consumer interests.

merger decisions.¹³ The principal-agent problem arises if the agency does not exert enough effort in order to maximize the legislator's objective.

Next, we impose the following assumptions on the pre- and the post-merger market structures.¹⁴

A3: *The information acquisition cost function C is given by the Inada-conditions $C(0) = 0, C'(\beta) > 0, C''(\beta) > 0, \lim_{\beta \rightarrow 1} C(\beta) = +\infty$.*¹⁵

The Inada-conditions represent standard assumptions imposed on production functions (Inada, 1963, and subsequent papers) and are also incorporated in Cosnita-Langlais and Tropeano (2012) and Szalay (2005). In our case, the produced good is information.¹⁶

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

Due to this profitability assumption, each merger type has an incentive to propose a full merger, but accepts also the potential obligation to merge with a certain remedy.¹⁷

¹³This assumption could be relaxed in the sense such that the government takes the costs of information acquisition also into consideration, however, to a lesser degree than the agency. For example, the government's objective may equal the consumer surplus minus a multiple of the information costs, which is smaller than one. In this case, our qualitative results still hold. For computational convenience, however, we stick to the simplified assumption that the government ignores information costs.

¹⁴Similar assumptions are invoked in Cosnita-Langlais and Tropeano (2012).

¹⁵Prominent examples of cost functions exhibiting these properties are $C(\beta) = \alpha\beta/(1 - \beta)$ or $C(\beta) = \alpha \ln(1/(1 - \beta))$ for $\alpha > 0$.

¹⁶In the subsequent analysis, A3 provides the uniqueness of the level of information, that is acquired in equilibrium.

¹⁷Given our purpose to analyze the principal agent problem under the different regimes, the assumption of the profitability of all merger types is the only adequate one due to the following reasoning. If a pure merger was profitable only for either \bar{e} or \underline{e} , then the other merger type would be never proposed in equilibrium. Thus, the agency held perfect information on a merger's type without any information acquisition, so that the principal-agent problem which we are going to analyze would vanish. If a merger

A5: *From a consumer point of view, the efficient merger's proposal should not be entirely denied, i.e., $\min\{CS^M(\bar{e}), CS^R(\bar{e})\} > 0$.*

A6: *From a consumer point of view, the inefficient merger's proposal should not be approved, i.e., $CS^M(\underline{e}) < \max\{0, CS^R(\underline{e})\}$.*

The assumptions A5 and A6 ensure that the agency's optimal decision is conditional on the merger's efficiency type. Else, the agency's optimal decision might be independent of a type's efficiency, so that information acquisition would be superfluous.

A7: *If the agency has to decide on a merger solely with knowledge of the prior distribution of efficiencies, then from a consumer surplus perspective an approval with remedies is most desirable; i.e., $\max\{CS^M, CS^{NM}\} < CS^R$.*

We incorporate this strong assumption in favor of remedies. This means that with no further knowledge than the distribution of efficiencies, it is on average optimal to implement each proposed merger under the concession of a remedy. This assumption fits our motivation, that a merger with a remedy resembles the intermediate option which is to be chosen if no information is available. Extreme options like the full approval or the denial of a merger bear the risk of making a larger mistake, whereas the choice of the intermediate option represents the safe choice in the absence of information.

4 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

with a remedy was not profitable for the efficient type, in practice it cannot be profitable for the inefficient type. Thus, if the profitability condition held not for \bar{e} , firms would never agree to implement a merger with a remedy, so that remedies could be not viable at all and the difference between the regimes would vanish. If the inefficient type's profitability condition was violated for a merger with a remedy, due to the subsequent conditions A5-A7 it would not propose a merger at all under regime R .

remedies are feasible (regime R) or not (regime NR). In the second stage, a firm proposes a merger. In the third stage, the agency decides on the quality of information β it acquires and in the last stage, the agency delivers its judgement about the proposal.¹⁸

The agency's decision on a proposed merger at the forth stage depends on the present regime and the information β it has acquired at the third stage. If the agency holds information that the merger proposal is of type \bar{e} , a situation which occurs with probability $q\beta$, according to A5, the merger is approved either fully or with remedies, depending on which decision is feasible and which one yields a higher consumer surplus. The subsequent implemented change in consumer surplus equals $\max\{CS^M(\bar{e}), CS^R(\bar{e})\}$ if remedies are feasible and $CS^M(\bar{e})$ else. If the agency has the information that the proposed merger is of type \underline{e} , a situation which occurs with probability $q(1 - \beta)$, then in accordance with A6, the proposal is either denied or approved conditional on a remedy. The subsequent change in consumer surplus equals $\max\{0, CS^R(\underline{e})\}$ if remedies are feasible and zero else. In case the agency does not gather information, which happens with probability $1 - \beta$, then the agency implements a merger with remedies if these are feasible according to A7. Under regime NR , the agency implements $\max\{CS^M, 0\}$.

Next, we analyze the agency's equilibrium information acquisition at the third stage. 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

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

if remedies are feasible and to

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

if remedies are not feasible. To further characterize the equilibrium information level

¹⁸A fifth stage, at which firms can either accept the agency's decision or preserve their status quo, is superfluous here since each implementation decision by the agency (either with or without remedies) will be accepted by the proposing firms due to profitability assumption A2.

by the agency, we have to distinguish the following four specific cases concerning the optimality of remedies,

Case I: From a consumer perspective, the implementation of a merger with a remedy is always optimal for every merger type, $CS^M(\bar{e}) < CS^R(\bar{e})$ and $0 < CS^R(\underline{e})$,

Case II: From a consumer perspective, the implementation of a merger with a remedy is not optimal for both merger types, i.e. $CS^M(\bar{e}) > CS^R(\bar{e})$ and $0 > CS^R(\underline{e})$;

Case III: From a consumer perspective, the implementation of a merger with a remedy is only for the inefficient type optimal, i.e., $CS^M(\bar{e}) > CS^R(\bar{e})$ and $0 < CS^R(\underline{e})$;

Case IV: From a consumer perspective, the implementation of a merger with a remedy is only for the efficient type optimal, i.e., $CS^M(\bar{e}) < CS^R(\bar{e})$ and $0 > CS^R(\underline{e})$.

For each regime, the respective equilibrium information acquisition levels of the agency in the four cases are unique (for a proof, see Appendix A) and denoted $\beta_{r,i}^*$, where $r \in \{R, NR\}$ indicates the regime and $i \in \{I, II, III, IV\}$ denotes the respective case.

In the following, we restrict our analysis on cases *I* and *II*. 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 features of the probability distribution of efficiencies and the degree to which remedies are optimal in either scenario. Thus, these cases yield intermediate results concerning remedies' effects on the agency's 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. However, the entire analysis for all cases is provided in Appendix A.

As our main result, we derive Proposition I, which clearly indicates the trade-off between the introduction of intermediate options, i.e. remedial divestitures, and the enhancement of the agency's information-acquisition incentives. In case remedies are feasible, the agency tends to exert less effort since errors going along with the intermediate decision may be less severe than in case the agency has to opt for an "extreme" option, i.e., either denial or full approval.

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., $\beta = 0$.*

ii) In case II (remedies are not 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.

If the remedial option is optimal for each merger type, then information is not needed in order to implement the best decision from a consumer surplus point of view, since a merger with remedies is optimal in each case. Since information acquisition is superfluous, the legislator's and the agency's objectives are aligned, no information is acquired in equilibrium and a merger with remedies is always implemented. If remedies are removed from the agency's action space, then the optimal decision can never be implemented, so that consumer surplus is lowered. Thus, allowance for intermediate options is optimal in this case and the legislator will decide for regime R at the first stage. This finding reflects the general positive view on remedies as stated in the legislation and the economic literature.¹⁹

In the other cases, in which the implementation of a merger with a remedy is not optimal in every case, information is valuable. Thus, in order to maximize consumer surplus, the legislator would opt for the highest level of information acquisition, i.e., $\beta = 1$. This level, however, is never chosen by the agency due to its high 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

¹⁹A positive view on remedies is provided by see EU (2004; 2008) for example. Economic research stressing benefits from the introduction of remedies are for example Medvedev (2007) and Dertwinkel-Kalt and Wey (2012).

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 anyway since the potential error going along with this decision cannot be very high. However, in case remedies are not feasible, the potential error going along with any decision might be so high that exerting more effort, i.e., acquiring better information, is optimal for the agency in order to limit the high costs going along with a potentially false decision. But the removal of the remedy has also a downside. Even though a merger with a remedy is not optimal in either, it is a valuable option, nevertheless, since it 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 from a higher information level may over-compensate surplus-losses resulting from the removal of the remedial option, so that the legislator removes the remedy from the agency's action space. This preference of the legislator for extreme options mirrors the central finding of Szalay (2005).

The optimality of extreme options depends on the 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 will be 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. However, the removal of the remedial option tends to be optimal, whenever information costs are at an intermediate level. 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). If remedies are feasible and information costs are neither too low nor too high, then the agency may abstain from acquiring information as a straight use of the remedy option tends to limit the costs associated with a false decision. Under these circumstances, the removal of the remedial option is lucrative for the legislator, since the difference in information acquisition may be sufficiently high to dominate the detrimental effect of removing a valuable option.²⁰

5 Examples

In this section, we analyze specific merger scenarios involving structural or behavioral remedies.²¹ 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; 2007). Second, we analyze a vertical merger scenario in which a behavioral remedy can be applied to prevent foreclosure.²²

²⁰In our setting, we assume that less effort by the agency has no positive externalities on other sectors, which could positively impact consumer surplus. Thus, we disregard the possibility that a lack of exerted effort results in the processing of alternative, valuable tasks. In contrast, we assume that less effort increases the employee's well-being by providing him more free time or less working pressure.

²¹Motta et al. (2003) yield a precise distinction between structural and behavioral remedies via property rights: a structural remedy means a change in property rights of the divested business, whereas a behavioral remedy does not change any property rights.

²²See Motta et al. (2003) for a survey of behavioral remedies in vertical merger cases.

5.1 Horizontal Mergers

We consider two examples for case *II* in order to motivate our insights in the case of horizontal mergers. First, we compute an entire numerical example, and second, we reconsider the example given in Cosnita-Langlais and Tropeano (2012) and show its application to our theoretical setup.

5.1.1 Example I

First, we consider an example in which the introduction of remedies is detrimental for the agency's information acquisition incentives. Second, we provide instances in which this is even detrimental for consumer surplus.

We consider a setting of a horizontal merger in a Cournot oligopoly which is closely related to Dertwinkel-Kalt and Wey (2012). We are given a symmetric n -firm Cournot oligopoly with inverse demand $p = 1 - X$ and pre-merger cost function $C(x_i, K_i) = x_i^2/K_i$ with $K_i = 1$. Each firm comprises two equally sized production plants.²³ Through a merger with firm j , firm i realizes savings in costs, first due to the higher amount of available capital, and second due to the realization of a synergy, which is given by $e \in [0, 1]$. Accordingly, the post-merger cost function is assumed to be $C(x_i, K_i, e) = (1 - (1 - \Delta) \cdot e)x_i^2/(K_i + \Delta K_j)$, where Δ indicates the share of firm j which is divested during the merging process. In case a remedy is required by the agency, it is assumed to be sold to a firm entering the market without own capital. Furthermore, the divestiture mode is such that the merging firms can make take-it or leave-it orders to potential entrants, so that they can extract the full profit an entrant may earn with the sold assets.

Two types of mergers may occur, either a merger generating a high synergy, i.e.,

²³Vasconcelos (2010) makes the plausible assumption that only entire production plants or entire units of capital can be divested. According to this setting, a merger of two firms, which hold two production plants each, can either be approved, entirely forbidden or approved under the concession of a divestiture of one production plant. Thus, the remedy in our setting here is unique.

$e = 0.75$ (which occurs with probability q), or a low synergy, i.e., $e = 0.25$ (which occurs with probability $(1 - q)$). For the low-efficiency type, $0 > CS^R(\underline{e}) > CS^M(\underline{e})$ holds, whereas for the efficient type the opposite ordering, i.e., $0 < CS^R(\bar{e}) < CS^M(\bar{e})$ holds.

In order to precisely assess a remedy's impact on consumer surplus, we have to consider a concrete numerical example. We provide the detailed analysis in Appendix B and focus here only on the results. Let four firms be active in the market, i.e., $n = 4$, and let both merger types occur with the same probability, i.e., $q = 0.5$. Information costs are given by the aforementioned cost function $C(\beta) = k \ln(1/(1 - \beta))$ for parameter $k > 0$. To exclude corner solutions, according to which information is so expensive, that it will not be gathered at all under one regime, we consider the specification of $k < k^*$, where $k^* \approx 0029739$. If $k < 002258$, then information is so cheap that the detrimental effect of a removal of remedies is not equalized by the beneficial effect of a higher information level. However, if $k > 0.002258$, then consumer surplus is indeed lower if remedies are feasible according to Proposition *I*, since the higher level of information acquisition under regime *NR* overcompensates for the removal of remedies. For example, for $k = 0.0023$, equilibrium information acquisition level is given by $\beta_{NR,2}^* = 0.55143$ in case remedies are not feasible, but only $\beta_{R,2}^* = 0.2266$ otherwise. Thus, the equilibrium information acquisition differs significantly under the two scenarios. Thus, the legislator may restrict the agency's action space at the first stage in order to implement in expectation a better market structure from the consumer's point of view.

5.1.2 Example II

Finally, to verify the generality of our findings, we take the example from Cosnita-Langlais and Tropeano (2012) and show how our insights apply to that setting. Consider a three firm, symmetric Cournot market, in which each firm holds k assets for production and produces a homogeneous good at the constant marginal cost rate $c(k)$. Demand is linear and given by the inverse demand function $p = 1 - Q$, where Q describes the overall output

in the market. We assume that two horizontal merger types are possible, an efficient and an inefficient one, which occur with probabilities q and $1 - q$. Each merger affects the production costs twofold. 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. In this case, a remedy is a structural remedy, which consists of the divestiture of Δ assets to the remaining competitor.

We will exemplify under which circumstances our assumptions of case *II* hold. A pure merger is beneficial from a consumer surplus point of view in case $c^M(2k, e) < (5c(k) - a)/4$ 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 have to fulfill $c^M(2k - \Delta, e) + c(k + \Delta) < (9c(k) - a)/4$. Thus, our assumptions *A5* and *A6* 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 furthermore require that the sum of the two firms' production costs is lower under the pure merger than under the merger with remedies for the efficient type, 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.²⁴ In this setting, for the efficient type a merger approval represents the agency's optimal and a denial the agency's worst decision, while it is vice versa for the inefficient type. Thus, in each particular setting there exists a range of distributions for which the remedial option is on average optimal, such that *A7* is fulfilled. Now, this setting fits exactly case *II* of our analysis, such that information acquisition incentives are higher under regime *NR* than under regime *R*. In order to decide if the decision for regime *NR* is optimal, however, concrete numerical values are to be considered.

²⁴Profitability conditions can be assumed to hold in each case, either if marginal costs do not exceed a certain threshold, or due to reduced fixed costs or due to earnings from selling the divestiture.

5.2 Vertical Mergers

Especially for vertical mergers, behavioral remedies are increasingly applied (Motta et al., 2003). Mostly, the agency does not face the choice between a structural or a behavioral remedy, but decides to implement the second if structural remedies are not available (Heyer, 2012). This gives further support for our assumption, that the agency does not face a broad choice of feasible remedies, but has to focus on a certain available remedies. Foreclosure is a prevalent objection against vertical mergers (Heyer, 2012; Motta et al., 2003). To countervail this, merged parties may be obliged not to foreclose outsiders, for to continue to supply them. Usually, foreclosure is not optimal for consumers due to the high market power of the surviving firm in the market. However, in the following we provide an example in which foreclosure may indeed be optimal, due to the increased incentives to provide a public good if rivals are not active in the market and thus could not free-ride on this.

We base our example on a model by Telser (1960) dealing with the underprovision of services. The underlying idea is that the provision of services by retailers, for example informative advertising, is a public good and leads to free-riding problems among retailers. A vertical merger ensures incentives to provide the public good in case rivals in the downstream market are foreclosed. However, the behavioral remedy not to foreclose, may eliminate a vertical merger's positive effects on a public good's provision, so that foreclosure may be optimal in the case of efficient mergers, whereas inefficient mergers are to be banned from a consumer surplus point of view.

The associated model is as follows. One manufacturer U sells its brand to two downstream retailers 1 and 2 at a non-discriminatory wholesale price w and faces own marginal costs of c . Consumers' demand $D(p) = q = (v + e) - p$ is linear in the price p and in the public service e_i provided by retailer i , where $e := e_1 + e_2$. Products are perfect substitutes and retailers compete in prices, so that the retailer with the lower price gains the entire market share. If resale prices are equal, each retailer gains half of the entire

demand in the market. Retailer i 's costs are $C(q, e_i) = wq + \mu e_i^2/2$ with $\mu \in (0, 1)$, which comprise the linear input price w as well as fixed service costs; e.g., advertising costs. The manufacturer's profit is denoted π_U , retailer i 's profit π_i , overall firm profits PS and consumer surplus CS .

We consider three different market structures, *i*) separation (NM), *ii*) vertical integration without a remedy (M), and *iii*) vertical integration with a remedy (R), i.e., with integration with the obligation to supply at a cost-based level under allowance of a small profit margin ε .²⁵

The game we analyze is the following. At the first stage, manufacturer U sets the (non-discriminatory) wholesale price w . Second, the retailers set the prices p_i and effort levels e_i simultaneously.

We assume that each merger realizes a saving in fixed costs, which is the main driver for undertaking a merger. Besides that, two merger types may occur. The inefficient type realizes an increase in marginal costs. First, an extra cost of producing the brand occurs, so that marginal costs of producing the brand rise by $s > 0$ (with $\nu > c + s$), and second, the public good's production rises from μ to $\alpha\mu$ for a certain $\alpha > 1$. The efficient type ($s = 0$ and $\alpha = 1$) does not realize extra costs of vertical integration and thus operates with marginal costs of c for the brand and μe_i for the public good. The feasible remedy which might be required by the agency means the prohibition to foreclose, i.e., a provision of the brand by the integrated supplier at a cost-based level. The analysis for all three market structures can be found in Appendix B.

A comparison of outcomes shows that for the efficient merger type $CS_M > CS_R > CS_{NM}$ always holds. Even though this merger goes along with the foreclosure of the outsider, due to the higher equilibrium provision of the public good it is the preferable market structure from a consumer surplus point of view. For the inefficient type ($s > 0$

²⁵Similar cost-based approaches, which strictly limit a firm's ability to increase prices, was pioneered by Antitrust Authorities in the UK (Davies and Lyons, 2008).

and $\alpha > 1$), the opposite $CS_{NM} > CS_R > CS_M$ holds if inefficiencies are relatively large, i.e., if $s + \varepsilon > (v - c)/2$ and α sufficiently large. Thus, remedies are for both types neither best nor worst, but intermediate. Depending on the distribution of efficiency types, remedies may, however, represent the agency's optimal choice in the absence of information. Profitability for all merger types with and without remedies is ensured by a sufficiently large saving in fixed costs.

Finally, we provide a concrete numerical example for this setting. For the parameters $\nu - c = 1$, $\mu = 1$, $s = 1/2$, $\varepsilon = 1/10$ and $\alpha = 2$ we obtain

$$CS_{ineff}^M > CS_{ineff}^R > CS_{ineff}^{NM} \text{ and } CS_{eff}^M > CS_{eff}^R > CS_{eff}^{NM},$$

where index *ineff* indicates the inefficient merger and *eff* the efficient merger.

In this example, a highly efficient merger is not be approved without a remedial obligation due to the subsequent provision of the public good. For an inefficient merger, even a remedy could not sufficiently fix the efficiency problem's negative impact on consumer surplus, so that an entire denial is the preferable option. 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, this may frustrate the agency's information acquisition incentives even in a consumer surplus-lowering way.

6 Extensions

6.1 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. We maintain

our previous assumptions A1-A7, where $CS^X = \int_{\underline{e}}^{\bar{e}} CS^X(e)f(e)de$ denotes the expected change in consumer surplus depending on 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, we assume that there are unique threshold values $\underline{e} \leq e_1 \leq e_2 \leq \bar{e}$, so that from a consumer perspective for all efficiency types $\underline{e} \leq e < e_1$ a denial of the merger is optimal, for $e_1 \leq e < e_2$ remedies are optimal and for $e_2 \leq e \leq \bar{e}$ a pure merger is optimal. Third, we assume there is a threshold $e_1 < \hat{e} < e_2$, so that for $e < \hat{e}$ no merger is better than a pure merger and for $e > \hat{e}$ a pure merger is better than no merger from a consumer perspective. This threshold is decisive under regime NR . These assumption mirror the following intuition. For all inefficient mergers, denial is the optimal decision, whereas for all relatively efficient merger, an approval of the full merger is optimal. For types of an intermediate efficiency, i.e., $e_1 < \hat{e} < e_2$, the remedial option is best. This setting is illustrated in Figure 1. Furthermore, we assume for notational convenience that $0 > CS^M$. This, however, does not influence our results qualitatively.

Proposition 2. *The results from the binary efficiency setup carry over to the continuous setup. 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 in case the remedial option is removed from the agency's action space.

The second integral 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 $[e, e_1]$ 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 . If this plus in 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, the insights from our basic model generalize to the continuous case and remedies may in fact have detrimental effects on information acquisition.

6.2 Welfare Standard and Comparison of Institutional Environments

Assuming a social welfare standard allows us to contrast the inquisitorial enforcement system we have analyzed so far with a system of advocates (see Dewatripont and Tirole, 1999). There is a dichotomy between the inquisitorial legal system and the adversarial legal system. In the former one, one institution gathers both evidence and counterevidence for a legal case. The inquisitorial system corresponds to the role of the antitrust agency in Continental Europe and Japan (Neven, 2006; Posner, 1999). Christiansen (2006) also argues that the European merger control corresponds to an inquisitorial regime due to the concentration of various functions within the same institution, i.e., the European Commission. In our basic setup, we impose this inquisitorial system in which all information gathering is bundled at the agency. In the latter one, there is a plaintiff and a defendant, i.e., an advocate for both sides, in front of a neutral and passive judge. This system is adopted by the US, where the agency or the Department of Justice acts as a plaintiff in front of a federal law (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 4, in which only the agency was responsible of gathering information. However, our results change entirely.

Our setup in this section is as follows. We suppose that the legislator's objective is to maximize social welfare instead of consumer surplus.²⁶ We modify the assumptions $A3$ - $A7$ into $A3'$ - $A7'$ by substituting consumer surplus (CS) by social welfare (W) in each case. We will 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, 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 adversarial 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.

²⁶It 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.

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 adversarial 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 latter the firms' advocate (AF).²⁷

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 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 function²⁸, however, information

²⁷We can assume that the antitrust agency represents the advocate of the consumers (Whinston, 2007).

²⁸This assumption may be weakened, then, however, results depend on the relative costs of information

is concealable, but not forgeable, i.e., advocates could hide, but not forge information. Notice that information that the advocates may have cannot contradict each other. 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, else it has priors $\beta_{\Pi} = \beta_{CS} = 0$ and decides for what is best on average.²⁹ 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} and 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 has priors and implements decision X for which the average effect on welfare, i.e., W^X , is largest.

For this game, we compare the levels of information the court receives at the last stage under the two regimes. We will 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 piece of information, which could for the legislator either be in favor of NM or of M , to the court. 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.³⁰ We denote $\hat{X} = R$

acquisition of the advocates.

²⁹Usually in adversarial systems, the court represents a neutral instance without expertise concerning the litigation, which decides according to a simple decision rule (Froeb and Kobayashi, 2001; Dewatripont and Tirole, 1999).

³⁰If AF holds \underline{e} , it might pass this piece of information only to the government in case this would decide against the merger anyway. If AC holds \bar{e} , it might pass this information only to the government in case

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

$$E \left(1_{\{e=\bar{e}\}}(e)(\beta_{\Pi}\Pi^M(\bar{e}) + (1 - \beta_{\Pi})\Pi^{\hat{X}}(\bar{e})) + 1_{\{e=\underline{e}\}}(e)(1 - \beta_{CS})\Pi^{\hat{X}}(\underline{e}) | \beta \right) - C(\beta_{\Pi})^{31}$$

and the agency chooses β_{CS} to maximize

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

Under R , this yields the first order conditions

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

and under NR it yields

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

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 info acquisition is higher under NR iff $q(\beta_{\Pi}^{NR} - \beta_{\Pi}^R) > (1 - q)\beta_{CS}^R$.³²

this would decide for the merger anyway. Thus, without loss of generality, we may assume that AF passes information if and only if it is \bar{e} , and AC passes information if and only if it is \underline{e} .

³¹Here, $1_{\{e=\bar{e}\}}(e)$ 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 a merger will be implemented equals β_{Π} , since she will report zu the court the information she has and the court will implement the merger. In case the advocate AF faces the low type, she will never report zu the court and the probability for a denial of the merger depends only on the choice of information by the AC, i.e., β_{CS} .

³²Furthermore, 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, since given the court has rational beliefs concerning the biasedness of information it gathers and given it wants to maximize welfare, a Nash equilibrium of the advocates and the court in pure strategies does not exist.

If $W^M > 0$, then info acquisition is higher under NR iff $(1 - q)(\beta_{CS}^{NR} - \beta_{CS}^R) > q\beta_{\Pi}^R$. 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, holds not anymore if we alter the institutional environment.

Proposition 3: If the legislator adopts a welfare standard and the remedial option is never optimal, but in each case the intermediate option, 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 $q(\beta_{\Pi}^{NR} - \beta_{\Pi}^R) > (1 - q)\beta_{CS}^R$, provided $0 > W^M$, and $(1 - q)(\beta_{CS}^{NR} - \beta_{CS}^R) > q\beta_{\Pi}^R$, 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 several agents with countervailing interests, each of whom represents other aspects 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, results are driven by the fact that whereas the inquisitorial regime considers the remedial option as the ex ante optimal decision, this is not the case for both agents 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 4 production plants, where synergies 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 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 bears high synergies 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).

	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 $[\Pi]$ 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.*

7 Conclusion

In practice, the general view towards remedies is a positive one. The European legislation, for instance, describes remedies as a an effective way to restore competition (EU, 2008, Article 22). Davies and Lyons (2008) argue in their conclusion of chapter 7, that more such Phase II investigations are needed. Whereas in practice on average most mergers are cleared without a remedial obligation, we could apply our insights to the important merger cases involving large market shares, which often proceed to Phase II. Since about 50% of Phase II merger decisions are cleared under a remedial obligation (Davies and Lyons, 2008), we might 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 on average, even in these instances 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 holds only under an inquisitorial regime which we typically find in the EU, whereas it does not hold under an adversarial regime like in the US.

Appendix

Appendix A: Proofs

Proof (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, and strictly monotonic increasing in β on the right hand side. Thus,

either an interior solution exists or the unique corner solution is $\beta = 0$.

Proposition I (extended version): 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., $(\beta_{NR,2}^* - \beta_{R,2}^*)(qCS^M(\bar{e})) > (1 - \beta_{R,2}^*)CS^R - (1 - \beta_{NR,2}^*)\max\{CS^M, 0\}$. 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., $(\beta_{3,NR}^* - \beta_{3,R}^*)(qCS(\bar{e})) > CS^R - \max\{CS^M, 0\} + \beta_{3,NR}^*\max\{CS^M, 0\} - \beta_{3,R}^*qCS^R(\bar{e})$ in case *III* and $\beta_{NR,4}^*qCS(\bar{e}) - \beta_{R,4}^*(qCS^R(\bar{e})) > CS^R - \max\{CS^M, 0\} + \beta_{NR,4}^*\max\{CS^M, 0\} - \beta_{R,4}^*CS^R$ in case *IV*.

Proof of Proposition I:

In case *I*, the left hand side of (1) reduces to $qCS^R(\bar{e}) + (1-q)CS^R(\underline{e}) - (qCS^R(\bar{e}) + (1-q)CS^R(\underline{e})) = 0$, 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 $E(CS|\beta)$ is increasing in β . In the third and the fourth case, the optimality of the regime depends on the interplay of efficiencies 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

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

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 the third case, 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.,

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

In the fourth case, 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 higher degree of information acquisition at least equalizes surplus losses due to removal of the remedial option, i.e.

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

Proof of Proposition II.

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

$$\beta(\int_{\underline{e}}^{\hat{e}} f(e)CS^{NM}(e)de + \int_{\hat{e}}^{\bar{e}} f(e)CS^M(e)de) + (1 - \beta) \max\{0, CS^M\} - C(\beta). \text{ Thus, } \beta_{NR}$$

and β_R are given by the following first order conditions,

$$\begin{aligned} \int_{e_1}^{e_2} f(e)CS^R(e)de + \int_{e_2}^{\bar{e}} f(e)CS^M(e)de - CS^R &= - \int_{\underline{e}}^{e_1} f(e)CS^R(e)de + \int_{e_2}^{\bar{e}} f(e)[CS^M(e) - \\ CS^R]de &= C'(\beta_R) \text{ and by} \\ - \int_{\underline{e}}^{\hat{e}} f(e) \max\{0, CS^M(e)\}de + \int_{\hat{e}}^{\bar{e}} f(e)[CS^M(e) - \max\{0, CS^M(e)\}]de &= C'(\beta_{NR}). \end{aligned}$$

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

Horizontal Mergers: Example I. At this place we add the information which we omitted in the main text. We continue with the numerical analysis of the given example for case II and investigate under which circumstances the lower information acquisition level leads to a lower consumer surplus. We have a four firm Cournot market, where the post-merger cost function equals $C(x_i, K_i, e) = (1 - (1 - \Delta) \cdot e)x_i^2 / (1 + \Delta)$. Furthermore, we consider the parameters $\underline{e} = 0.25$ and $\bar{e} = 0.75$, where both types occur with probability $q = 1 - q = 1/2$.

The information cost function's derivative is given by $C'(\beta) = k/(1 - \beta)$. 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 $\beta_{R,2}^* = (F^R - k)/F^R$ and according to Proposition I, case II, consumer surplus is higher under regime NR if

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

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

Here, we have $CS^M(\bar{e}) = \frac{906}{67081}$, $CS^M(\underline{e}) = -\frac{1110}{108241}$ and thus $CS^M \approx 0.0016256$. Furthermore, $CS^R(\bar{e}) = \frac{125697}{15523592}$, $CS^R(\underline{e}) = -\frac{10887}{20199368}$ and thus $CS^R \approx 0.0037791$. Therefore, $F^R \approx 0.0029739$ and $F^{NR} \approx 0.0051274$. We restrict $k < 0.0029739$ in order to exclude. Now, we solve the preceding condition for k and find that regime NR is preferable if $k > 0.002258$. For $k = 0.0025$ for example we obtain the equilibrium values $\beta_{NR,2}^* = (0.0051274 - 0.0025)/0.0051274 = 0.55143$ and $\beta_{R,2}^* = (0.0029739 - 0.0025)/0.0029739 = 0.2266$. Thus, the equilibrium information acquisition differs significantly under the two regimes, so that consumer surplus is higher if the legislator restricts the agency's action space at the first stage.

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

$$w_{NM} = \frac{v+c}{2},$$

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

ii) Next, we consider the equilibrium outcome under vertical integration of the manufacturer and retailer 1.

In case 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

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

Thus, in equilibrium we obtain

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

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. and 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. In case of a remedy, we assume 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 steals all the public good provider’s market share. Even though this remedy is quite strict since it restricts the integrated firms’ profits strictly, we show that according to Proposition 1, a removal of the remedial option may be optimal for consumers. 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 $CS^{NM} = 0.125$, $CS_{ineff}^M = 1/18 \approx 0.056$, $CS_{eff}^M = 0.5$, $CS_{ineff}^R = 0.08$, and $CS_{eff}^R = 0.405$.

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