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Sequential decision making in merger control

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Abstract

We model merger control procedures as a process of sequential acquisition of information and compare US and EU procedures. In the US, the authorities do not have to justify their decision to require further information (issue a second request), whereas in the EU, the authorities face a different (enforceable) standard of proof in phase I relative to phase II. We find that in the absence of remedies, the US procedure is always superior in terms of expected consumer welfare. When we allow for remedies, we find that, compared to the US, merging parties in the EU have more scope to propose remedies in phase I that will preempt the authorities from uncovering unfavorable information in phase II, and this might reduce expected consumer welfare. However, the higher standard of proof in phase I can also in some circumstances act as a commitment not to accept remedies below some threshold and yield a higher expected consumer welfare in the EU. Our model also shows that for global mergers that have the same effect in the two jurisdictions, a decision to trigger a Phase II in the EU yields the same expected consumer welfare as a clearance in Phase I with remedies in the US. However, the converse is not true.

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Sequential decision making in merger control*

PRELIMINARY VERSION

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October 2014

Abstract

We model merger control procedures as a process of sequential acquisition of information and compare US and EU procedures. In the US, the authorities do not have to justify their decision to require further information (issue a second request), whereas in the EU, the authorities face a different (enforceable) standard of proof in phase I relative to phase II. We find that in the absence of remedies, the US procedure is always superior in terms of expected consumer welfare. When we allow for remedies, we find that, compared to the US, merging parties in the EU have more scope to propose remedies in phase I that will preempt the authorities from uncovering unfavorable information in phase II, and this might reduce expected consumer welfare. However, the higher standard of proof in phase I can also in some circumstances act as a commitment not to accept remedies below some threshold and yield a higher expected consumer welfare in the EU. Our model also shows that for global mergers that have the same effect in the two jurisdictions, a decision to trigger a Phase II in the EU yields the same expected consumer welfare as a clearance in Phase I with remedies in the US. However, the converse is not true.

JEL classification: K21, K40, L40

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1 Introduction

Merger control in most important jurisdictions proceeds in several stages. The authority initially acquires information and decides to either clear the notified merger on the basis of the information that it has gathered in a relatively short period of time or to delay the decision while additional information is acquired.

Such sequential process of information gathering is common to the US (where the decision to acquire additional information is known as a second request) and the EU procedure (where the procedure is organised in two phases, commonly referred to as phase I and phase II)¹. There are, however, important differences between the jurisdictions in the implementation of a sequential process of information gathering that have some interesting consequences in terms of strategic interaction between the merging firms and the authority and, as a result, in terms of welfare.

The EU procedure has a specific standard of proof for a decision in Phase I, which is formulated in terms of “serious doubts”. Art 6 of the merger regulation enjoins the Commission to decide (after 25 working days) (i) that the proposed concentration does not raise doubts regarding its compatibility with EU law (Art 6.1(b)) or (ii) that the concentration raises serious doubts regarding its compatibility and, to this effect, initiate proceedings, which means to open a phase II investigation (Art 6.1(c)). The standard of proof for taking a decision in phase II is however different². In phase II, the Commission is supposed to clear the merger if it is more likely than not that the merger is compatible with the Common market. In other words, the

¹We jointly refer to both phase II investigation in the EU and a second request in the US as “second stage”

²In the recent appeal to the clearance of the Microsoft/Skype merger, the General Court (case T-79/12) adopted language suggesting that the standards of proof in phase I and phase II were identical. This statement is surprising as it does not give effect to the very formulation of Article 6 of the merger regulation. It is not entirely clear what the Court meant to say however. At paragraph 46, the Court acknowledges that the merger regulation has a specific standard of proof for phase I decision. The Court then notes that the substantive criteria (significant impediment to effective competition) is the same in phase I and phase II. The Court then continues by merely stating that the standards of proof are the same. Hence, it might very well be that the Court merely meant to say that the standard for clearance is the same in the two phases. In any event, some of our results (in particular the results of section 3), would go through even if the standard of proof was identical in phase I and phase II.

standard of proof is formulated in terms of the balance of probabilities. This standard is not articulated as such in the merger regulation but it has been clarified by the General Court and the Court of Justice³. Hence, the decisions in the two phases are taken on the basis of different standards of proof (balance of probabilities versus serious doubts), with respect to the same substantive criteria (namely the compatibility with the common market⁴). The standard of proof in phase I is thus higher. In addition, these different standards are enforceable, to the extent that both types of decisions (and in particular the decision by the Commission in phase I) can be appealed in Court. This means the Commission needs to be able to substantiate the absence (or presence) of serious doubts on the basis of the information that is available in phase I. This also implies that the Commission cannot use its beliefs about the information that would be uncovered in phase II if it was triggered, in taking a decision in phase I.

The situation in the US is different⁵. The FTC and Department of Justice only have constraints in terms of timing; the authorities have 30 days to decide whether to issue a second request or to allow the transaction to proceed without challenge⁶. Decisions in the second stage are taken according to the balance of probabilities. In addition, unlike what happens in the EU, the US authorities do not have to justify in a written decision (that can be appealed) on what basis they decided to issue a second request. We will assume that the authorities decide whether to issue a second request by considering the benefit of acquiring more information in terms of expected consumer welfare.

Regarding remedies, both authorities can accept remedies proposed by the merging parties at any time in the procedure (either before or after the second stage has been entered into). In the first phase, the remedies are evaluated in the EU against the serious doubt standard. In the US, the decision on whether to accept the remedies or issue a second request is taken by considering the benefit of acquiring more information relative to a

³See for instance, the GC (T5/02) and ECJ (C-12/03) judgments in *Tetra Laval/Sidel* and the ECJ (C-413/06) judgment in *Impala/ Sony/BMG*

⁴The compatibility with the Common market is itself defined by the (2004) revision of the merger regulation in terms of whether the merger leads to "a significant impediment to effective competition, and in particular leads to the creation or strengthening of a dominant position" (Art 2 of the merger regulation, Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings.

⁵For a discussion, see B. Kovacic, P. Mavroidis, D. Neven, (2014)

⁶For a discussion of the factors that lead to a second request, see D. Tucker, (2013).

clearance with the proposed remedies, in terms of expected welfare⁷.

We analyse the alternative procedures in a model with the following features: there is a finite support of possible realisations for a merger in terms of the objective function of the authority (consumer surplus, for instance). This support includes a negative segment which corresponds to anti-competitive mergers and a positive segment which represents pro-competitive transactions. The authorities learn about the characteristics of the merger in the first stage of the investigation and develop a prior about its effect.

For the EU procedure, we represent the standard of proof in terms of serious doubts as an upper bound on the cumulative density over the negative segment. There is thus a serious doubt if the probability that a negative realisation occurs exceeds some threshold⁸.

A standard of proof formulated in terms of balance of probabilities (“more likely than not”) corresponds to a threshold of $1/2$ for the cumulative density over the negative realisations. In the second stage, a merger is then cleared if the probability that it will be anti-competitive is less than $1/2$ ⁹. We thus model the decisions of the authorities in terms of the probability that the merger will be harmful and not in terms of the merger’s expected value, in line with the literature and consistently with the formulation of these standards. However, as discussed below, when a decision to issue a second request is not subject to particular threshold in terms of probability and cannot be challenged (as in the US), this decision will optimally be taken considering expected values. This implies that in the US both the probability that a merger will be anti-competitive and its expected value will play a role.

We model the acquisition of information in the second stage as a process in which the authority acquires a signal. The signal truncates the support

⁷There is another important difference between the US and EU procedures; whereas the Commission can both allow and prohibit a merger, the US agencies can only allow them to proceed. They need to challenge mergers in Court if they wish to prohibit them. This asymmetry will naturally trigger some strategic interactions between the agencies and the merging parties (such that the agencies can be expected to be biased towards clearance). In what follows, we abstract from these strategic interactions and focus on the analysis of the effect of having different enforceable standards in different stages of the investigation.

⁸The exact value of this threshold is irrelevant to our results, but to fix ideas, one could imagine that it could be 10% or 20%.

⁹The balance of probability is the only standard of proof which is consistent with symmetry - so that it applies both to prohibitions and clearance. For a discussion, see B. Versterdof, (2005).

of the prior distribution of the quality of the merger from above (in a case of a negative signal) or from below (in case of a positive signal). As we explain in more detail later, the extent to which the support is truncated represents the precision of the market investigation in the second phase. To simplify our analysis, the parameter that captures this precision is considered as exogenous to our model.

We further assume that the authority will have beliefs with respect to the signals that it will obtain in the second stage (in particular with respect to whether the support will be truncated from above or from below). These beliefs are associated with information for which the authority cannot provide firm evidence without further investigation.

Our main results are as follows. Intuitively, it might appear that having a higher standard of proof in phase I is attractive. Arguably, this allows the Commission to weed out the mergers that are clearly not problematic and focus attention on those that may raise concerns. This intuition is however deceptive. The higher standard of proof in phase I will lead to inconsistencies between the decisions that are taken in this phase and in phase II. We show that for any given merger there is a single threshold for serious doubt in phase I which is consistent with the beliefs of the Commission about the outcome of further investigation. This arises because the enforceability of phase I decisions compels the Commission to ignore the signals that they have received in phase I investigation insofar as these do not constitute firm evidence. Furthermore, we show that such a procedure involves a loss of expected welfare compared to the US where the decision to proceed to the second stage is made on the basis of the expected benefit from acquiring more information.

The matter is however different when remedies are taken into account. In the EU, the parties will either propose remedies in phase I that remove serious doubts or allow the investigation to proceed into phase II. They decide on the remedies anticipating what the Commission is likely to find (but would not be able to use to support its phase I decisions). We can then show that remedies will sometimes be proposed which exceed those that would be expected to satisfy the Commission in phase II. This is the case even for mergers for which a good signal is expected, if the merger parties are sufficiently impatient. We also find that when the merger parties expect a bad signal, they may propose remedies in phase I that induce the clearance and prevent the Commission from finding out more precise evidence (that the merger is harmful). In those circumstances, the EU procedure will tend to be dominated by the US

procedure. However, we also find that the imposition of a different standard in phase I will also sometimes fare better. This arises because in a US style procedure, the merging parties will propose remedies that will make the agency indifferent between accepting these and proceeding with the second request. By contrast, by imposing a higher enforceable standard in phase I the Commission may obtain better remedies, in particular when it is expected that favorable information would be forthcoming in the second stage.

The paper is structured as follows. The model is presented in section 2. Section 3 characterises the US and EU procedures in the context of the model and discusses some of their properties in the absence of remedies. Section 4 introduces remedies and allows for strategic interactions between the authorities and the merging parties. Section 5 discusses possible extensions and concludes.

2 A model of sequential merger control

The timing of the game is presented in Figure 1. After the merger notification, the first stage of the investigation starts. Over the course of the first stage, the authority develops a prior distribution F over the possible outcomes of the merger in terms of its quality $[-1, 1]$ ¹⁰. This prior reflects verifiable evidence collected in the first stage. As such, it does not include any belief of the authorities about the evidence it might collect if the investigation proceeds into the second stage. The authority may either have to follow a pre-defined procedure (as in the EU) or has a level of discretion (as in the US) over the decision on whether to proceed to the second stage. In both cases (see figure 1), we allow the firms to propose remedies, as a take it or leave it offer, before the authority makes its decision to move into the second stage. If the remedies are accepted, the game ends and the merger is implemented.

If the merger is not cleared in the first stage, the investigation proceeds into the second stage (phase II or second request). In this stage, additional evidence is acquired. The merging parties are allowed to propose remedies after the authorities have concluded their investigation. The final decision is then made.

We model the acquisition of information in phase II by assuming that the authority acquires a pair of signals: $l \in \{-1, 1\}$ and $s \in [0, 1)$, whereby l

¹⁰With some mean m and variance σ^2

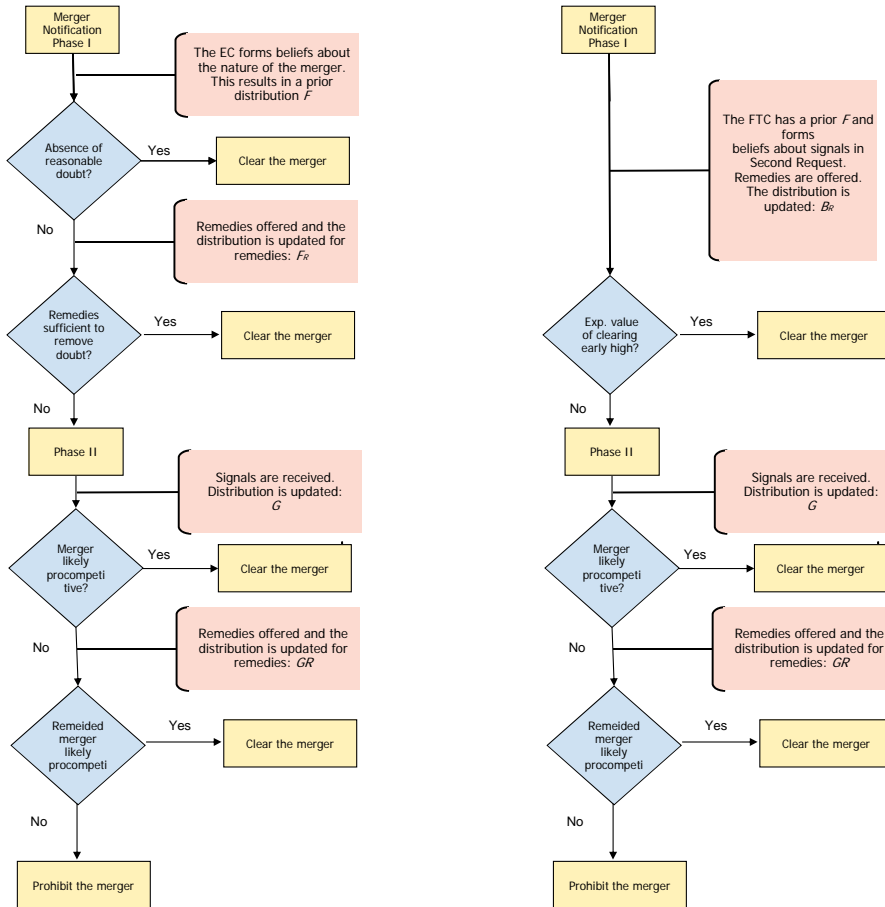


Figure 1: Timing

indicates the signal direction (that is, whether additional evidence indicates worse or better merger quality relative to the authority's prior) and s indicates how revealing the evidence is in terms of the precision with which the authority can establish the quality of the merger. In particular, receiving the signal s means that all outcomes above s (for $l = -1$) or below $-s$ (for $l = 1$) are impossible. Notice that the more precise the signal, the smaller is s . For $s = 0$, the authority knows with certainty that the merger is always detrimental ($l = -1$) or beneficial ($l = 1$) in terms of consumer welfare. The cost of the signal is a decreasing and convex function of its precision $k : [0, 1) \rightarrow (0, +\infty)$ with $k'(s) < 0$ and $k''(s) < 0$ reflecting the time and effort that the authority needs to invest in the investigation.

To assess the merger in the second stage, the authorities will update the prior distribution of the possible outcomes using the signal that they have received. We assume that this takes the form of a simple Bayesian updating procedure. That is, given the pair $\{l, s\}$, the posterior distribution G has its support $[\min\{l, -s\}, \max\{l, s\}]$ and is computed as

$$G(x) = \begin{cases} \frac{F(x)-F(-s)}{1-F(-s)}, & l = 1; \\ \frac{F(x)}{F(s)}, & l = -1. \end{cases}$$

Clearly, one feature of the posterior distribution is its lower variance relative to the prior distribution, $\sigma_G^2 < \sigma^2$. Another feature is that the expected value is shifted in the direction indicated by the signal l : for $l = -1$, $m_G < m$; for $l = 1$, $m_G > m$. The merger is cleared (without remedies) in the second stage if $G(x) < 1/2$.

The signal described above constitutes evidence about the quality of the merger that the authority uncovers in the second stage. The authority will, however, at the end of the first stage, also have formed beliefs about what direction this evidence is likely to take. These are the prior beliefs (at the end of the first stage) about the direction of the signal and we specify them by a binary distribution that puts probability b on realization $l = 1$ and, correspondingly, probability $1 - b$ on the realization $l = -1$. We can then write the prior distribution of the merger quality that incorporates the beliefs of the authority by combining them with existing evidence summarized in F :

$$B(x) = \begin{cases} (1 - b) \frac{F(x)}{F(s)}, & x \in [-1, -s); \\ (1 - b) \frac{F(x)}{F(s)} + b \frac{F(x)-F(-s)}{1-F(-s)}, & x \in [-s, s); \\ 1 - b + b \frac{F(x)-F(-s)}{1-F(-s)}, & x \in [s, 1]. \end{cases}$$

The EU procedure is characterized by an exogenously determined threshold value α such that for $F(0) < \alpha$ the merger is cleared in phase I. In terms of the model, α is a threshold probability that the merger ends up harming consumers¹¹.

We capture the higher level of discretion of the US authority with regards to the decision in the first stage of an investigation by assuming that the authorities decide whether to issue a second request simply by assessing the marginal benefit of acquiring more information. They compare the expected welfare from a clearance in the first stage with the expected welfare of a decision following a second request (using the balance of probability as a decision rule). With respect to the expected outcomes of a decision in the first stage, the US authorities do not use F as the relevant distribution but rather the prior B which takes into account the information that they expect to find after a second request.

With respect to remedies, we assume that a remedy is costly for the merging parties and improves the outcome of the merger. We represent a remedy as a function which shifts the relevant distribution of outcomes to the right, across the whole support. Accordingly, for any outcome in the support, the probability that the merger is better than that outcome is larger with the remedies than without. Formally, remedies are thus represented as a strictly increasing function $R : [-1, 1] \rightarrow [-1, 1]$ which will shift any distribution and results in another distribution which first-order stochastically dominates the first one.

Remedies can be implemented with respect to decisions in different stages and will thus be applied to different distributions. For a decision in phase I in the EU, F is the relevant distribution and the application of remedies will yield another distribution F_R which first-order stochastically dominates F . Of course, the decision rule of the authority is not affected by the remedy so that for instance in phase I, the EU would only clear a merger if $F_R(0) < \alpha$ ¹². With respect to decisions by the US authorities in the first stage, the relevant distribution is B and the application of remedies will yield B_R . For decision in the second stage (by either EU or US authority), the relevant distribution

¹¹As mentioned above, we abstract from the question of the extent to which it harms them.

¹²Accordingly firms will, to the extent possible, choose a remedy function that shifts density from the negative to the positive segment (they will not be interested in shifting the density to the right among positive values in the support, as it will not affect the decision in the authority).

is G and the the application of remedies will yield G_R .

The costs of remedy to the merger parties is a strictly increasing function of the improvement in the outcome that the remedy brings (the improvement is the difference between the quality of the remedied merger and the merger without the remedy) $c : [0, 2] \rightarrow [0, +\infty)$ with $c(0) = 0$. Correspondingly, for any distribution $L \in \{F, B, G\}$ the expected (and actual) cost of remedy is $\mathbb{E}c(R) = \int_{-1}^1 c(R(x) - x) dL(x)$.

We develop the analysis in two stages. We first compare the US and EU procedures in the absence of remedies (section 3) and subsequently allow for remedies (section 4)

3 Decision without remedies

In this section, we first characterize the decision taken in the EU-style as well as the US-style procedure and then show that the US decisions are always better when no remedies are allowed.

Consider the decisions in the EU. As mentioned above, given that EU decisions in phase I are taken only on the basis of verifiable information, beliefs about the outcome of further investigation in phase II have to be discarded. We show that, as a consequence, for any given merger there is a single decision *rule* in phase I (a unique value of α) consistent with prior beliefs of the EU authority. Any other value would result in situations in which the authority has to allow or prohibit the merger in the first stage even if it believes it is most likely to do otherwise in the second stage.

Lemma 1 *For any given $F(\cdot), b, s$, there is a unique value of the threshold probability α that a merger harms consumers that is consistent with the beliefs of the authority about the outcome of additional (second stage) investigation. In particular,*

$$\alpha = \frac{F(s)(1 - F(-s)(1 - 2b))}{2((1 - b)(1 - F(-s)) + bF(s))}.$$

Proof. *For consistency, we need the following condition:*

$$F(0) = \alpha \Leftrightarrow B(0) = \frac{1}{2}.$$

The condition above states that when the merger is (not) cleared at the end of the first stage (phase I), the authority must also believe it would have (not) cleared it at the end of the second stage (phase II), or vice versa.

Looking at the expressions for the updated prior $B(x)$, we get

$$(1 - b) \frac{F(0)}{F(s)} + b \frac{F(0) - F(-s)}{1 - F(-s)} = \frac{1}{2},$$

which using $F(0) = \alpha$ after a rearrangement gives the statement of the proposition. ■

Of course, this lemma does not imply that decisions in phase I are always at odds with those that would be expected in phase II. For instance consider a merger characterized by a given prior F and belief about the information that will be uncovered in phase II. Assume that a value of α' would ensure that the decision in phase I is consistent with the decision that would be taken in phase II given the beliefs about the information about the quality of the merger that would be uncovered in phase II. Assume further that the serious doubt threshold $\alpha < \alpha'$. If $F(0) < \alpha$, the merger is cleared under both decisions rules (the serious doubt standard and the rule that ensures consistency). Similarly, for $F(0) > \alpha'$, a phase II is opened under both decision rule. However if $\alpha < F(0) < \alpha'$, a phase II is opened with the serious doubt standard even though it is expected that it will be cleared in phase II.

The Lemma implies that if a single threshold α is applied uniformly for all merger cases, one can expect that it will systemically diverge from the threshold that would ensure a consistent application of the authority's beliefs about the evidence that an additional investigation is likely to uncover. That happens because both the beliefs as well as the prior distribution F vary from case to case and would thus required a different threshold value to ensure consistency.

The inconsistency induced by the different standards leads to a loss of consumer welfare. We now show that an alternative procedure akin to that in the US is superior.

Consider a US style procedure in which the authority is free to incorporate its beliefs about the signal when deciding whether to issue a second request and decides whether the issue of a second phase on the basis of the expected benefit of acquiring more information. The expected value (updated by the beliefs on the direction of the signal) of clearing the merger in the first stage is:

$$V_I = \int_{-1}^1 x dB(x).$$

The expected value of the merger review in the second stage is determined according to the following expression:

$$\begin{aligned}
V_{II} = & b\mathbb{I}\left(\frac{F(0) - F(-s)}{1 - F(-s)} < \frac{1}{2}\right) \int_{-s}^1 \frac{xdF(x)}{1 - F(-s)} \\
& + (1 - b)\mathbb{I}\left(\frac{F(0)}{F(s)} < \frac{1}{2}\right) \int_{-1}^s \frac{xdF(x)}{F(s)} - k(s), \tag{1}
\end{aligned}$$

where the first term is the expected value in case the merger is cleared in the second stage after the good signal and the second term is the expected value if the merger is allowed after the bad signal. \mathbb{I} is an indicator function that takes the value of 1 if the condition in the brackets is satisfied, and 0 otherwise. The authority will decide whether to issue a second request by comparing V_I with V_{II} .

It is useful to further characterize the decision of the US authorities in the first stage as a function of what is anticipated to happen after a second request. Depending on the parameter values (in particular $F(-s)$, $F(0)$, $F(s)$), we have one of the three possible situations after the second request. For each of these situations, we derive the condition such that the merger is cleared in the first stage:

- In the second stage investigation the merger is prohibited regardless of the signal. This will happen when $\frac{F(0) - F(-s)}{1 - F(-s)} > \frac{1}{2}$.

The corresponding condition for clearance in the first stage is:

$$k(s) > - \int_{-1}^1 xdB(x).$$

This is a situation in which the the merger is cleared in phase I despite the fact that it is anticipated that it would always be prohibited in phase II. This arises naturally when the cost of gathering information exceeds the expected harm from the merger given the information that is available in phase I and given the expectation that the agency has about the evidence it would collect in phase II.

This outcome illustrates an important feature of the US procedure: The agency can clear a merger on the basis of its expected value (in the first stage) rather than on the basis of the probability that it will be harmful. Indeed, in the first stage, the authority anticipates the

outcome of its decision in the second stage (that will be based on the probability that the merger will be deemed harmful) but compares the expected welfare from this decision with the welfare that would accrue from immediate clearance (and choose the later if it is higher). Hence, the US merger control procedure cannot be characterized as one in which decisions are taken solely in terms of the probability that the merger is harmful to consumer welfare; it also allows the authority to consider the expected welfare that the merger would yield¹³.

- In the second stage, the merger is allowed regardless of the signal. This will happen when $\frac{F(0)}{F(s)} < \frac{1}{2}$.

The corresponding condition for clearance in the first stage is then:

$$k(s) > 0.$$

This is a trivial case. When the US agency expects that it will clear the merger in the second stage whatever the outcome of the investigation, it will always clear in the first stage. There is no point in incurring the cost of the investigation.

- The merger is allowed if the signal is good, but prohibited, if it is bad. This will happen if the following two conditions are satisfied: $\frac{F(0)-F(-s)}{1-F(-s)} < \frac{1}{2}$ and $\frac{F(0)}{F(s)} > \frac{1}{2}$.

The corresponding condition for clearance in the first stage is:

$$k(s) > -(1-b) \int_{-1}^s x \frac{dF(x)}{F(s)}.$$

In this case, the merger will be cleared in the first stage only if probability of the good signal b is sufficiently high.

We are now in a position to compare the EU and US procedures in terms of expected consumer welfare. It is easy to establish the superiority of the US procedures as one sees it as one in which the standard for clearance in the first stage is endogenous and determined in such a way that the expected consumer surplus is maximized, once the prior distribution is known, and taking account of beliefs. In other words, given $F(0)$, and given the beliefs

¹³For a discussion of the merit of a decision rule which takes into account the expected value of consumer welfare, see K. Heyer, (2005).

about the signal, the US authorities decide whether to set $\alpha_{US} > F(0)$ and allow the merger in the first stage, or to set $\alpha_{US} < F(0)$ and thereby trigger a second request depending on which outcome yields the highest expected consumer surplus.

Proposition 1 *The procedure that allows to base the first stage decision on the beliefs about the signals in the second stage and thus sets α endogenously (“the US procedure”) is superior to the procedure that disregards these beliefs and sets α exogenously (“the EU procedure”) in terms of expected consumer surplus.*

Proof. *Since for given s the expected consumer surplus after the second stage decision V_{II} is the same under both the US and the EU procedures and α_{US} is set to maximize the expected surplus after the first stage, for each prior F , the expected consumer surplus under the US procedure cannot be lower than the expected consumer surplus under the EU procedure. There exist exogenous $\alpha \neq \alpha_{US}$ such that the merger is cleared in the EU in phase I despite $V_{II} > V_I$ or a phase II is triggered despite $V_{II} < V_I$. ■*

The superiority of the US procedure stems from the fact that it uses more information than the EU procedure and, more importantly, from the fact that it is allowed to decide on the outcome of the first stage by explicitly considering the expected consumer surplus (rather than probabilities of harm). The US design is thus more frequently consistent with the maximization of consumer surplus maximization than the EU procedure when remedies are not allowed.

4 Strategic interactions with remedies

This section allows for remedies that are proposed by the parties and strategic interactions between the parties and the authorities. We consider the EU and US procedures in turn and then compare them.

Given the strategic interactions induced by the remedies, we need to further specify our assumptions on the information structure. We thus assume that all the distributions introduced so far are common knowledge. The merging parties are also assumed to know the quality of the merger in terms of consumer surplus and its profitability with certainty. We denote the consumer and merging parties’ value of the merger as $w \in [-1, 1]$ and $v \in (0, 1]$, respectively. We assume that \mathbf{w} and \mathbf{v} are distributed independently (\mathbf{w} and

w and v), so that the merging parties will not be able to signal anything about w by offering a remedy that will not be accepted. To close the model, we assume that beliefs obtained by the authority are dependent on the true value of the merger. In particular, $b : [-1, 1] \rightarrow [0, 1]$ is a strictly increasing function of w . The authority is not aware that this function exists, otherwise it could precisely recover the type of merger from its belief ($w = b^{-1}(\cdot)$).

4.1 EU

Allowing for remedies, the game unfolds as follows: the authority takes a decision in phase I on the basis of the prior F . The merging parties know this and can propose remedies as a take-it-or-leave-it offer. If the remedies are proposed and accepted, the game ends and the merger is implemented. If not, the game proceeds to phase II. In phase II, a posterior distribution is obtained. The merging parties can make another take-it-or-leave-it offer. The final decision is then made by the authority.

In our setting, when considering remedies in phase I, the merging parties will take into account the decisions that the authority would take in phase II (depending on the information that it uncovers). Given that the authority does not optimize (it applies a decision rule which exhibits predetermined and different standards of proof in the two phases), the only strategic decision in this game relates to the decision of firms whether to offer remedies in phase I.

We now derive the equilibrium of the game and characterize the circumstances in which the merging parties will offer sufficient remedies in phase I.

In phase II, assuming that the merger is prohibited, the outcome is $(-k(s), -t)$, where t is the cost to merging firms of undergoing further investigation. Because in phase II the merging firms forgo v as a result of the merger prohibition, they will offer remedies of up to v to the authority in this phase.

The authority has a posterior distribution of the quality of the merger in terms of consumer surplus G in phase II (which is based on the prior F updated by the signal as specified earlier). It will accept any remedy R such that $G_R(0) \leq \frac{1}{2}$ (where G_R is the posterior distribution of the quality of the merger in terms of consumer surplus, taking account of the remedy). $R(x)$ gives the consumer surplus for a merger of quality $x \in [-1, 1]$ after it has

been remedied.

The merging firms will offer remedies which minimize costs subject to being accepted by the authority as sufficient. We can thus write $R_2 = \arg \min_{G_R(0) \leq \frac{1}{2}} \int_{-1}^1 c(R(x) - x) dG(x)$. The merging firms will offer such a remedy, if $\int_{-1}^1 c(R_2(x) - x) dG(x) < v$.

Because the merging firms make the offer and c is a strictly increasing function, they will choose the remedy such that $G_R(0) = \frac{1}{2}$.

There are thus 3 possible outcomes of phase II:

- $(w - k(s), v - t)$ when the merger is cleared without remedies, $G(0) \leq \frac{1}{2}$;
- $(-k(s) + R_2(w), v - t - \int_{-1}^1 c(R_2(x) - x) dG(x))$ when the merger is cleared with remedies, $G(0) > \frac{1}{2}$, $\int_{-1}^1 c(R_2(x) - x) dG(x) \leq v$;
- $(-k(s), -t)$ when the merger is prohibited (as no remedies that could solve the authority's concerns are rational from the point of view of the merger firms) $G(0) > \frac{1}{2}$, $\int_{-1}^1 c(R_2(x) - x) dG(x) > v$

We now turn to phase I. The merger is cleared in this phase if $F(0) < \alpha$ with the outcome (w, v) . If this condition does not hold, the merging firms can offer remedies. They will not offer any above those which satisfy $F_R(0) = \alpha$. They will make this offer if the value of the merger under the phase I remedies is higher than the expected value to them from the investigation proceeding to phase II.

Denote the least costly remedies that satisfy the authority as $R_1 = \arg \min_{F_R(0) \leq \alpha} \int_{-1}^1 c(R(x) - x) dF(x)$. The value of the merger with the remedies for the merging firms is then $v - \int_{-1}^1 c(R_1(x) - x) dF(x)$, whereas the expected value to the merging firms of the investigation proceeding into phase II if they do not offer such remedies is

$$V_2 = -t + bV_1 + (1 - b)V_{-1},$$

Where V_{-1} and V_1 are defined as follows for $i \in -1, 1$:

$$V_i = \begin{cases} v, & G(0|l = i) < \frac{1}{2}; \\ v - \int_{-1}^1 c(R_2(x) - x) dG(x), & G(0|l = i) > \frac{1}{2}, \int_{-1}^1 c(R_2(x) - x) dG(x) \leq v; \\ 0, & G(0|l = i) > \frac{1}{2}, \int_{-1}^1 c(R_2(x) - x) dG(x) > v. \end{cases}$$

Hence, there are also three outcomes in the end of the first stage:

- (w, v) if the merger is accepted without remedies $F(0) < \alpha$;
- $\left(R_1(w), v - \int_{-1}^1 c(R_1(x) - x) dF(x)\right)$ if the merger is accepted with remedies: $v - \int_{-1}^1 c(R_1(x) - x) dF(x) \geq V_2$;
- the merger review proceeds to phase II: $v - \int_{-1}^1 c(R_1(x) - x) dF(x) < V_2$.

We now have a full characterization of the equilibrium and we can compute the equilibrium path once $F, \alpha, b, s, w, v, t, k, c$ are known. The only strategic choice in this game is that of the merging firms, which may have the choice between offering adequate remedies in phase I or triggering a phase II. This choice can be characterized as follows.

First, the merging firms may propose adequate remedies in phase I even if they understand that favorable information is most likely to be uncovered in phase II. In such circumstances, the authority, bound to rely on verifiable evidence in phase I decisions, will ask for remedies that are in excess of those that are expected to be required in phase II.¹⁴ The condition for sufficient remedies to be offered in phase I is

$$v - \mathbb{E}c(R_1) \geq V_2,$$

Assuming that the merger is allowed without remedies if the signal is favorable but that remedies are required if the signal is unfavorable, this condition can be simplified to

$$(1 - b) \mathbb{E}c(R_2|l = -1) + t \geq \mathbb{E}c(R_1).$$

Hence, firms will propose adequate remedies in phase I even if they anticipate lower remedies in phase II, if the cost of delay is significant.

In our experience, such instances are not uncommon. The merger between Intel and MaAfee (case M5984)¹⁵ may serve as an illustration of the type of circumstances in which the issue arises. The transaction involved

¹⁴Remedies are anticipated to be lower in phase II both because it is expected that the information will be favorable and because the standard of proof (balance of probability) is lower in phase II.

¹⁵Two of the authors were involved in the assessment of this merger, while working at the European Commission. The remarks that follow should not be construed as a judgment on the facts of this case.

the integration between the CPU (hardware) and security software and the parties argued that integration would allow them to develop better solutions than what could be achieved in the context of a looser cooperation (that they had tried before). The potential anti-competitive effects in this case arise from the foreclosure of other security software producers. Of course, to the extent that efficiencies require a tight integration, they will also imply some foreclosure effect and access remedies (for other software producers) would run the risk of jeopardizing the efficiencies (by reducing the scope of integration).

These are complex issues that are difficult to assess in phase I. However, the merging firms proposed extensive access remedies in phase I in this case, while the US authorities cleared the merger without remedy and without issuing a second request. Given that plausible arguments of efficiencies were put forward by the parties in phase I, one can wonder whether the anticipation that these arguments would be validated in phase II could not have supported an expectation that lower remedies would be required in phase II.

Second, remedies may be proposed in phase I when the firms (and the authority) believe that it is highly likely that unfavorable information will be uncovered in phase II. The authority cannot use such beliefs and is lead to accept remedies that fall short of those that it would likely require in phase II.

We now show that in such circumstances the surplus of the consumer from a phase I clearance decision may be lower than the surplus that would be expected from phase II. The condition for sufficient remedies to be offered in phase I is the same as above,

$$v - \int_{-1}^1 c(R_1(x) - x) dF(x) \geq V_2$$

The outcome in phase I is worse for the consumer than the expected outcome in phase II if the following condition is met:

$$R_1(w) < W_2.$$

If we again assume that $G(0|l = 1) < \frac{1}{2}$ and $G(0|l = -1) > \frac{1}{2}$, these conditions can be rewritten as

$$\begin{aligned} v - \mathbb{E}c(R_1) &\geq -t + bv + (1 - b)V_{-1}, \\ R_1(w) &< -k(s) + b \int_{-1}^1 x dG(x|l = 1) + (1 - b)W_{-1}. \end{aligned}$$

If we further assume that $\mathbb{E}c(R_2) \leq v$, so that remedies would actually be proposed in phase 2, we can further simplify this to

$$\begin{aligned} v - \mathbb{E}c(R_1) &\geq -t + bv + (1 - b)(v - \mathbb{E}c(R_2|l = -1)), \\ R_1(w) &< -k(s) + b\mathbb{E}(\mathbf{x}|l = 1) + (1 - b)\mathbb{E}(R_2(\mathbf{x})|l = -1), \end{aligned}$$

or

$$\begin{aligned} (1 - b)\mathbb{E}c(R_2|l = -1) + t &\geq \mathbb{E}c(R_1), \\ b\mathbb{E}(\mathbf{x}|l = 1) + (1 - b)\mathbb{E}(R_2(\mathbf{x})|l = -1) &> R_1(w) + k(s). \end{aligned}$$

These two equations will be satisfied simultaneously when the waiting costs of the firms are high relative to the investigation costs of the authorities (regardless of b). They are more likely to be satisfied if the standard in phase I is relatively lax (so that the expected cost of the remedies and the welfare in phase I are lower). They are also more likely to be satisfied if it is more likely that the information in phase II will be unfavorable (b is low).

4.2 US

We now turn to the US procedure. In the last stage, the game is the same as in the EU setting. In the first stage, however, the US authority is allowed to incorporate its belief b to form the prior B as the basis for its decision on whether to issue a second request. To decide, the authority compares the expected consumer welfare of issuing a second request with the expected consumer welfare of a clearance in the first stage (possibly with remedies)¹⁶.

As before, the merging firms may have incentives to propose relatively high remedies before the second request is issued in order to avoid the costs of waiting and/or even higher remedies following the second request in particular when information is likely to be unfavorable. However, compared to the EU, the merging parties may have less of a leverage over the authorities to the extent that the authorities can also use the expectation that unfavorable information is likely to be forthcoming in deciding whether to accept remedies in the first phase.

Given that the merger was not cleared without remedies and given an offer R_o by the merging firms before a second request, the US authority will

¹⁶We assume that in taking their decision in phase I, the authorities neglect the possibility that the merger may be withdrawn in phase II.

clear the merger if the expected value of this is above the expected value from issuing a second request:

$$\int_{-1}^1 x dB_{R_o}(x) \geq W_2 = -k(s) + bW_1 + (1-b)W_{-1},$$

where W_1 and W_{-1} are expressed as:

$$W_i = \begin{cases} \int_{-1}^1 x dG(x|l=i), & G(0|l=i) \leq \frac{1}{2}; \\ \int_{-1}^1 R_2(x) dG(x|l=i), & G(0|l=i) > \frac{1}{2}, \mathbb{E}c(R_2) \leq v; \\ 0, & G(0|l=i) > \frac{1}{2}, \mathbb{E}c(R_2) > v. \end{cases}$$

Hence, there are 3 possible outcomes at the end of the first phase:

- the authority will clear merger immediately if $\int_{-1}^1 x dB(x) \geq W_2$;
- the authority will require remedies and the firm will make an offer R_o : $\int_{-1}^1 x dB_{R_o}(x) = W_2$ if $\int_{-1}^1 x dB(x) < W_2$, $v - \int_{-1}^1 c(R_o(x) - x) dB(x) \geq V_2$;
- second stage is triggered if $\int_{-1}^1 x dB(x) < W_2$, $v - \int_{-1}^1 c(R_o(x) - x) dB(x) < V_2$.

This completes the characterization of equilibrium. We observe that firms will offer remedies in the first stage in such a way as to make the authorities indifferent between clearing the merger and triggering a second request. Given the decision rule of the agency, this arises when the expected consumer surplus of the options is the same. By contrast, in the EU, the firms will avoid a second phase with remedies that are just sufficient to exclude serious doubts. This suggests that at least in some (but not all) circumstances (as shown below) the merging parties may have more scope for avoiding a phase II in the US than in the EU.

4.3 Discussion

We now analyze the differences in equilibrium play between the US and the EU procedures for given exogenous variables and distributions.

We focus on the expected consumer surplus under the two procedures. The previous results are summarized in Table 1.

EU	procedure
$\int_{-1}^1 x dB(x),$	$F(0) \leq \alpha;$
$\int_{-1}^1 R_1(x) dB(x),$	$F(0) > \alpha, v - \int_{-1}^1 c(R_1(x) - x) dF(x) \geq V_2;$
$W_2,$	$F(0) > \alpha, v - \int_{-1}^1 c(R_1(x) - x) dF(x) < V_2.$
US	procedure
$\int_{-1}^1 x dB(x),$	$\int_{-1}^1 x dB(x) \geq W_2;$
$W_2,$	$\int_{-1}^1 x dB(x) < W_2.$

Table 1: Expected consumer surplus under different parameter constellations.

As can be seen from the table, the minimum level of expected consumer surplus which is guaranteed by the US procedure is the level that can be expected in the second phase (W_2). This is achieved either with remedies sufficient for clearance in the first stage or through proceeding to the second stage itself (depending on what is more attractive to the firms). A higher level of expected welfare can be obtained when the merger is cleared unconditionally in the first stage.

In the EU, contrary to the US, when the merger is cleared with remedies in phase I, the level of welfare could be higher or lower than that expected from a phase II. This arises because the EU authority, operating with a stricter standard in phase I, might be able to obtain remedies from the parties that yield a higher consumer surplus, in particular when the information that will be uncovered in phase II is expected to be favorable. This is a reflection of the fact that the EU, unlike the US, will not accept remedies that make it indifferent to triggering a second phase. As a result the EU authority may credibly require higher remedies. Similarly, the EU procedure may yield a higher welfare also when the merger is cleared unconditionally in stage I in the US (first line in the table above) but cleared with remedies in phase I in the EU (second line in the table above). Here again, the higher standard of proof in the EU can allow the authorities to improve on the outcome.

At the same time, as mentioned above, the merging parties may have more leverage in the EU, in particular when it is anticipated that the information that will be gathered in phase II will be unfavorable. Accordingly, there is no guarantee that the remedies obtained by the EU in phase I will yield a higher expected welfare relative to those obtained in the US. These results are collected in the following proposition.

Proposition 2 *When remedies are allowed, the procedure in which a deci-*

sion on whether to trigger a second stage is determined on the basis of expected welfare and beliefs about the second stage signals are taken into account (“the US procedure”) is superior to the procedure which involves a different standard of proof in phase I (“the EU procedure”) in terms of expected consumer surplus, except when remedies in the EU procedure are accepted in phase I and $\int_{-1}^1 x dB_{R_1}(x) > W_2$

Proof. Observe that if the authority proceeds to the second stage, both procedures produce the same outcome W_2 . With the US procedure, this is the minimal expected consumer surplus that may be obtained. In the EU, $\int_{-1}^1 x dB(x)$ may be obtained even if it is lower than W_2 , so that the US procedure is superior. However, in some cases it may be that $\int_{-1}^1 x dB_{R_1}(x) > W_2$ even though $\int_{-1}^1 x dB(x) < W_2$. This arises when remedies are accepted by the authority in phase I. The set of parameters for which these conditions hold is non empty. The conditions under which the EU regime dominates are written: $F(0) > \alpha, v - \int_{-1}^1 c(R_1(x) - x) dF(x) \geq V_2, \int_{-1}^1 x dB_{R_1}(x) > W_2$. Consider for instance a situation in which $k(s)$ is high. Then, it is clear that the US authority will agree to any positive remedy, whereas the EU authority will only agree to the remedy $R_1 > 0$. ■

Further insights into how the two procedures compare in terms of welfare can be gained by considering the alternative outcomes. Hence, we consider a merger that has the same effect in two jurisdictions and compare the outcomes of the two procedures. This comparison would be appropriate for a transaction in which the relevant markets are global (or at least encompass the US and the EU), so that relevant market shares (and more generally, the competitive effects) will be the same in the two jurisdictions. The comparison is summarized in Table 2, where outcomes in the EU are in columns and US outcomes in rows.

	Phase I	Phase I with rem.	Phase II
Phase I	=	EU > US	EU < US
Phase I with rem.	EU < US	EU > US	EU < US
Phase II	EU < US	EU > US	EU < US

Table 2: Comparison of the outcomes of US and EU procedures

- **Second stage in both jurisdictions:** As suggested above, the set of parameters for which a second stage is triggered will be different in the two procedures, but the merger trivially yields the same expected surplus if a second stage is triggered in both jurisdictions (bottom right hand corner in Table 2).
- **Clearance with remedies in stage I in the US and phase II in the EU:** In the US, the agency is indifferent in terms of consumer surplus and hence the expected consumer surplus in the first stage (with remedies) is equal to the expected consumer surplus in the second stage. Accordingly, there is no difference between the EU and the US procedures for parameters which result in such outcomes. That is also to say that if the *EU moves into phase II while the US accept remedies in phase I* for a merger that has the same distribution of potential outcomes (effects) in the two jurisdictions, one can expect that the two procedures are equivalent in terms of expected consumer welfare. There is in principle no ground for concern about such divergence in the outcome of the procedure.
- **Clearance with remedies in phase I in both jurisdictions:** In the US, the expected consumer surplus is equal to that of proceeding into the second stage (as the agency is made indifferent between stage I with remedies and stage II). The expected consumer surplus in the EU could however be higher, as discussed above. This arises because, on the one hand, given the standard of proof for a phase I clearance in the EU, merging parties may have been induced to propose remedies that increase consumer surplus beyond the level that can be expected from a phase II. On the other hand, as discussed above, the merging parties have more leverage in the EU to the extent that the authority cannot take into account their expectation of unfavorable information in phase II in order to extract remedies in phase I. Hence, remedies could be higher or lower in the EU but there will be a parameter range for which remedies (and expected consumer surplus) will be higher in the EU.
- **Clearance with remedies in phase I in the EU and stage II in the US:** The expected level of welfare in the US is then also equal to that of proceeding into the second stage and for the same reasons as in the previous case, the outcome could be better or worse in the EU.

That is also say that *if a merger is cleared in phase I with remedies in the EU but a second stage is triggered in the US, one should expect that the outcomes of the two procedures will diverge.*

- **Clearance without remedy in phase I in both jurisdictions:** If the merger is cleared without remedies in both jurisdictions, the expected welfare is trivially the same.
- **Clearance without remedy in stage I the EU and second stage (or remedies in stage I) in the US:** We know from the previous section that for a given merger a decision to move into the second stage (without allowing for remedies) in the US will always be superior to a decision to clear in phase I in the EU. Since a phase II in the US which might involve remedies can only yield a higher expected consumer surplus than one without remedies, it follows that a phase II with remedy in the US will dominate a clearance without remedy in stage I in the EU. In addition, we know (from the analysis of this section) that for the range of parameters for which we observe a phase II or a clearance with remedy in phase I these outcomes are equivalent in the US in terms of expected consumer surplus. Hence, it follows that a decision to clear without remedy in the first stage in the EU is always dominated by another decision in the US. This would correspond to a situation in which the "serious doubt" standard is actually too lax (and may accordingly be somewhat unlikely).
- **Clearance in phase I without remedies in the US, against a decision to move into phase II in the EU:** We know that since a decision to move into phase II in the EU yields the same expected welfare as in the US and since the US decides whether to clear in phase I or move into phase II by maximizing expected consumer welfare, the US will always do better than the EU when it clears in phase I without remedies while the latter moves into phase II.
- **Clearance in phase I without remedy in the US and clearance in phase I with remedies in the EU:** the EU procedure which imposes remedies to the benefit of consumers, cannot do worse.

Overall, we observe that for a merger having the same effect, clearance with remedies negotiated in phase I by the EU might dominate remedies negotiated by the US authorities or a second request for this merger. Clearance

with remedies in phase I in the EU will dominate clearance without remedies in phase I in the US. By contrast, when a merger is cleared without remedy in phase I in the EU but not in the US, the US decision has to be better.

5 Conclusion

In principle, one would expect that the higher threshold for clearance in phase I should allow the EU authorities to obtain a higher expected consumer surplus. Indeed, our analysis, which compares the US and EU procedures in terms of expected consumer surplus could be considered to be biased from the outset in favor of the EU, as it uses a more stringent standard in phase I. This intuition is however deceptive because the existence of an enforceable threshold in phase I also changes the bargaining position of the authority with respect to remedies, as they cannot rely on information that may not be verifiable. While we find that the EU procedure can be superior to the US procedure in terms of expected consumer welfare when the information that is expected to be uncovered in phase II is favorable, we obtain the opposite result when it is expected that the information will be unfavorable. Hence, it would appear that the EU procedure obtains a better outcome with respect to relatively innocuous mergers but fares less well with respect to potentially more anti-competitive transactions. In other words, the power of the EU standard seems to be bite more in transactions that matter less.

There is an additional drawback from the EU procedure which is not captured by our model. The fact that information which is not (yet) verified cannot be used in the context of phase I decision is likely to be a source of difficulties, given that margin of discretion that the Commission enjoys in its assessment. For instance, one could anticipate that if the Commission expects that unfavorable information will be uncovered in phase II, it will resist accepting remedies in phase I. It might use its discretion to discourage the parties to submit remedies in phase I, exaggerate the significance of the remedies that would be required, or overemphasize the reservations that may be expressed in the market test of the remedies. In the context of our model, such tactics might of course contribute to a more efficient outcome (in terms or expected welfare). However, the inherent tension between the decision dictated by the available evidence and the decision that is consistent with the Commission's beliefs will naturally make the Commission vulnerable to capture. Competitors or other interested parties may for instance provide

unverifiable but plausible information which helps the Commission in pushing the transaction into phase II but effectively only serves their own interest in the remedies discussion.

Our analysis has also focused on the effectiveness of the US and EU procedure in terms of their own declared objective, namely expected consumer welfare. This is arguably a narrow perspective and it would be interesting to assess the procedure in terms of the overall welfare which would include the value of the transactions of the merging firms and consequences for competitors. It would be interesting to consider for instance the extent to which the higher standard of proof in phase I in the EU comes at the expense of a reduction in the value of the transactions. This could only be undertaken by further specifying the priors of the effect of the transactions in terms of an explicit models of mergers.

Other extensions of our work might include an analysis of the strategic provision of information by the merging parties, their competitors as well as other interested third parties. It could also include a decision on the depth of the investigation that the agency undertakes in phase II, which would effectively endogenise the precision of the signal that the agency receives. Finally, as mentioned above, our model provides some testable empirical predictions with respect to the circumstances in which the US and EU procedures with respect to global transactions actually diverge in terms of expected consumer welfare.

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