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Discussion paper

Optimal merger policy

BY
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Optimal merger policy

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Abstract:

The purpose of this article is to investigate the optimal merger policy in the presence of deterrence as well as type I and type II errors. We derive the optimal number of merger investigations, both when the competition authority commits to a particular activity level and when they do not commit. It is shown that no commitment can lead to a less active merger policy and lower welfare than what is the case if commitment. If commitment there will be a positive welfare effect of the merger investigations due to its deterrence effect, while the merger investigations as such might have a negative impact on welfare (enforcement effect). The results have important implications for how one should interpret the empirical studies of the effects of merger enforcement.

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1. Introduction

Several competition authorities have had an active merger policy the last decade. It is natural to question whether such an active merger policy has been successful. There have been studies investigating whether competition authorities have made the right decision in merger investigations.² Several jurisdictions have at their own initiative quantified the expected effects of their own merger investigations.³ Some of them have also initiated ex post studies of the actual effect of a merger ban or a decision to allow a merger.⁴ However, all commentators seem to agree that such studies might detect only a ‘tip of the iceberg’ when it comes to the overall impact of merger policy.⁵ The reason is that an active merger investigation policy will probably deter some firms from merging, and those cases will not be easily observed and certainly not be present in those studies referred to above. This is acknowledged by, for example, US Department of Justice:⁶

‘We have not attempted to value the deterrence effects (...) of our successful enforcement efforts. While we believe that these effects in most matters are very large, we are unable to approach measuring them’.

Recent empirical studies have shown that the deterrence effect of merger policy is probably substantial.⁷ Unfortunately, to our knowledge the existing theoretical literature on merger

² An early study of the effect of merger investigations is Eckbo (1983). It applies an event study by analysing how the stock market value of non-merging firms is affected by a merger and a merger investigation. Duso, Neven and Röller (2007) and Duso, Gugler and Yurtoglu (2007) undertake related studies, focusing on the merger investigation in the EU. Other studies apply simulation models to investigate the possible anti-competitive effect with respect to price increases. For example, Postema, Goppelsroder and van Bergejik (2006) simulate the hypothetical price effects of 11 mergers that were banned or cleared with remedies in the Netherlands. See also Peters (2006), where it is shown that simulation models can make poor predictions of actual price increases following a merger.

³ In 1999 both FTC and DOJ in the US started publishing estimates of savings for the consumers following merger bans. More recently both OFT and Competition Commission in United Kingdom and NMa in the Netherlands have published similar kind of studies, see for example Office of Fair Trading (2005). In these studies they typically apply some rules of thumb, for example that a merger would have resulted in a 1 % price increase for one year. At OFT and NMa they have supplemented those rules of thumb estimates with some estimates from simulation models, see for example OFT (2007).

⁴ One example is the European Commission, who initiated a study of the effects of the ban of the merger between Pirelli and BICC in 2000 (see Lear, 2006). They did an event study, as well as a survey. OFT in the UK initiated a survey that detected the effects of permitting ten different mergers, see PwC Economics (2005).

⁵ The phrase ‘tip of an iceberg’ is a quote from Seldeslachts *et al* (2008). The important role of deterrence has been pointed out by many as something that is not taken into account, see for example Eckbo (1989), Davies and Majumar (2002), Joskow (2002), Crandall and Winston (2003) and Baker (2003).

⁶ See its congressional submission for the fiscal year 2001, quoted in Davies and Majumar (2002), p. 72.

⁷ See, for example, Seldeslachts *et al* (2008), Twynstra Gudde (2005) and Deloitte (2007). They are all referred to in Section 3.

policy rules out that merger control has any deterrence effect.⁸ The purpose of this article is to help fill this gap. According to our model deterrence as such has a decisive impact on the choice of an optimal merger policy, for example with respect to how many mergers that should be investigated and the welfare effect of merger enforcement as such. This illustrates that the merger policy recommendations as well as the predictions for empirical research drawn from the existing literature can be misguided.

If each firm knows that there will be an active merger control, this implies that some firms might be deterred from merging. They decide not to merge, because they anticipate that the probability of a ban is large. It seems plausible to assume that firms are well informed about the impact of a merger, and that those firms with a large negative welfare effect of a merger are those that typically will be banned following an investigation. If there is such a bias, the actual mergers that are proposed by the parties will mainly consist of those with a positive welfare effect and those mergers where the welfare effect is highly uncertain or only have a modestly negative effect on welfare.

In our basic model we assume that the competition authority commits to a particular activity level, which means that there is a certain probability for a proposed merger being investigated. If investigated, the competition authority receives a signal about the welfare effect of the proposed merger. Even though they take the signal into account in their final decision, they can make both type I and type II errors. When setting the activity level, the competition authority must make a tradeoff between deterrence and making mistakes in its final decision. On the one hand, an active merger policy will deter those mergers most detrimental to welfare. On the other hand, an active merger policy will imply that fewer mergers detrimental to welfare are proposed and thereby lead to a more limited scope for banning bad mergers. We show that with an optimal merger policy the merger investigations as such can have a detrimental effect on welfare (enforcement effect). The reason is that those

⁸ Two exceptions are Katsoulacos and Ulph (2007, 2008). The deterrence effect is present in their model. However, their main focus is the choice between legal standards (a rule of reason versus a per se rule). There are also some studies of how the presence of merger control would affect which type of mergers is being proposed. This was first discussed in Stigler (1966), who argued that the 1950 amendment to the Clayton Act in the US discouraged the proposal of horizontal mergers and encouraged the proposal of vertical and conglomerate mergers. Fridolfsson and Stennek (2005a) discuss whether mergers on the same market can be substitutes for each other. Besanko and Spulber (1993) consider a case where firms have private information about cost savings following a merger, and they discuss how the choice of welfare standard will affect which mergers that will be proposed. The importance of the welfare standard is also discussed in Fridolfsson (2007) and Lyons (2003). In contrast to our study, none of the referred studies consider the overall impact of the deterrence effect and the enforcement effect of merger control.

mergers that are investigated are chosen among those that are not deterred. Since the mergers that have the largest anti-competitive effects are already deterred this leads to a large risk for type I errors (prohibiting welfare enhancing mergers). We show that it is optimal to commit to an activity level that leads to some mistakes when the final decision is made. The losses associated with the enforcement are then traded off against the gains associated with deterrence.

If no commitment by the competition authority, we show that the merger policy can become less active and that the welfare will always be lower than what is the case with commitment. We extend our basic model by allowing the competition authority to update their beliefs after observing the number of mergers being proposed. It is assumed that they can find out whether the investigations in total are welfare improving or not by inspecting the number of mergers being proposed. Obviously, if very few mergers are proposed then they can infer that all of them must be beneficial for society. However, it turns out that they will also clear all mergers without any investigation even if they know that some of them are detrimental to welfare. This is done to avoid banning any mergers that are welfare improving. If no commitment, the merging parties can behave strategically. They can refrain from proposing a merger, in order not to trigger any investigations. Then there will be a multiplicity of equilibria, because each potential merger candidate would like to be among those that are proposed. We show that no commitment leads to lower welfare, because the merging parties can exploit the fact that they are able to influence the competition authority's decision to investigate or not.

It is an open question whether commitment is possible for the competition authority. Apparently, it is difficult not to take into account information they receive concerning the number of mergers being proposed. However, it is doubtful whether you can infer much information, if any at all, by just observing the number of mergers being proposed.⁹ More importantly, the institutional setting in most competition authorities can be interpreted as if there is a commitment to investigating some proposed mergers during a certain period. For example, in some countries they have a merger unit that is responsible for merger control.

⁹ In most countries the number of proposed mergers is very large compared to the number of mergers being banned. For example, in the EU in the period 1990-2006 more than 3000 mergers have been notified and only 19 of them have been banned (see Davies and Lyons, 2007). This indicates that it can be difficult to draw any inference about whether there are many mergers detrimental to welfare from simply observing the total number of notifications. However, we can learn something from a careful econometric study. See for example Seldeslacht *et al.* (2008), who use cross-country data with merger notifications to check whether it is any deterrence effect.

Moreover, the role of the competition authority is to carefully check whether there are some mergers detrimental to welfare and also to deter mergers. Such a goal is difficult to accomplish if they choose not to investigate any of the proposed mergers. In line with this it is plausible to assume that there is a commitment to an activity level. Our results show that such a commitment is not only plausible, but that it can also be optimal to organize merger control in such a way.

Our results indicate that the competition authorities may find it difficult to determine whether it has succeeded in choosing an optimal merger policy. If, for example, empirical studies show that merger investigations as such are welfare enhancing this might imply under-enforcement if they do have a commitment to an activity level. On the other hand, a large amount of both type I and Type II errors is neither a sign of an optimal merger policy. In any case, if the competition authorities have the impression that they are left with only difficult merger cases this should not be a surprise according to our analysis. It should apparently be in accordance with what we would expect if they have succeeded in deterring those mergers most detrimental to welfare by organizing their merger control in such a way that they commit to a certain activity level.

To have a correct understanding of the overall impact of merger enforcement one should evaluate not only the direct effect from those mergers that were investigated (type I and type II errors), but in addition try to measure the number of mergers being deterred. Evidence of a large deterrence effect combined with rather ambiguous empirical results concerning the direct effect of merger enforcement might be a better sign of an optimal policy than evidence of a limited amount of deterrence and at the same time large direct gains from merger enforcement.

In the next section we present our model, and solve for the optimal merger policy both with respect to the extent and the quality of the merger control. In Section 3 we offer some concluding remarks, and confront our theoretical results with empirical studies of the deterrence of mergers.

2. Merger policy

2.1 The basic model

Let us consider a population of Z potential mergers in an economy, where $Z = X + Y$. There are some potential mergers, denoted Y , which obviously will not cause any concern for competition authorities. Various screening devices will clear those mergers very early on, and we expect that all potential mergers Y are implemented since they will be cleared. First, there are some mergers that are not notified to the competition authorities because they are below the threshold levels. Second, some notified mergers do apparently not raise any competition concerns. For example, for mergers where firms are not even in related markets it is obvious that there will be no anti-competitive effects. The same is true if a merger takes place in an industry with low concentration.¹⁰ Those mergers are cleared very early on.¹¹ In what follows we do not consider Y , but focus on the remaining population of potential mergers that is not cleared very early on. That is defined as X .

Among the population of X potential mergers, some are welfare improving and others not. Let us define W_x as the welfare effect of merger x , defined as

$$W_x = A - x \quad (1)$$

If $x = 0$, it implies that this particular merger has a positive welfare effect equal to A , while $x > A$ implies that the welfare effect of that particular merger is negative. If X is the total number of mergers, the aggregate welfare effect of all potential mergers is as follows:

$$W = \int_{x=0}^{x=X} (A - x) dx \quad (2)$$

¹⁰ In most countries they have some threshold levels for concentration. For example, in the EU they refer to threshold levels, both with respect to Herfindahl-Hirschmann index and market shares, and state that it is unlikely to identify horizontal competition concerns below such a concentration. See European Commission (2004), paragraphs 18-21.

¹¹ In EU this can be interpreted as those mergers that are not cleared soon after notification, and some of them proceed to second phase investigation. Note that in the EU in the period 1990-2006 less than 5 % of the notified mergers proceed to phase II investigation. In Norway, where the threshold level for notification is low, less than 5 % of the notified mergers submit a complete notification. This implies that more than 95 % of the notified mergers in Norway are cleared within 15 working days.

The aggregate welfare effect can be illustrated by Figure 1. The horizontal green lines illustrate the total welfare gain from all welfare improving mergers, while the vertical red lines illustrate the total welfare loss from all mergers that are detrimental to welfare.

As a starting point, let us consider a setting with perfect information and no costs associated with merger control. In such an unrealistic situation the competition authorities is prepared to challenge all mergers where $x > A$. This would lead to a situation where all mergers $x < A$ is permitted and implemented, while all mergers where $x > A$ are banned. The net welfare effect following mergers that are implemented would then be equal to the area marked by the horizontal green lines in Figure 1, while the welfare gain from blocking mergers detrimental to welfare is equal to the vertical red lines in Figure 1.

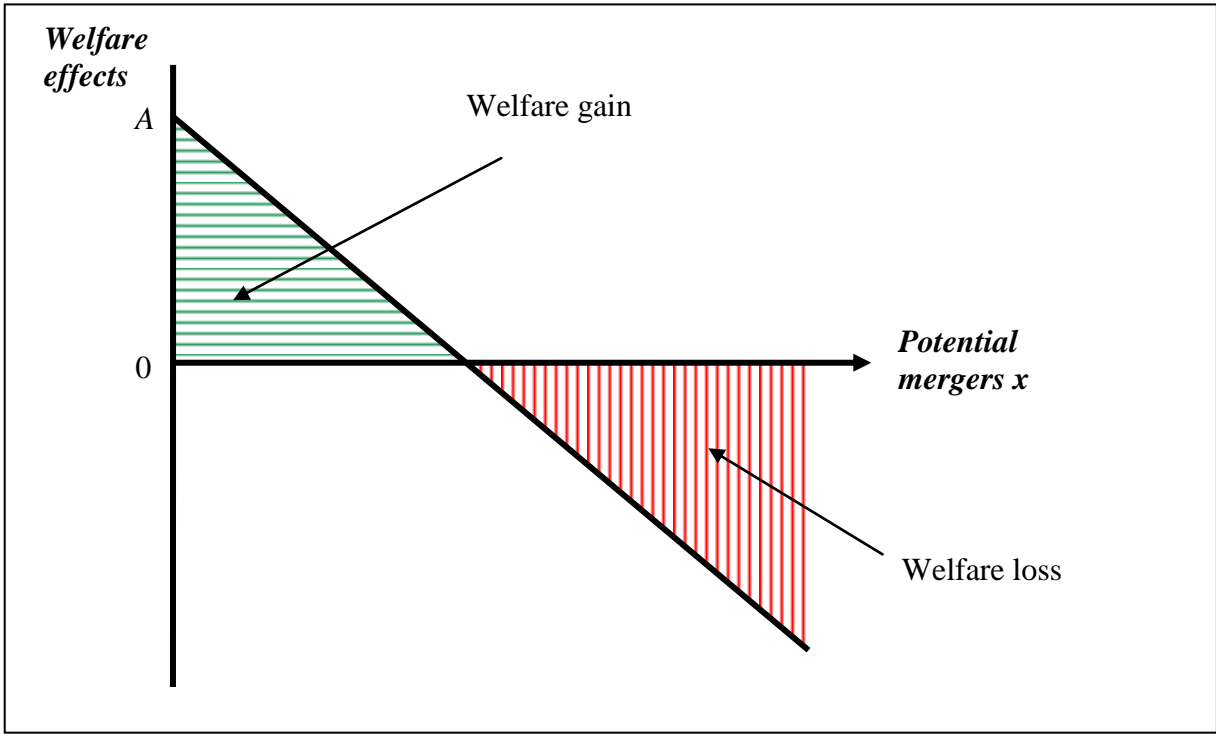


Figure 1: Potential mergers and welfare effects of them

We all know that this is not a realistic description of merger control. In particular, it is obvious that there will be imperfect information.¹² Although the competition authority knows that there are some good and some bad mergers, they do not know which one is good and

¹² Obviously, it is also wrong to assume that there are no costs associated with merger investigations. However, we will show that even by assuming no such costs there will be an optimum number of merger investigation. Our point is to illustrate that there are other forces than such costs that can limit the number of merger investigations. If we include costs associated with a merger investigation, this would obviously have a quantitative effect. However, it will not make any qualitative difference.

which one is bad – at least early in the investigation.¹³ To understand the potential forces at work, let us make some simplifying assumptions concerning the uncertainty. First, we assume that all mergers not cleared in the early phase have the same probability of being investigated in detail by the competition authority (uniform distribution). It is a plausible assumption, given that the competition authority has a large degree of uncertainty early in the merger investigation when all the obvious cases are already cleared.¹⁴

Second, we assume that the competition authority in its final decision to a certain degree can distinguish between mergers that are welfare improving and those that are detrimental to welfare. This seems natural, since the competition authority is expected to learn from the investigation. In our model this is captured by assuming that the competition authority receives a signal about the welfare effect of the merger. They receive either a good or bad signal (a ‘yes’ or a ‘no’), and this signal is drawn from a distribution that is contingent on the actual welfare effect. The probability for receiving a good signal for merger x is as follows:

$$P_x = \frac{X - x}{X} \tag{3}$$

We see that the larger the true welfare gain, the larger the probability of receiving a good signal.

As can be seen from (3), we assume a linear relationship between the welfare effect of a merger and the probability of receiving a good signal. The best merger will receive a good signal with a probability of one, while the worst merger will receive a good signal with a probability of zero.

¹³ We could have assumed that the competition authority could learn something from simply observing the number of mergers being proposed, and by doing so could revise its beliefs about the welfare effect of a particular merger. We will come back to that later on, when we assume that they can update their belief in such a way.

¹⁴ Duso, Neven and Röller (2007) investigated the quality of merger control in the EU. They find that the probability for waving an anti-competitive merger through is 75 % larger in phase I than in phase II investigation. This shows that the uncertainty is much larger in the early phase of the investigation than later on. We will later on discuss what might happen if we relax the assumption of uniform distribution, and allow for less uncertainty concerning the choice of mergers to investigate.

Furthermore, let us assume that the final decision is in accordance with the signal the competition authority receives. The expected value of merger x is the welfare effect multiplied with the probability that it receives a good signal and then is cleared:

$$EW_x = (A - x) \left[\frac{X - x}{X} \right] \tag{4}$$

2.2 The benchmark

Let us assume that $X = 2$ and $A = 1$, which implies that we normalise the number of mergers to 2.¹⁵ In Figure 2 we have plotted the expected value of all mergers, taking into account the probability that a merger is cleared or not after investigation.

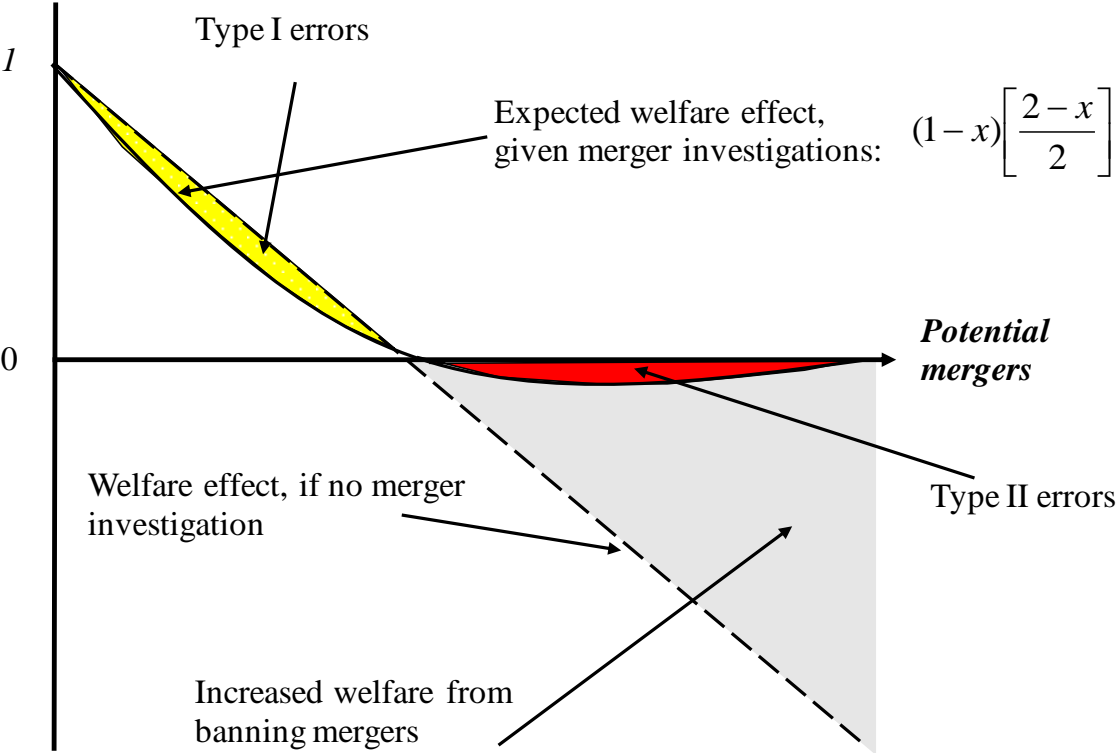


Figure 2: Welfare effects of mergers, given merger enforcement

The dotted line in Figure 2 is the welfare effect of each merger, given that all potential mergers are implemented and none of them are banned. The solid curve is the expected

¹⁵ This should not be taken literally. We could, for example, assumed that $X = 2000$, and at the same time $A = 1000$, and our result would be the same. Then there would be 2000 potential mergers rather than 2. In any case, there will be a continuum of mergers.

welfare effect of each merger, given that all of them are investigated and the final decision is in accordance with the signal the competition authority receives.

The difference between the solid curve and the dotted line in Figure 2 is the welfare effect of investigating all mergers. We see that there is a large probability that mergers that could cause a large welfare loss is banned, shown with the large difference between the solid and the dotted curve for x approaching 2. This is the positive effect of having merger investigations, although not all mergers that are detrimental to welfare are banned. Hence, it still remains some type II errors: Mergers that are detrimental to welfare are permitted. This is illustrated in Figure 2 with the red (dark grey) area. On the other hand, merger investigation leads to some welfare improving mergers being banned. This is illustrated in Figure 3 with the difference between the solid and the dotted curves for $x < 1$. These are the type I errors, shown with the yellow (light grey) area in Figure 2.

Note that the situation illustrated in Figure 2 can be seen as a benchmark. This is the case if no deterrence effect at all, and all potential mergers are actually proposed (even though some of them are not permitted). Let us consider the effect if only some of the mergers are proposed and not all. In particular, let us for the moment consider what happens if the worst mergers are banned. Let x^L denote the merger with the largest negative impact on welfare that is proposed. If all proposed mergers are investigated, that is all $x \leq x^L$ are investigated, then the welfare effect of having a merger policy is as follows:

$$\Delta EW = \int_{x=0}^{x=x^L} (1-x) \left[\frac{2-x}{2} \right] dx - \int_{x=0}^{x=x^L} (1-x) dx \quad (5)$$

This is the expected welfare when all proposed mergers are investigated, deducted the welfare if no merger investigation at all. Since we assume a uniform distribution if some but not all proposed mergers are investigated, we know that investigating only some mergers would lead to higher welfare if (5) is positive. Then we have the following result:

Lemma 1: *If x^L mergers are proposed and all or some of $x \leq x^L$ are investigated and the final decision is in accordance with the signal the competition authority receives, then merger investigation as such is detrimental to welfare if $x^L < 1.5$.*

Proof: We can rewrite (5) as:

$$\Delta EW = \left(x - \frac{3x^2}{4} + \frac{x^3}{6} \right) - \left(x - \frac{x^2}{2} \right) \Bigg|_0^{x^L}$$

Setting $\Delta EW = 0$ and solving it, we have that $\Delta EW = 0$ when $x^L = 1.5$. This implies that $\Delta EW < 0$ when $x^L < 1.5$. Q.E.D.

In Figure 3 we have shown the welfare effect of investigating all proposed mergers, given that only x mergers are proposed and those mergers not proposed are those that are most detrimental to welfare.

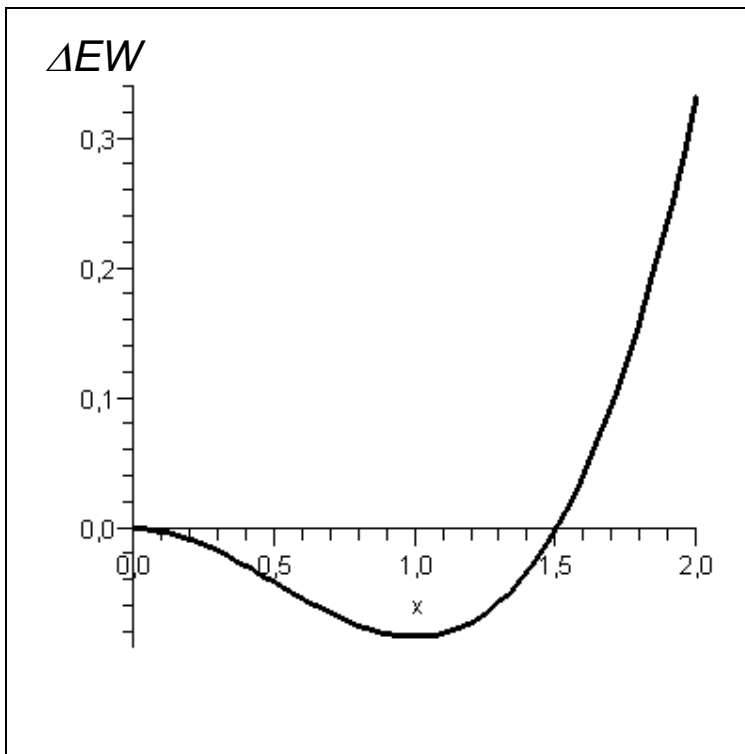


Figure 3: Welfare effect of merger investigations, given that x mergers are proposed

We see that when some of the worst mergers are not proposed, then the welfare effect of merger investigation becomes lower. This is natural, since we no longer can ban those worst mergers. For $x^L < 1.5$, the merger investigation is detrimental to welfare. Then one is left with mergers that are welfare enhancing and only modestly detrimental to welfare, and for those mergers there is a large risk of both type I and type II errors. We will later on explain how those worst mergers can be deterred in optimum.

2.3 Merger control and the merger decision

Given that there is an institution that is responsible for competition policy, it is difficult to see how this institution can have the flexibility to change the merger control activity quite dramatically from one year to another. It would be of interest for such an institution to build a reputation. For example, by committing to a specific activity level it might succeed in deterring some mergers detrimental to welfare. One way to commit to a merger control policy would be to devote resources to merger control. As described above, we assume that the competition authority commits to a certain activity level towards each proposed merger. It determines the probability for a merger (that has not been cleared early on) to be investigated in detail. We let N denote probability for a proposed merger being investigated. This means that the probability for being investigated does not depend on the total number of mergers that are proposed.¹⁶ The competition authority then determines each merger's probability for being investigated by choosing N . If $N = 1$, then all proposed mergers are investigated.

We assume the following sequence of moves:

- Stage 1: Competition authority sets N
- Stage 2: The firms decide to merge or not
- Stage 3: Competition authority determines which of the proposed mergers that will be investigated
- Stage 4: Competition authority receives a signal concerning the welfare effect of each of the investigated mergers
- Stage 5: For each merger investigated, competition authority either clears or prohibits the merger

It seems plausible to assume that the firms know more about the effect of the merger than the competition authorities, or at least has the same knowledge about the welfare effect of a merger as the competition authority when the final decision is made by the competition authority. In line with this, we assume that the firms considering to merge anticipate the welfare effect of their own merger and the expected decision that will be made by the competition authority.

¹⁶ Later on we relax this assumption, see Section 2.6.

Let us assume that the net present value associated with the merger is π , and that the costs associated with implementing the merger are equal to C . The latter is a sunk cost that is incurred following the decision to merge, irrespective of whether the merger is allowed or not. We assume that π and C are identical for all mergers.¹⁷

It is profitable for firm x to undertake a merger if:

$$M_x = \pi \left[N \frac{2-x}{2} + (1-N) \right] - C > 0, \quad (6)$$

The second term inside the bracket shows the probability for not being investigated. If so, the merger will be permitted. The first term inside the bracket shows the probability of being investigated, multiplied with the probability of being cleared if investigated. Both terms are multiplied with the net present value, so that we have the expected net present value. The merger candidates find it profitable to merge if the expected net present value exceeds the sunk costs associated with merging.

Rearranging, we have that a merger will take place if:

$$x < \frac{2(\pi - C)}{N\pi} \equiv x^* \quad (7)$$

$\pi > C$ is a necessary condition for a merger being profitable, and therefore for a merger being proposed. If $C > 0$, we see that some firms are deterred from merging. They anticipate that the probability of clearance is quite low. Given that, for some firms it is no longer profitable to incur a cost C when merging.

From (7) we can derive how a more active merger enforcement policy will influence the numbers of mergers that is proposed:

¹⁷ This implies that the costs associated with a merger process and the profits from a merger are identical for all firms. Clearly, some mergers are more profitable than others. If mergers that are detrimental to welfare had on average been more profitable, that would make our assumption unrealistic. We will later on discuss this assumption.

$$\frac{\partial x^*}{\partial N} = -\frac{2(\pi - C)}{N^2 \pi} \quad (8)$$

We see that $\partial x^* / \partial N < 0$, which implies that the total number of mergers that are actually proposed is lower the larger the probability of being investigated. This is plausible, since more mergers investigated would imply that the probability of a merger ban for a particular merger is increased. Moreover, we see that the lower C and the larger π the larger impact on x^* will an increase in N have.

2.4 The extent of the merger control

To determine how many mergers that should be investigated, the competition authority has to consider a trade off. On the one hand, a higher probability for being investigated would have a deterrence effect. This is beneficial, as long as the deterred merger is detrimental to welfare. On the other hand, one more merger investigation might lead to a merger being banned that should not be banned (enforcement effect).

As explained above, the competition authority commits to a probability for investigating each proposed merger by choosing N . The optimal N is determined by the following general condition:

$$\underbrace{\frac{\partial EW}{\partial N}}_{- \text{ if } x^* < 1.5} + \underbrace{\frac{dEW}{dx^*} \cdot \frac{\partial x^*}{\partial N}}_{\substack{- \text{ if } x^* > 1 \\ + \text{ if } x^* > 1}} = 0 \quad (9)$$

The first term is the direct effect of merger enforcement. It is the expected welfare effect of the particular merger investigation as such. The last term, consisting of two products, is the deterrence effect. We know from (8) that the last product in the last term is always negative. Moreover, we know from (1) that for $x^* > 1$, the welfare effect of a deterred merger is positive so that dEW / dx^* is negative. Then we know that for $x^* > 1$ we have that one more merger investigation has a deterrence effect that is welfare enhancing. Furthermore, we know from Lemma 1 that as long as $x^* > 1.5$, then merger investigation as such (the enforcement effect) has a positive effect. This implies that $x^* > 1.5$ cannot be an optimum unless we have a corner solution, because then both the enforcement effect and the deterrence effect of one more

merger investigation is positive. On the other hand, $x^* < 1$ can neither be an optimum unless mergers are not profitable. The reason is that in such a case both the deterrence and the enforcement effect are negative. A marginal reduction in the number of merger investigations must be welfare enhancing. Then we know that in optimum we have that $1 < x^* < 1.5$ unless we have a corner solution.

Given that $1 < x^* < 1.5$ and we have an interior solution, the deterrence effect is positive and the enforcement effect is negative. Consequently, in optimum the welfare effect of the last merger investigation is negative. Since we assume a uniform distribution concerning which mergers are investigated, this means that on average the welfare effect of merger investigation as such (the enforcement effect) is negative.

Not all mergers detrimental to welfare are deterred in optimum. In that respect it is a surprise that it is not welfare improving to investigate more mergers. The driving force, however, is the systematic bias in the mergers that are proposed. When the worst mergers are deterred, the remaining ones are those that are welfare enhancing and those that are modestly detrimental to welfare. By choosing which one to investigate among them, it is a large risk of both type I and type II errors. Although one is fully aware of this fact when deciding on how many mergers to investigate, in optimum the merger investigations as such (enforcement effect) are detrimental to welfare.

We can solve explicitly for the optimal merger investigation. Since we have a uniform distribution of mergers that are investigated, to check for the effect of the enforcement effect of the merger investigation we can look at the average effect of an increase in N among all those mergers that are proposed. Then the total expected welfare effect for all proposed mergers divided by x^* is the enforcement effect of a marginal change in N .

Concerning the deterrence effect, we know that the merger that is deterred on the margin is x^* , which has $(1 - x^*)$ as the welfare effect. In addition, we must take into account how a merger investigation affects the deterrence. We then have that optimum deterrence is determined by the following condition

$$\frac{\int_{x=0}^{x=x^*} (1-x) \left[\frac{2-x}{2} \right] dx - \int_{x=0}^{x=x^*} (1-x) dx}{x^*} + (1-x^*) \frac{\partial x^*}{\partial N} = 0 \quad (10)$$

When we replace x^* with the expression in (7) and $\partial x^* / \partial N$ from (8), we can solve with respect to N . We know that at most all proposed mergers will be investigated ($N = 1$ at maximum). Then we have that:

$$N^* = \min \left\{ 1, \frac{\left(\sqrt{\pi(37\pi - 32C) + 4C^2} - 2\pi - C \right)}{3\pi} \right\} \quad (11)$$

If $N^* < 1$, then we have an interior solution (probability lower than one for each proposed merger being investigated). If so, we can replace N in (7) with N^* from the right term expression in (11), and we can find the optimal number of mergers that are not deterred. Otherwise, we set $N = 1$ in (7). The optimum x is then as follows:

$$x^* = \begin{cases} \frac{2(\pi - C)}{\pi} & \text{if } N^* = 1 \\ \frac{6(\pi - C)}{\sqrt{\pi(37\pi - 32C) + 4C^2} - 2\pi - C} & \text{if } N^* < 1 \end{cases} \quad (12)$$

We can now summarise our results:

Proposition 1: *If $N^* < 1$, we have that $1 < x^* < 1.5$, and some but not all potential mergers detrimental to welfare are deterred. The deterrence effect is positive, while the enforcement effect as such is on average negative. If $N^* = 1$, then all proposed mergers are investigated, and $x^* = 2(\pi - C)/\pi$.*

In Figure 4 we have reported a numerical example. It is assumed that $C = 0.1$. The solid black curves denotes x^* while the dotted black curve denotes N^* for different values of π . For $\pi < 0.35$, not all proposed mergers are investigated and we have an interior solution ($N^* < 1$). For $\pi \geq 0.35$ all proposed mergers are investigated ($N^* = 1$). We see that for $\pi < 0.35$ an increase in profits has a smaller impact on the optimal number of proposed mergers than what is the

case for $\pi > 0.35$. The reason is that the impact of an increase in π is partly offset by an increase in N . The offsetting effect is no longer present when π is sufficiently large, because then there is no scope for a further increase in the number of mergers investigated.

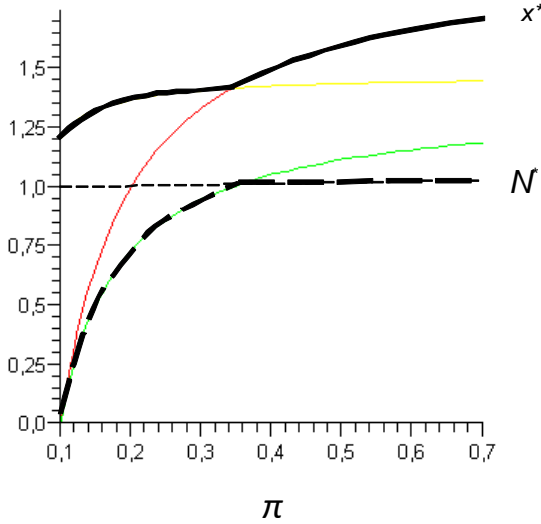


Figure 4: A numerical example, given that $C = 0.1$

We have assumed that all mergers have the same profitability. Obviously, some mergers are more profitable than others. If the profitability varies, then there is no longer a one-to-one relationship between mergers being deterred and the mergers that are detrimental to welfare. For example, a merger that has a large negative impact on welfare might be proposed because there are prospects for large profits following a clearance for this particular merger.

In principle, large variation in profits between potential mergers might destroy the deterrence effect. Those deterred mergers are the unprofitable ones rather than the ones with a negative impact on welfare. Note, however, that we still assume that mergers that are detrimental to welfare have a higher probability for being banned than welfare enhancing mergers.

Moreover, if mergers typically lead to synergies then we expect a positive correlation between welfare and profits, which also tends to prevent the mergers with a positive impact on welfare from being deterred. As long as the variation in profits is sufficiently small, we would observe that not all but most of the deterred mergers are typical mergers that are detrimental to welfare. If this is true, the expected deterrence effect of a merger is still positive as long as not too many mergers are deterred. This is analogous to the mechanism in our basic model. In optimum the last merger deterred is then expected to be a merger detrimental to welfare.

Given that, the enforcement as such has on average a negative impact on welfare. Proposition 1 will then hold, as long as the variation in profits is not too large and the quality of the merger control is sufficiently high (see next point).

2.5 The quality of the merger control

If the quality of the merger control is sufficiently high, the deterred mergers are expected to be on average those with a negative impact on welfare even if we observe variation in profits. Let us now introduce a parameter β , where $0 \leq \beta \leq 1$. This parameter can be a proxy for the quality of the final decision. We now define the expected welfare effect of merger x following a merger investigation as follows:

$$EW_x = (1-x) \left[\frac{(2-x)^\beta}{2} \right] \quad (13)$$

Until now we have assumed that $\beta = 1$. If $\beta < 1$, there will be more type I and type II errors. In fact, if $\beta = 0$ the final decision is a random choice where all investigated mergers will have a probability of $\frac{1}{2}$ for being banned. More type I and type II errors implies that the enforcement costs of merger investigations are higher, and according to this effect fewer mergers should be investigated.

On the other hand, we must also check how a reduction in β will influence the merger candidates' incentives to propose a merger. To do that, let us also introduce the possibility of a relationship between the welfare effect and the profitability. We take into account that mergers detrimental to welfare can be more or less profitable than mergers that enhance welfare. The parameter α captures this relationship. If $\alpha = 0$, then there is no relationship between the profitability and the welfare effect of a merger. If $\alpha < 0$, then mergers with the highest profitability are the ones with the largest improvement in welfare. If $\alpha > 0$, the opposite is true and the welfare effect is decreasing in the profitability of a merger. A merger is now profitable if:

$$M_x = x^\alpha \pi \left[N \frac{(2-x)^\beta}{2} + (1-N) \right] - C > 0 \quad (14)$$

For the moment, let us assume that $\alpha = 0$ (as in the previous discussion). It can then easily be seen that a reduction in β will make it more profitable to merge for all mergers $x > 1$. The reason is that a less precise final decision by the competition authorities is beneficial for all merger candidates that have more than 50 % probability of being banned. Those merger candidates with a merger that is expected to be detrimental to welfare do have larger probability than $\frac{1}{2}$ for being banned, and a less precise final decision would make it more likely for them to be cleared.

We now see that a less accurate final decision will lead to a higher cost of enforcement and higher incentives for the firms with mergers that are detrimental to welfare to propose a merger. This implies that a reduction in β will result in fewer mergers being deterred, *i.e.*, a higher x^* . Our main result will not change, since the enforcement as such still has a negative impact on welfare in optimum. In fact, the average cost associated with merger investigations as such is now higher than what is the case with a more correct outcome of the merger investigation. We see that the quality of the merger investigation is not only about type I and type II errors, but also about deterrence since a more accurate final decision leads to more deterrence.¹⁸

If $\alpha < 0$, there is a positive correlation between profitability and welfare. For example, this can be true if there are cost synergies that both the firm and the society benefits from. In such a case our results still holds, since both the probability of being banned and the profits tends to favour mergers with a positive impact on welfare.

However, $\alpha > 0$ can change our results quite dramatically. It can easily be seen from (14) that if α is sufficiently high there will no longer be any deterrence of the mergers with the largest negative impact on welfare. The reason is that those anticompetitive mergers are by definition the most profitable mergers, so they propose a merger even if there is a probability that they can be banned. For a given α , though, the quality of the merger investigation is crucial for the deterrence effect. As shown above, a higher β (more precise final decision) will make it more profitable to merge for those mergers that are welfare enhancing and less profitable to merge for those mergers detrimental to welfare. Moreover, a higher β has the largest impact on the worst mergers seen from a welfare perspective (and on the best mergers). If the negative

¹⁸ As shown in Schinkel and Tuninstra (2006), active enforcement may actually make anticompetitive behavior more likely if enforcement agencies commit mistakes.

relationship between profits and welfare is sufficiently weak (sufficiently low α), then deterrence of the mergers most detrimental to welfare is still possible if we have a sufficiently high quality on the merger investigations.

It is an empirical question whether there is a (negative) relationship between welfare and profits. A merger to monopoly is expected to lead to higher prices and higher profits. In that respect the merger most detrimental to welfare can be among the most profitable mergers. However, the probability for a merger to monopoly to be banned is quite high. In our model, if $\beta = 1$ and the merger to monopoly is the worst one seen from society's perspective it is banned with certainty. This might imply that the marginal merger being deterred is not a merger to monopoly, and certainly not if the quality of the final decision of the competition authorities is sufficiently high. Concerning merger to oligopoly, it is not obvious that there is a strong negative relationship between welfare and profits for the merging firms even if it is clear that a merger leads to higher prices. For example, a merger with no cost effects and a reduction from three to two firms can lead to substantial higher prices but lower profits for the merging parties.¹⁹ This illustrates that the mergers with the largest price increases are not necessarily the ones with the largest increase in profits for the merging parties. Results from empirical studies are mixed, where some of them find that mergers are motivated by cost reductions while others find that they are motivated by market power.²⁰ If cost synergies are present, then we expect a positive relationship between profits and welfare since synergies are typically beneficial both for firms and for the society. This raises questions about whether there in fact is a negative relationship between profits and welfare. But even if there is such a relationship, the mergers most detrimental to welfare are the ones that are deterred if the competition authorities' final decision is of sufficiently high quality.

Proposition 2: *If the relationship between profits and welfare (α) is positive or modestly negative, then a sufficiently high quality of the merger control (high β) will ensure that anti-*

¹⁹ This was first shown in Salant *et al* (1983), where they applied a setting with Cournot competition and identical firms. The basic mechanism is that the non-merging parties can free ride on the output reduction of the merging firms, and thereby can the non-merging firms increase both sales and prices. If we apply a model with Bertrand instead of Cournot competition, a merger with no cost savings will always increase profits. However, also in that case the non-merging firms are better off following the merger than the merging firms.

²⁰ For recent surveys of the empirical literature, see Fridolfsson and Stennek (2005b) and Kokkoris (2007). Note, though, that these studies are mainly concerned about distinguishing between market power and cost reductions as a motive for merging. Even if they conclude that market power is the motive, they have not proven that mergers with a large negative impact on welfare are more profitable.

competitive mergers are deterred. A higher quality of merger control (higher β) leads to more deterrence.

The quality of the merger decisions made by the competition authority also depends on the choice of mergers being investigated. Until now we have assumed that the choice of mergers being investigated is uniform distributed. What if the selection process is less random, so that it is influenced by whether a merger is welfare improving or not? First, we know from the discussion concerning (9) that the marginal effect of merger investigations (enforcement effect) must in any case be negative. The question is whether the enforcement effect can be negative on average for other cases than uniform distribution of which mergers are investigated. If the decision concerning which mergers are investigated is influenced by the welfare effect and not chosen randomly, this would lead to a lower risk for type I errors (banning a merger that is not anti-competitive). If so, we expect more mergers to be investigated and then a larger fraction of the anti-competitive mergers being deterred. But even then we might end up with merger enforcement as such being detrimental to welfare. For example, think about a situation where the choice of which mergers to investigate is close to being perfect. Then close to all mergers that are detrimental to welfare are deterred, and the observed mergers being proposed consists of almost only mergers that are welfare enhancing. This leads to very few, but at least one, type I error. The actual effect of merger enforcement is then on average expected to be negative.

2.6 No commitment

Let us now relax the assumption that there is a commitment to a merger investigation activity at stage 1. We let the competition authority observe the number of mergers being proposed before they decide how many of those mergers that will be investigated. They can then update their beliefs about the welfare effect of investigating a merger. Moreover, let us assume that they can observe which mergers are proposed but not the identity for each of them.

For the moment, let us assume that the proposed mergers are those with the lowest negative impact on welfare. If this is the case, the competition authority would know that a banned merger will on average be detrimental to welfare as long as $x^L < 1.5$ (see Lemma 1). This is true even when the competition authority takes into consideration the signal when the final decision is made. It means that as long as $x^L \leq 1.5$, no mergers should be investigated. If $2 \geq$

$x^L > 1.5$, the competition authority knows that investigating a merger would on average improve welfare. In that case all mergers should be investigated.

Proposition 3: *If no commitment and the mergers with the largest negative impact on welfare are those that are not proposed, then no mergers will be investigated if $x^L \leq 1.5$, and if more mergers are proposed all of them will be investigated. The number of proposed mergers are $x^{**} = \max \{1.5, \min\{2(\pi - C)/\pi, 2\}\}$.*

Given no commitment by the competition authority, the firms considering to merge can influence the decision to investigate. If the profitability to merge is sufficiently high, they will decide to merge even if they know that it will trigger an investigation of all proposed mergers. Otherwise, the equilibrium outcome implies that so few firms merge that the competition authority decides not to investigate any proposed mergers. Strategic behaviour by the merging parties will then result in no investigation taking place in equilibrium. This is an equilibrium, because one more additional merger would trigger an investigation of all mergers. If so, this additional merger is not profitable.

The effect of no commitment in this case is illustrated in Figure 5, which is the same numerical example as in Figure 4. We assume that $C = 0.1$. The left hand figure is from Figure 4. The right hand figure is the optimal amount of proposed mergers and the optimal activity level if no commitment for the case where the proposed mergers are the best mergers for society. We see that the optimal number of proposed mergers is higher if no commitment as long as $\pi < 2/5$. For higher values of π , all proposed mergers are investigated irrespective of whether there is no commitment or a commitment.

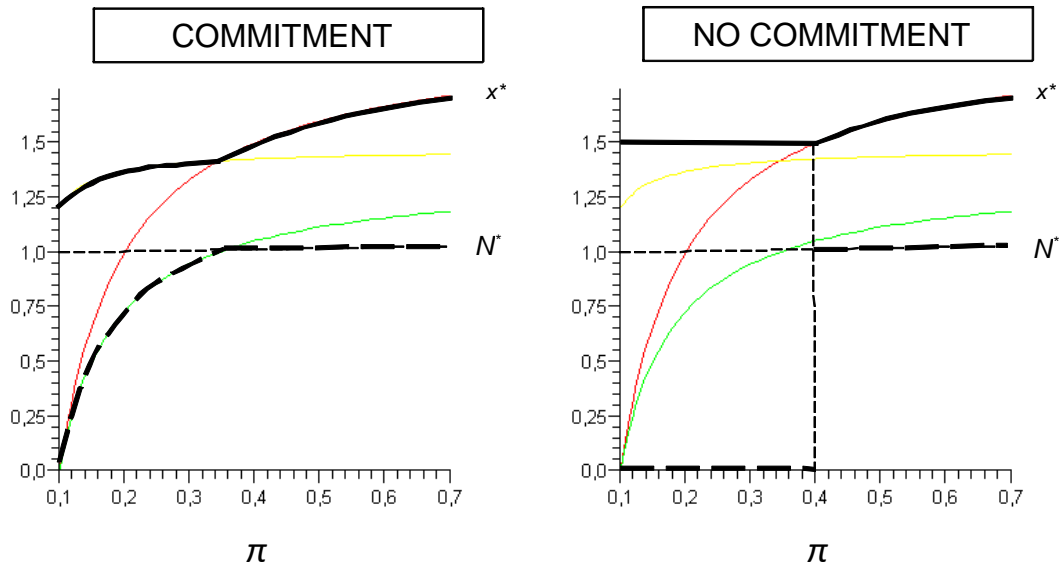


Figure 5: A numerical example, given that $C = 0.1$, for commitment and no commitment

So far we have derived the equilibrium outcome given that the mergers with the largest negative impact on welfare are the ones not proposed. However, there might be other equilibria as well. The reason is that the merging parties now can act strategically, since their decision can affect whether any investigation are undertaken or not. Each merger candidate would like to be one of the proposed mergers, given that the total number of proposed mergers is so low that the competition authority decides not to investigate any mergers.

Note that there will always be some mergers that will be proposed in any case, and that consists of all mergers including $x = 2(\pi - C)/\pi$. These are the mergers that are profitable even if all proposed mergers are investigated. As shown in the case in Figure 5, with low π there is scope for some additional proposed mergers without triggering any investigations. Those additional proposed mergers can be chosen among all remaining potential mergers. If some of the worst mergers seen from society is proposed and the competition authority knows which mergers are proposed, but not the identity of each of them, it would imply that an investigation is triggered at an earlier total number of mergers. The next potential merger that can be proposed will refrain from doing so, because he knows that it would have triggered an investigation of all mergers including this particular merger.²¹

²¹ Note that since there is a multiplicity of equilibria in pure strategies, there will also be an equilibrium in mixed strategies.

The merging parties can behave strategically, and they do so by proposing such a limited number of mergers so that any investigation – whether all or only some mergers are investigated – will not increase welfare. Then it can be shown that we have the following result

Proposition 4: *If $2(\pi - C)/\pi \geq 1.5$, merger policy is not affected by whether there is a commitment or not. Otherwise, we have that with no commitment merger policy leads to a less active merger policy and lower welfare compared to a regime with commitment.*

Proof: If commitment and $x^* > 2(\pi - C)/\pi$, $dEW / dN = 0$ in optimum. For lower values of N , $dEW / dN > 0$. Hence, $\Delta EW > 0$ with commitment. If no commitment, either $N = 0$ or $N = 1$. For all $x > 2(\pi - C)/\pi$, $M_x < 0$ if $N = 1$. Then $N = 1$ cannot be an equilibrium for $x > 2(\pi - C)/\pi$. If the number of proposed mergers are such that $\Delta EW \leq 0$, then $N = 0$. Obviously, in equilibrium then the number of proposed mergers are such that $\Delta EW = 0$. Hence, welfare is higher with commitment.

Consider whether there are any investigations in the no commitment regime. If $x^* > 2(\pi - C)/\pi$, there are some of the proposed mergers in the commitment regime where $M_x < 0$ if $N = 1$. Hence, $N = 1$ cannot be an equilibrium with no commitment. If $x^* > 2(\pi - C)/\pi$, we would then have $N = 0$ with no commitment and $0 < N < 1$ if commitment. If $x^* \leq 2(\pi - C)/\pi$, $N = 1$ in both regimes. Q.E.D.

It implies that a situation where the competition authority updates their beliefs after observing the number of mergers is detrimental to welfare. This is rather paradoxical. But the driving force is that the competition authority would prefer not to make too many type I errors and that the merging parties can exploit this fact. They propose mergers until an additional merger would have triggered an investigation of all proposed mergers, thereby encouraging the competition authority to have no merger investigations. This will lead to a less active merger policy, as illustrated in the example in Figure. In other cases it can in addition lead to an inefficient deterrence of mergers. Those mergers most detrimental to welfare can be among those proposed mergers, in contrast to what would happen if the competition authority had a commitment to an activity level.

3. Some concluding remarks

An important lesson from our model is that deterrence matters for the choice of an optimal merger policy. If deterrence is present, it would have an impact on how active - or more precisely how restrictive - merger investigation policy should be. For example, we show that it is wrong to think that the deterrence effect is something that comes in *addition* to the enforcement effect. If the deterrence effect is present, the enforcement effect should be negative on average in optimum. This is true if the competition authority commits to a certain activity level. Commitment would lead to a more active and a better merger policy even if some mergers that are beneficial to welfare are banned (type I errors). Moreover, the quality of the merger investigation is crucial not only for the amount of type I and type II errors, but also for how many and which mergers that are deterred.

One implication of our results is that it matters how the competition authority is organized. If no commitment, we find that merger control can be less active and lead to lower total welfare. A commitment to an active merger control could be implemented by instructing the enforcement agency – which typically is the competition authority – to have a particular activity level concerning investigating proposed mergers. One way to do this could be to establishing separate merger units within the competition authority, to ensure that resources are not devoted to other activities within the competition authority.²² In any case, it might not be that difficult to solve such a commitment problem since competition authorities should be concerned about the deterrence effect and would prefer to build a reputation for having a rather active policy.

Our results illustrates that it is important to have information about whether any potential mergers are deterred, and whether those mergers most detrimental to welfare are the ones that are deterred. A recent study, covering 28 different jurisdictions, finds that an increase in the ban on mergers does have a negative impact on the number of mergers that is notified.²³ This is consistent with merger policy having a deterrence effect. Another study did find some

²² This is analogous to the time inconsistency problem discussed in Besanko and Spulber (1993). They have shown that it can be optimal for the legislator to impose a consumer welfare standard on an agency, because that would lead to decisions being more in line with an overall total welfare standard. See also Farrell and Katz (2006), where the commitment problem is discussed.

²³ See Seldeslachts *et al.* (2008), in which both the effects of a ban and imposing remedies is investigated. They employ a cross-jurisdictional data set for merger policies over the period 1992-2003.

support for a change in merger policy in the US towards a more active merger control led to deterrence of more anti-competitive mergers.²⁴ On the other hand, a study did not find any tendency of more anti-competitive mergers in Canada than in the US in the period 1961-82 despite the fact that Canada did not have any antitrust agency prior to 1985.²⁵

There is also evidence from surveys suggesting that the deterrence effect can be present.²⁶ NMa in the Netherlands initiated a survey where individuals working in competition law and consultancy firms were asked about possible cases where merger plans were dropped due to the anticipation of an active merger control.²⁷ They did find support for mergers being deterred by the merging parties due to the anticipated problems associated with acceptance by the NMa. In sectors with very high concentration, undertakings do not invest energy in ideas for mergers. This indicates not only deterrence as such, but also that those mergers that are deterred are those with the largest negative impact on welfare. Of the ideas that reach lawyers – approximately 400 each year – almost half is abandoned almost immediately and according to the study the anticipation of merger control may play a role. A recent study from United Kingdom used a similar kind of survey.²⁸ It was found that for every merger that is blocked or modified following an intervention by the UK competition authorities, there are at least five mergers that are either abandoned or modified on competition grounds. This implies that for every merger ban there are at least five mergers that are deterred or modified. In line with this, they also found that the deterrence effect is more prevalent in those sectors where it has recently been a Competition Commission inquiry.

These studies of the existence of deterrence indicate that what we observe is indeed a ‘tip of the iceberg’. Given these indications of deterrence of a rather large magnitude, it is of interest to look at the figures for merger control for the EU. 20 mergers have been prohibited since 1990, which is on average slightly more than one merger ban each year in EU since 1990. This is on average less than 0.6 % of the number of notified mergers in the same period. More

²⁴ See Eckbo and Wier (1985), using an event study to analyse the effect of the US Hart-Scott-Rodino reform.

²⁵ See Eckbo (1992).

²⁶ For earlier surveys of possible deterrence effects of antitrust, see Beckenstein and Gabel (1983) concerning the US and a similar survey in Feinberg (1985) concerning Europe. See also Audretsch (1983), which is quoted in Kouliavtsev (2004). It is found that an average merger case brought by the Justice Department or FTC in the US deters between 11 and 16 other mergers.

²⁷ See Twynstra Gudde (2005). See also NMa (2005), section 13.1, where some of the results are reported.

²⁸ See Deloitte (2007), a report that was initiated by OFT.

interestingly, the number of mergers being banned every year has gone down in recent years. This is illustrated in Figure 5, where the accumulated number of banned mergers is reported.²⁹

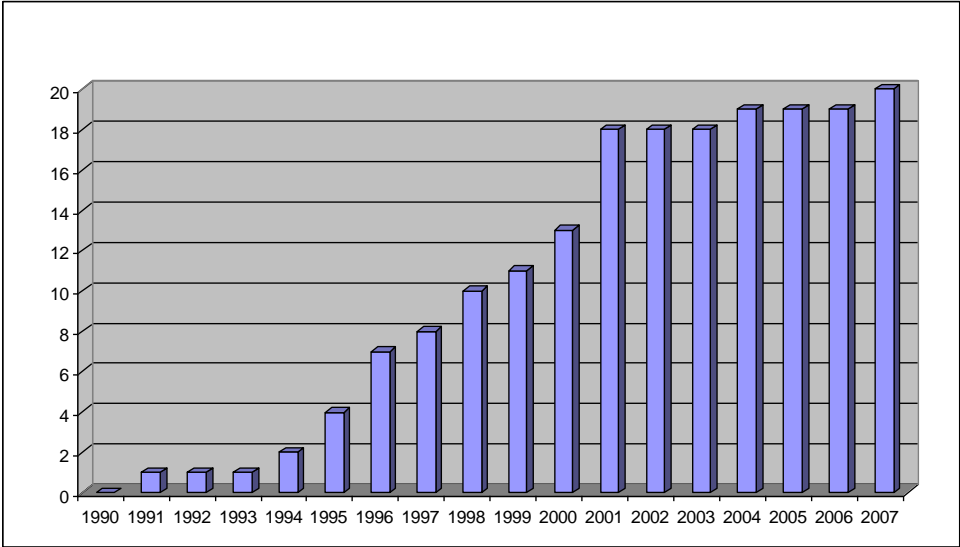


Figure 5: Accumulated number of merger prohibitions in EU 1990-2006

After 2001, only two mergers have been banned in EU. Does the slowdown in the growth in the accumulated number of prohibited mergers in recent years indicate that the deterrence effect is present and has become more prevalent in recent years? It is also of interest to note that the number of withdrawn mergers during the merger process has fallen in the EU. This might indicate that merging parties are becoming better to anticipate the outcome of the merging investigation in the EU, which implies that more mergers that is expected not to be cleared are not proposed.³⁰

The presence of a deterrence effect is also important for understanding the impact of the actual merger enforcement. In our model we find that on average merger investigations are detrimental to welfare, and they are undertaken simply because they deter anti-competitive mergers. In such a perspective one should be careful with the interpretation of the impact of actual merger control. If one finds a large positive impact, as for example in the study by

²⁹ The data are reported at <http://ec.europa.eu/comm/competition/mergers/statistics.pdf>.

³⁰ See Davies and Lyons (2007), Table 1.1., where they compare the number of withdrawals in the EU for different time periods since 1990.

OFT, how can we explain that?³¹ One interpretation could be that we have underenforcement. Could it be that merger policy then should be more active, to deter more firms from merging and thereby achieve the optimum merger policy? Another interpretation could be that one so far has not reached the optimum, so merger candidates will in the future learn and be deterred to a larger degree than today. But if this is true, measuring the effects of merger enforcement as such over time will then in the future wrongly conclude that merger control has become less successful.

³¹ In OFT (2007) they report the outcome of merger simulations, and conclude that ‘during the past three financial years OFT merger control has saved, on average, £ 52M each year’ (see paragraph 4.38). In comparison, for the financial year 2006-07 OFT spent £ 4M on merger control (see Table 8).

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