Optimal merger policy:

Enforcement vs. deterrence[1]

Lars Sørgard

Department of Economics

Norwegian School of Economics and Business Administration

Email: lars.sorgard@nhh.no

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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 consider the optimal number of merger investigations, both when the competition authorities commit to a particular activity level and when they do not commit. If commitment, it is shown that a low quality of the final decision may lead to deterrence of the mergers that would have been welfare improving. On the other hand, when the potential mergers with the largest negative impact on welfare are deterred we find that the merger investigations as such might have a negative impact on welfare (enforcement effect). It is shown that no commitment can lead to a less active merger policy and lower welfare than what is the case if commitment. The results have important implications for how one should interpret the empirical studies of the effects of merger enforcement.

JEL codes: L13, L41

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 decisions 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

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[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 Office of Fair Trading (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 existing literature is mainly concerned about how to minimize the costs associated with errors of type I and II.[9] The purpose of this article is to help fill this gap. We formulate a model which incorporates type I and type II errors as well as the potential for deterrence. 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. Given that mergers detrimental to welfare are more likely to be prohibited than welfare improving mergers, we expect that the deterred mergers are the ones that would have had large negative impact on welfare. On the other hand, those mergers might be the ones with the largest profitability from merging. We show that if the quality of the final decision to ban or not is sufficiently low, we may end up with deterring the mergers that would have improved welfare. This illustrates that the accuracy of merger control is not only about avoiding type I and type II errors, but also about deterring the right mergers.

In our basic model we assume that the competition authorities commit to a particular activity level, which means that there is a certain probability for a proposed merger being investigated. If investigated, the competition authorities receive 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 authorities must make a tradeoff between deterrence and making mistakes in its

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[8] Two exceptions are Katsoulacos and Ulph (2007, 2008), described later on in the text. There are 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.

[9] Such a decision-error framework was introduced in Easterbroook (1984). For a discussion of this framework, see Beckner and Salop (1999) and Joskow (2002).

final decision. On the one hand, an active merger policy that is sufficiently accurate 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). In fact, the enforcement effect is negative if the marginal cost of enforcement is sufficiently low. Those 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 authorities, we show that the merger policy can become less active and that the welfare can be lower than what is the case with commitment. We allow the competition authorities to observe the number of mergers being proposed before they decide whether to investigate or not. 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 might decide not to investigate any mergers 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. We show that no commitment can lead to lower welfare, because the merging parties can exploit the fact that they are able to influence the competition authorities' decision to investigate or not.

The two papers closest related to our work are Katsoulacos and Ulph (2007, 2008). One of the novelties of their work is to combine the decision-error framework with deterrence and procedural effects. They find conditions for when an effects-based approach is able to effectively discriminate between benign and harmful actions and consequently perform better than a per se approach. We complement their analysis by focusing on the effects-based approach used in merger control. In our model an active merger control can lead to an adverse selection of proposed mergers, since those mergers most harmful to society are more likely to

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be banned than other mergers. This is the driving force in our model, a mechanism not present in their model.[10]

In the next section we present our basic model and our results, report an example, and analyze the outcome if no commitment by the competition authorities. 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 X potential mergers in an economy. Among the population of potential mergers, some are welfare improving and others not. Let us define $f(x)$ as the welfare effect of merger x. The mergers are ranked according to their welfare effect, with $x = 0$ as the best one and $x = x^H$ as the worst one. The aggregate welfare effect of all potential mergers is as follows:

$$W = \int_0^{x^H} f(x) \tag{1}$$

We assume that all these mergers are profitable if there is no merger control. Let us introduce a merger control by allowing competition authorities (CA) to investigate some (or all) proposed mergers and either clear or prohibit those that have been investigated. The probability of investigating a proposed merger is N, where $0 \leq N \leq 1$. The sequence of moves is as follows:

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

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[10] In their model the fraction of harmful action in an environment is decisive for the probability of having an action disallowed. Note, however, that within an environment the probability of an action being disallowed is the same for a harmful action as for a benign action.

At stage 5, CA uses the signal it received at stage 4 to make a decision. The signal is drawn from a distribution that is conditional on the actual welfare effect.[11] Let $g(x)$ denote the probability of a clearance (a 'yes') for merger x, where $0 \leq g(x) \leq 1$. We assume that $\partial g / \partial x < 0$. It implies that it is a larger probability for a clearance for a welfare improving merger than for a merger that is detrimental to welfare. However, this signal is not perfect. There is scope for both type I and type II errors when the final decision is made.

At stage 3 CA decides which mergers to investigate. We assume that all mergers have the same probability of being investigated in detail by the CA. It is a plausible assumption, given that CA has a large degree of uncertainty early in the merger investigation.[12]

At stage 2 the firms decides to merge or not. It seems plausible to assume that the firms know more about the effect of the merger than CA. In line with this, we assume that each firm anticipates the welfare effect of their own merger and the expected decision that will be made by CA.

$\pi(x)$ denotes the net present value of the merger that is cleared, implying that the net present value from merging depends on which merger we consider. Furthermore, we assume that the costs associated with implementing the merger are equal to C for all mergers. The latter is a sunk cost that is incurred following the decision to merge, irrespective of whether the merger is allowed or not. It is profitable for firm x to undertake a merger if

$$M_x = \pi(x)\big[N \cdot g(x) + (1-N)\big] - C > 0. \tag{2}$$

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 inside the bracket are multiplied with the net present value from a merger that is cleared, so that we

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[11] It can also be the case that the signal it receives is updated after it observes the number of mergers being proposed. This is discussed later on.
[12] 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.

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 implementing the merger.

If $N > 0$, some of the potential mergers might be unprofitable since they anticipate a possible prohibition. To see which mergers that are deterred, let us consider how the profitability from merging is for different merger candidates:

$$\frac{\partial M_x}{\partial x} = \frac{\partial \pi}{\partial x} \cdot \left[N \cdot g(x) + (1 - N) \right] + \pi \cdot \frac{\partial g}{\partial x}$$

(3)

We then have the following result:

Proposition 1:

If

$$\frac{\partial \pi}{\partial x} < -\frac{\pi \cdot \dfrac{\partial g}{\partial x}}{N \cdot g(x) + 1 - N},$$

those mergers that are deterred are the ones with the largest negative impact on welfare.

Otherwise, the mergers with the largest positive impact on welfare are deterred.

Proof: This follows straightforward from (3). Q.E.D.

Note that since we assume that $\partial g / \partial x < 0$, the right hand side of the expression in Proposition 1 is always positive. It can then easily be seen from Proposition 1 that a sufficient condition for the worst potential mergers being deterred is that there is a non-negative relationship between mergers' net present value and welfare, *i.e.,* net present value is non-decreasing in welfare ($\partial \pi / \partial x \leq 0$). This is easily seen if we consider the case where all potential mergers have the same net present value ($\partial \pi / \partial x = 0$). Then the only difference between the mergers is the probability for being prohibited given that they are investigated. Since a merger with a large negative impact on welfare has a larger probability of being prohibited, the potential mergers that are deterred are the ones with the largest negative impact on welfare. This implies that:

Corrollary 1: *∂π/∂x ≤ 0 and ∂g/∂x < 0 are sufficient conditions for the potential mergers with the largest negative impact being deterred.*

If there is a negative relationship between mergers' net present value and welfare – the mergers with the largest negative impact on welfare are the most profitable ones – then the accuracy in the merger investigations matters for which potential mergers being deterred. For example, let us assume that *∂g/∂x* is negative and close to zero so that the signal is a poor predictor for whether a merger is welfare improving or not. If the mergers with the largest negative impact on welfare are the ones that have the highest net present value, then the welfare improving mergers can be the ones that are deterred. This implies that the quality of the merger investigation is not only about type I and type II errors when investigating mergers, but also about whether the right potential mergers are deterred.[13]

It is an empirical question whether there is a non-negative relationship between welfare and merger profitability. 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 can be quite high. If so, this might imply that the marginal merger being deterred is not a merger to monopoly.

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.[14]

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.[15] If

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[13] This is in line with the result shown in Schinkel and Tuninstra (2006). They found that active enforcement may actually make anticompetitive behavior more likely if enforcement agencies commit mistakes.

[14] 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.

[15] 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.

cost synergies are present, 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, as shown in Proposition 1 the mergers most detrimental to welfare are the ones that are deterred if CA's final decision is of sufficiently high quality.

At stage 1 of the game CA sets the activity level by determining the probability for a proposed merger being investigated (setting N). We know that N will influence the number of mergers being proposed. For ease of exposition, let us assume that the condition in Proposition 1 is met so that the worst mergers are deterred. Let us define x^* as the proposed merger with the largest negative impact on welfare. Then all mergers $x* < x \leq x^H$ are deterred. Note that a marginal change in N will affect $x*$. Furthermore, let us normalise the marginalcost of enforcement to zero.[16]

If a merger is investigated, there is a probability $g(x)$ that this merger will be cleared. If it is not cleared, we assume that the merger is not implemented and there is no effect on welfare. This implies that the welfare effect of the proposed merger x if it is investigated is $f(x)g(x)$. To see the net effect of enforcement, we have to compare this expected welfare with the welfare effect of this merger if no merger control. In addition, we have to take into account the deterrence effect of an active merger control. CA has the following maximization problem at stage 1:

$$\underset{N}{Max} \quad EW = \int_{0}^{x^*} \left\{ N \cdot [f(x)g(x)] + (1-N) \cdot f(x) \right\} dx - \int_{x^*}^{x^H} f(x) dx \tag{4}$$

The first integral is the welfare effect of enforcement as such, and it contains two terms. The first term inside the square brackets is the expected welfare of a proposed merger that is investigated. Since all proposed mergers have the same probability for an investigation (N), they are multiplied with N. The second term is the welfare effect if a proposed merger is proposed but not investigated. The second integral is the welfare effect of the potential mergers that are deterred by an active merger control.

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[16] An extension of our model could be to allow the effort of CA to influence the signal. We leave this issue for future research.

The first order condition for CA is then the following:

$$\frac{\partial EW}{\partial N} = \underbrace{\int_0^{x*}[f(x)g(x)-f(x)]dx}_{ENFORCEMENT} + \underbrace{(f(x*)[2-N\cdot(1-g(x*))])\frac{dx*}{dN}}_{DETERRENCE} = 0 \qquad (5)$$

The first term, denoted the enforcement effect, is the net welfare effect of any possible prohibition following an investigation. The second term is the deterrence effect. It is the effect of an increased activity level by CA on the number of mergers being proposed and, in turn, on expected welfare. This implies that the sum of the enforcement effect (the first term) and the deterrence effect (the second term) should be equal to the marginal cost of enforcement, which is normalised to zero.

Let us define x^0 as the potential merger with no effect on welfare, $i.e.$, $f(x^0) = 0$. Then all mergers $x^0 > x$ are detrimental to welfare. Furthermore, let us assume that if all potential mergers are proposed, then merger enforcement as such is beneficial for society.

Proposition 2:

If the potential mergers with the largest negative impact on welfare are deterred, then (i) x^0 < x^* < x^H and (ii) the deterrence effect is positive and the enforcement effect is negative.

Proof: We know from the profit function for merging that $dx*/dN < 0$. Since we assume that $0 \le g(x) \le 1$ and $0 \le N \le 1$, we see that the sign of the deterrence effect is determined by the sign of $f(x*)$. This implies that the deterrence effect is negative if $x* < x^0$. We know that the enforcement effect is negative if $x* < x^0$. Since both effects are negative when $x* < x^0$, this cannot be an equilibrium. If $x* = x^0 + \varepsilon$, then the enforcement effect cannot be positive since enforcement leads to errors and in such a case almost all proposed mergers are beneficial for society. Let us consider the case where the enforcement effect is zero. As explained, this would imply that $x* > x^0$. However, this cannot be an equilibrium since then the deterrence effect is positive. A higher N would then lead to higher expected welfare. This implies that when in optimum the deterrence effect is positive, the enforcement effect must be negative. Q.E.D.

To determine how many mergers that should be investigated, CA 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 shown in Proposition 2, in optimum the enforcement effect is lower than the deterrence effect. In the case shown in the Proposition, where marginal costs are normalised to zero, it implies that in optimum the enforcement effect is negative while the deterrence effect is positive.

The driving force behind our result 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 type I 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) can be detrimental to welfare.

We have normalised marginal cost of enforcement to zero. For sufficiently high marginal costs, the enforcement effect will be positive. This implies that the enforcement effect is negative as long as marginal costs are sufficiently low.

2.2 An example

To illustrate the trade off between the enforcement effect and the deterrence effect, let us consider an example. The welfare effect of merger x is defined as follows:

$$f(x) = 1 - x \tag{7}$$

We normalise the number of mergers to 2. The merger $x = 1$ has then no effect on welfare. The probability for receiving a good signal for merger x is defined as follows:

$$g(x) = \frac{2 - x}{2} \tag{8}$$

We see that the larger the true welfare gain, the larger 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.

Furthermore, let us for the moment assume that the final decision is in accordance with the signal CA receives (no updating). The expected value for society of merger x is the welfare effect multiplied with the probability that it receives a good signal and then is cleared:

$$EW_X = (1 - x)\left[\frac{2 - x}{2}\right] \tag{9}$$

To illustrate the existence of type I and type II errors, let us for the moment consider the case where all potential mergers are proposed and all of them are investigated. In Figure 1 we have plotted the expected value for society of all mergers, taking into account the probability that a merger is cleared or not after investigation.

The dotted line in Figure 1 is the welfare effect of each merger, given that all potential mergers are implemented and none of them are banned (no merger control). The solid curve is the expected welfare effect of each merger, given that all of them are investigated and the final decision is in accordance with the signal CA receives.

The difference between the solid curve and the dotted line in Figure 1 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 (medium grey area). This is the positive effect of having merger investigations. However, not all mergers that are detrimental to welfare are banned. 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 1 with the difference between the solid and the dotted curves for mergers that are welfare improving. These are the type I errors, shown with the yellow (light grey) area in Figure 1.
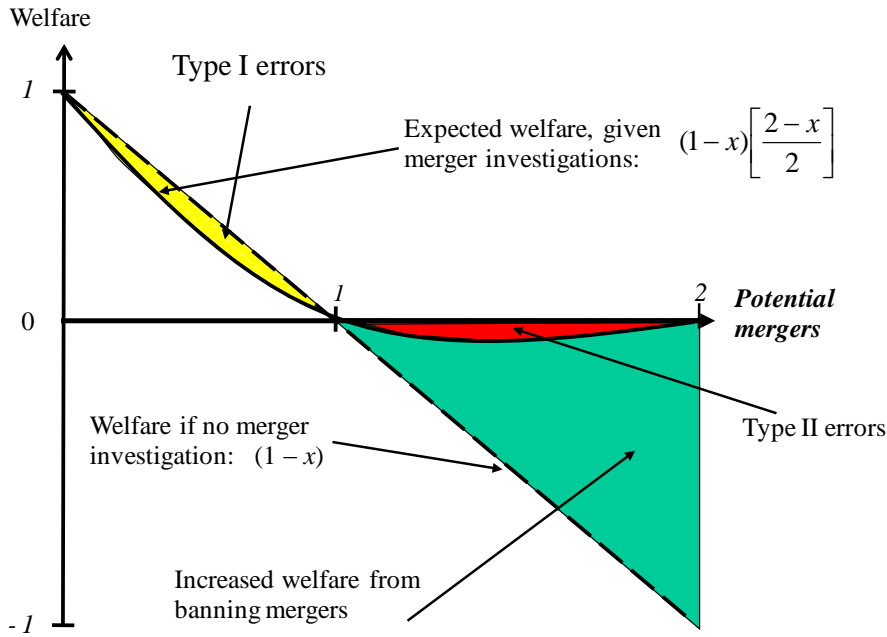
Figure 1: **Expected welfare effects of mergers**

In contrast to what is shown in Figure 1, some potential mergers are not proposed because the probability for a ban is too large. Given the assumption we have made, the mergers with the largest negative impact on welfare are the ones that are deterred. At stage 5, CA can observe the number of mergers being proposed. It can then update its signal. If for example we observe a population of 1 mergers being proposed, then we know that all those mergers are welfare improving. Let x^L denote the proposed merger with the largest negative impact on welfare. If $1 < x^L \leq 2$, we know that there is a population of 1 of the proposed mergers that are welfare improving. This implies that the fraction of the proposed mergers that are welfare improving is $1/x^L$. Then we have the following result:

Proposition 3*: If $f(x) = 1 - x$, $g(x) = (2 - x)/2$, CA uses the following updated signal after observing x^L:*

$$g(x,x^L) = \begin{cases} 1 & \text{if } x^L \leq 1 \\ \dfrac{2-x}{2-x(2-x^L)} & \text{if } 2 \geq x^L > 1. \end{cases}$$

Proof: Updating implies that the signal is as follows if $1 < x^L \leq 2$:

$$g(x, x^L) = \frac{\dfrac{2-x}{2} \cdot \dfrac{1}{x^L}}{\dfrac{2-x}{2} \cdot \dfrac{1}{x^L} + \dfrac{x}{2} \cdot \dfrac{x^L - 1}{x^L}}$$

Rearranging, we have the expression in the Proposition for $1 < x^L \leq 2$. Q.E.D.

Note that if $x^L = 2$, then the update will not change anything. The updated signal will be identical to the initial signal, *i.e.*, $g(x) = (2 - x)/2$. The reason is that all the potential mergers are proposed. In such a case we cannot learn anything from observing some potential mergers being not proposed, simply because all potential mergers are proposed.

Let us assume that π and C are identical for all mergers. The profitability of merger x is then the following:

$$M_x = \begin{cases} \pi - C > 0 & \text{if } x^L \leq 1 \\ \pi \left[N \dfrac{2 - x}{2 - x(2 - x^L)} + (1 - N) \right] - C > 0 & \text{if } 2 \geq x^L > 1 \end{cases} \tag{10}$$

Then we have the following result:

Proposition 4: *Given that CA follows the signal shown in Proposition 3, for a given activity level (N) the number of proposed mergers is:*

$$x^L = \frac{2 \cdot C - \pi \cdot (2 - N) + \sqrt{\pi^2 \cdot (N \cdot (N + 4) - 4) + 4 \cdot \pi \cdot C \cdot (2 - N) - 4 \cdot C^2}}{2 \cdot (C - \pi \cdot (1 - N))}$$

If all mergers are investigated, then the number of proposed mergers is:

$$x^{LN} = \frac{2 \cdot C - \pi + \sqrt{\pi^2 + 4 \cdot C \cdot (\pi - C)}}{2 \cdot C}$$

Proof: Rearranging (10) for the case $x^L > 1$ and for $x = x^L$ and solving with respect to x^L, we have the first expression. Setting $N = 1$, we find the second expression. Q.E.D.

2.3 No commitment

Let us now relax the assumption that there is a commitment to a merger investigation activity at stage 1 and a decision made in accordance with the signal that is received. We let CA

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observe the number of mergers being proposed before they decide how many of those mergers that will be investigated.

Let us assume that the proposed mergers are those with the lowest negative impact on welfare. Let us define x^{EE} as the number of proposed mergers that leads to zero enforcement effect. CA knows that a banned merger will on average be detrimental to welfare as long as the number of proposed mergers is below x^{EE}. If so, no mergers should be investigated. Otherwise, CA knows that investigating a merger would on average improve welfare. In that case all mergers should be investigated.

Proposition 5: *If no commitment and the mergers with the largest negative impact on welfare are not proposed, then no mergers will be investigated if the number of proposed mergers is lower than x^{EE}. If more mergers are proposed, all of them will be investigated.*

Given no commitment by CA, the firms 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 CA decides not to investigate any proposed mergers. Strategic behaviour by the merging parties can 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. Note that there is no longer any deterrence effect as such, since CA decides the activity level *after* observing how many mergers that are proposed.

We see from Proposition 4 that x^{LN} mergers will be proposed even if all proposed mergers are investigated. Each of those merger candidates will have as a dominant strategy to propose a merger. However, as explained above, the remaining parties that have the option to merge can behave strategically. They can 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 6: *Let us assume that the mergers with the largest negative impact on welfare are deterred. If $x^{LN} \geq x^{EE}$, 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 $x^{LN} \geq x^{EE}$, the enforcement effect is non-negative and $N^* = 1$ both with and without commitment. Let us consider the case where $(\pi - C)$ is such that $x^{LN} = x^{EE}$. A marginal reduction in $(\pi - C)$ will lead to $N^* = 0$ if no commitment. However, the enforcement effect is close to zero while the deterrence effect is strictly positive. This implies it is welfare improving to have $N^* = 1$ with commitment, than having $N^* = 0$ if no commitment. This shows that commitment, where both the enforcement effect and the deterrence effect is taken into consideration, leads to higher welfare as long as $x^{LN} < x^{EE}$. Q.E.D.

It implies that a situation where CA decides to investigate or not after observing the number of mergers can be detrimental to welfare. This is rather paradoxical. But the driving force is that CA 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 CA to have no merger investigations. This will lead to a less active merger policy.

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 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 CA decides not to investigate any mergers. Those additional proposed mergers can be chosen among all remaining potential mergers. If some of the worst mergers seen from society is proposed and CA 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.[17] This implies that the result shown in Proposition 6 is expected to still hold, even if some of the most harmful mergers are proposed.

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

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 control 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 and the mergers with the largest negative impact on welfare are deterred, the enforcement effect as such can in optimum be detrimental to welfare. This is true if the competition authority commits to a certain activity level and the marginal cost of enforcement is sufficiently low. 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.[18] 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 show that such a commitment is not only plausible, but that it can also be optimal to organize merger control in such a way.

To have a correct understanding of the overall impact of merger enforcement one should evaluate not only the enforcement 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

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[18] 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.

of a limited amount of deterrence and at the same time large direct gains from merger enforcement.

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.[19] This is consistent with merger policy having a deterrence effect. Another study did find some support for a change in merger policy in the US towards a more active merger control led to deterrence of more anti-competitive mergers.[20] 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.[21]

There is also evidence from surveys suggesting that the deterrence effect can be present.[22] 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.[23] 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.[24] 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.

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[19] See Seldeslachts *et al.* (2008), in which both the effects of a ban and imposing remedies is investigated. The employ a cross-jurisdictional data set for merger policies over the period 1992-2003.
[20] See Eckbo and Wier (1985), using an event study to analyse the effect of the US Hart-Scott-Rodino reform.
[21] See Eckbo (1992).
[22] 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.
[23] See Twynstra Gudde (2005). See also NMa (2005), section 13.1, where some of the results are reported.
[24] See Deloitte (2007), a report that was initiated by OFT.

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 interestingly, the number of mergers being banned every year has gone down in recent years. This is illustrated in Figure 2, where the accumulated number of banned mergers is reported.[25]
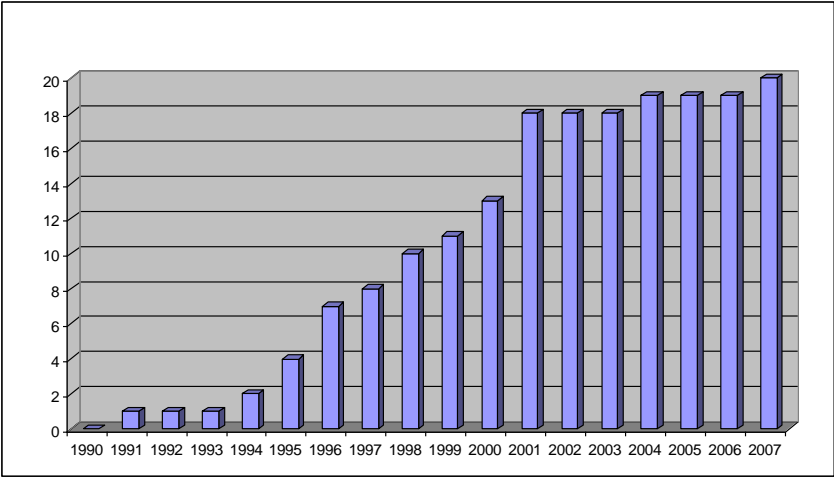

Figure 2:   Accumulated number of merger prohibitions in EU 1990-2007

In the period 2001-2007, only two mergers was 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.[26]

The presence of a deterrence effect is also important for understanding the impact of the actual merger enforcement. In our model we find that merger investigations as such can be

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[25] The data are reported at http://ec.europa.eu/comm/competition/mergers/statistics.pdf.
[26] See Davies and Lyons (2007), Table 1.1., where they compare the number of withdrawals in the EU for different time periods since 1990.

detrimental to welfare, and they are undertaken 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 OFT, how can we explain that?[27] 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.

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[27] In Office of Fair Trading (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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