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Fight Cartels or Control Mergers? On the Optimal Allocation of Enforcement Efforts within Competition Policy

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Abstract

This paper deals with the optimal enforcement of the competition law between the merger and anti-cartel policies. We examine the interaction of these two branches of the competition policy given the budget constraint of the competition agency and taking into account the ensuing incentives for firms' behavior in terms of choice between cartels and mergers. We are thus able to conclude on the optimal competition policy mix. We show for instance that to the extent that a tougher anti-cartel action triggers more mergers taking place, the public agency will optimally invest only in control fighting for a tight budget, and then in both instruments as soon as the budget is no longer tight. However, if the merger's coordinated effect is taken into account, then when resources are scarce the agency may optimally have to spend first on controlling mergers before incurring the cost of fighting cartels.

Keywords: competition law enforcement, antitrust, merger control, anti-cartel policy

JEL classification: L41, K21, D82

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1. Introduction

Competition authorities address the challenge of anticompetitive horizontal agreements both by controlling mergers and fighting cartels. Under the realistic assumption of a limited budget of the public agency, one may ask how much should be spent on fighting cartels as compared with controlling mergers. Taking into account the incentives thus provided to firms, we develop in this paper a very simple framework to determine the optimal competition policy mix between merger control and cartel fighting.

Firms have been known to adapt their behaviour to past decisions of the competition agency. The most famous example is probably that of the Sherman Act, which, in the words of Mueller (1996), "ironically, by prohibiting cartels, encouraged firms to combine [...] and thus helped precipitate the first great merger wave at the turn of the century"[1]. Its impact on the first merger wave was empirically confirmed by Bittlingmayer (1985). More recently, and based on the analysis of duration for a sample of international cartels prosecuted in the 1990s, Evenett et al (2001) found that joint ventures and mergers are adopted by firms in cartel-prone industries where cartel formation is restricted. The following real-life example supports this statement: in 2005 the three main players on the French local markets of urban transport were fined for part-taking in an anti-competitive agreement to share the public transport market of urban bus services during calls for tender[2]. As a result, two of them, Transdev and Veolia, changed plans and five years later notified a horizontal merger, which was granted conditional approval by the French Competition Authority at the end of 2010[3].

In our model we first discuss the case of this apparent substitutability between mergers and cartels. Then we also consider their complementarity, i.e. the case where firms merge before engaging in collusion. This possibility is explicitly taken into account by the competition agencies, which are bound to assess a merger's coordinated effect during its overall competitive appraisal[4]. Nonetheless, merger control being prone to errors, firms may sometimes still take the opportunity to collude after having merged. For instance, on November 9, 2010, the European Commission fined 11 air cargo carriers €799 million in a price fixing cartel that spanned over six years, from December 1999 to 14 February 2006[5] on the European cargo services market.

[1]This American example was later "confirmed" in the UK by the Restrictive Trade Practices Act of 1956, which similarly triggered a merger wave by outlawing cartels - see Symeonidis (2002).

[2]See decision 05-D-38 of July 5, 2005, available on the site of the Autorité de la Concurrence.

[3]See decision 10-DDC-198 of December 30, 2010, also available on the site of the Autorité de la Concurrence.

[4]See for instance the European Commission's Horizontal Merger Guidelines - OJ C 31/5, from 5.2.2004, paragraphs 39 to 57.

[5]See the European Commission's press release IP/10/1487.

Interestingly enough, most of the European airlines involved (such as British Airways, AirFrance-KLM, SAS and Lufthansa-Swiss Air) had previously engaged in several successive mergers on the European airfreight market[6], which had all gained approval from the European Commission[7].

We start by discussing the firms' choice to coordinate, and consider first that they can either form a cartel or notify and undertake a horizontal merger. The relative profitability of the two options will depend on the probability for a cartel to be convicted, as well as on the private gains from mergers. Cartel fighting is imperfect in our model, as not all cartels get punished, and the probability to convict a cartel will depend on the amount of resources allocated for this purpose. This amount will therefore capture the severity of this action. The enforcement of merger control is also imperfect, since the *ex ante* assessment of horizontal mergers inevitably gives rise to both types of errors, i.e. clearing welfare-reducing anti-competitive mergers and banning cost-efficient pro-competitive ones. This is mainly due to the asymmetric information between the competition agency and the merging partners on the true level of potential cost savings. Accordingly, in our model the competition agency (CA henceforth) will only be able to identify and prohibit the anti-competitive mergers after paying a fixed cost. The latter will thus capture in our model the severity of merger control. At any rate, given the limited budget of the CA, devoting more resources to fighting cartels will prevent it from applying a stricter merger control, and vice-versa.

The trade-off we put forward in this framework is the following. Whenever more money is spent on fighting cartels, not only will more cartels be detected and punished and thus welfare losses avoided (a detection effect), but also firms will be prompted to abandon cartel formation and undertake instead horizontal mergers (a so-called selection effect). The detection effect is always positive, but the sign of the selection effect depends on the welfare impact of the mergers that are triggered when more cartels get detected. We derive the first result from the net outcome of these two effects in terms of relative returns of the two instruments of the competition policy. More precisely, with a tight budget, the returns from merger control are so low that the CA will optimally invest only in fighting cartels. It will however eventually spend money on both branches of competition policy if more resources are available, because in this

[6] See the cases M.157/1992, M.259/1992, M.278/1993, M.562/1995, M.616/1995, M.967/1997, M.1128/1998, M.1328/1999, M.1696/1999, M.2672/2002 and the joint-venture M/2830/2002.

[7] Ironically, when clearing the GF-X joint venture for an air freight trading platform between several European airlines (Lufthansa, Air France, British Airways and Global Freight Exchange Limited - see case M.2830/2002), the European Commission declared that the joint venture was set up in such a way that it would not lead to any co-ordination of the competitive conduct of the parent companies on the market for air freight transport - see the European Commissison's press release IP/02/1560 form October 28, 2002.

case the two instruments complement each other. This result may no longer hold when one takes into account the merger's coordinated effect, i.e. its impact on post-merger market collusion. This materializes as a higher likelihood for a cartel to be formed and sustained after a horizontal merger, and therefore makes the firms' strategies of merger and cartel complements. To account for this, we allow the firms to choose between forming a cartel from the beginning, or merging first and later on forming a more stable cartel. In this case, and for a high enough coordinated effect of the merger, the best way for the CA to fight against cartels is to prevent the mergers in the first place. In other words, despite scarce resources, the CA cannot avoid paying the price of a strict merger control.

To put it short, we find that for a tight budget the CA's optimal policy depends on the relationship between cartels and mergers from the firms' point of view: if they are substitutable, then the CA optimally invests only in cartel-fighting, but if they are complementary, the CA must pay for merger control before investing in cartel-fighting.

This is to our knowledge the first research paper to examine the optimal competition law enforcement mix between merger control and cartel fighting. In a related but different context, Aubert and Pouyet (2004) dealt with the relationship between cartel-fighting and sectorial regulation[8]. As far as antitrust and merger control are concerned, the only theoretical contribution, albeit from a positive perspective, is that of Mehra (2008), which deals with the firms' choice between merger and cartel depending on the severity of the anti-cartel action (the fine in case the cartel is detected).

The rest of the paper is structured as follows. We first present the benchmark case of our analysis, then extend it to take into account the merger's coordinated effect. Each time we discuss first the optimal strategies of the firms and the CA, then we establish the optimal policy mix between merger control and cartel fighting. All formal proofs are grouped at the end of the paper in a technical appendix.

2. Model

Consider the following reduced-form setting, in which the CA chooses the amount of resources to be spent on fighting cartels and controlling mergers, whereas a group of two firms may coordinate in order to improve profitability either by colluding or by engaging in a horizontal

[8] See also Bensaid et al. (1995), which investigate the optimality of having a unique antitrust authority to deal with both cartel and mergers, or whether it is on the contrary best to separate the two on account of information and incentives issues.

merger. The group of two firms is considered as a single player and we assume risk-neutrality throughout. The cartel is formed and not detected with probability $c(\Delta)$, where Δ stands for the amount of resources spent by the CA on fighting cartels, with $c'(\Delta) < 0$, $c''(\Delta) > 0$ and $\underset{\Delta \to +\infty}{Lim} c(\Delta) = 0$. It provides a joint collusive payoff of π^C. It may however either fail to be formed or be detected and punished with probability $1-\ c(\Delta)$[9]. If so, then the ensuing payoff for the firms will be the status-quo competition[10] joint profit $\pi < \pi^C$.

The horizontal merger on the other hand is not only a legal means to achieve coordination, but also a source of cost savings or efficiency gains, denoted by e. The joint profit earned is then equal to $\pi^M(e)$. For simplicity, we assume that there are only two types of cost savings, either high or low, $\overline{e} > \underline{e}$, leading to $\pi^M(\overline{e}) > \pi^M(\underline{e})$. Both types occur with equal probability, and the merger is always more profitable than price fixing because of efficiency gains, all else equal: $\pi^M(\underline{e}) > \pi^C$. We assume that the efficiency gains parameter e is *a priori* not observed by the CA. The CA may however invest $M > 0$ in merger control in order to investigate the merger project and then to observe the true level of efficiency gains. Otherwise the merger is not investigated and if so the merger is permitted[11]. Finally, the merging firms incur a fixed cost K in order to merge. This assumption captures the fact that coordination through merger is likely to be costlier than through collusion, or at any rate that merging requires a sunk cost as compared with price-fixing[12]. This cost is distributed on the interval $\left[0, \overline{K}\right]$ following a cumulative distribution function $F(x)$. The cost $\overline{K}$ is high enough to avoid the trivial case where the firms always merge: $\pi^M(\underline{e}) - \pi^C < \overline{K}$.

In terms of competition policy, the CA maximizes the expected consumers' surplus from both fighting cartels and controlling mergers[13]. The total amount of resources available is exogenous and equal to $R \geq M$. Let W^C denote consumers' welfare following a successful cartel, and W the status-quo competition welfare without any coordinated behavior whatsoever, with $W^C < W$. A strict cartel policy denotes that the whole resources R are spent against cartels, while a soft cartel policy implies that only $\Delta < R$ will be used for this purpose. Concerning the merger policy, the post-merger consumers' welfare is equal to $W^M(e)$, where $W^M(\overline{e}) > W^M(\underline{e})$, meaning that

[9] We do not explicitly use cartel fines, but their role is captured by the probability $1 - c(\Delta)$ for the cartel to function poorly.

[10] Our results do not depend on the type of competition (price or quantities) prevailing on the market.

[11] We follow here Sørgard (2009).

[12] The point worth stressing is that price-fixing does not require a structural change in the organization of the partners, and also that there are legal constraints (notification) to be obeyed and legal costs (lawyers' fees) to be incurred for a merger to be initiated.

[13] In practice, mergers get cleared or banned depending on the expected competitive impact, which is basically assessed in terms of expected post-merger price variation.

the more efficiency gains the higher the consumers' surplus. We also consider that the inefficient merger is welfare-reducing but still preferable to the cartel ($W^c < W^M(\underline{e}) < W$), whereas the efficient merger is welfare-improving ($W^M(\overline{e}) > W$). We focus on the possible trade-off between cartel formation and choice of merger for the inefficient merger projects only, so we assume that the efficient merger is always more profitable than the cartel: $\overline{K} < \pi^M(\overline{e}) - \pi^C$. In our framework the CA implements a soft merger control whenever it does not investigate mergers and thus clears $\underline{e}$-mergers as well as $\overline{e}$-ones. When the CA invests M to investigate merger projects, we call it a strict merger control. Thus the policy choice under the budget constraint consists in either implementing the toughest cartel fighting by spending R on it, or carrying out both merger control and cartel fighting by investing M in the former[14].

The timing of the game will be the following:

At the first stage the CA chooses the amount of resources Δ allocated to fighting cartels and decides whether to invest M in merger control.

At the second stage, the firms make their coordination choice between horizontal merger and collusive behavior. If the merger is chosen, they notify it to the CA.

At the final stage, notified mergers are cleared or banned. If there is no merger, then the cartel is convicted with probability $1 - c(\Delta)$ and the market is forced back to its status-quo competition situation. Otherwise, the industry ends up with the collusive market outcome.

The relevant equilibrium concept is the subgame perfect Nash equilibrium, and in what follows we solve the game backwards.

3. Optimal competition policy mix

At the final stage, the CA clears the merger given the available information, i.e. depending on the amount of resources available and its own previous choice of how much to spend on merger control. At the second stage, when deciding how best to achieve profitable coordination, the firms anticipate the outcome of the CA's decision. This means that the choice between horizontal merger and cartel is determined by the probability for a cartel to be detected on the one hand, and the merger control decision on the other.

[14] Although dealing with the CA's optimal activity level in terms of cartel prosecutions, Harrington (2011) mentions the possibility of endogenizing the amount of public resources allocated to cartel fighting by considering a fixed budget that the CA must divide among its various activities, such as prosecuting cartels, controlling mergers and investigating market monopolization.

Lemma 1. *(i) If the merger is expected to be cleared at the final stage, there exists a cost threshold $\widehat{K}(\Delta)$ increasing with Δ, such that the inefficient merger is notified iff $K \leq \widehat{K}(\Delta)$.*

(ii) If the CA invests in merger control, there exists a threshold of resources $\widehat{R}$ such that the CA blocks the inefficient merger iff $R > \widehat{R}$.

Lemma 1 states first of all that the choice of firms stems from a self-selection effect according to which the merger is preferred to cartel for a low enough merging cost[15]. Furthermore, this threshold depends on the amount spent on fighting cartels. The intuition is straightforward: the merger is possibly costlier than the cartel as a means to increase joint profits, so it takes a low enough merger cost for the firms to prefer it to price-fixing. In addition, the more resources dedicated to fighting cartels, and thus the higher the cartel detection probability, the higher the incentives for firms to prefer the merger instead.

Secondly, if the CA invested in information acquisition for merger control, it will block the merger provided that enough resources are available: $R > \widehat{R}$. This is easily explained: a merger will be blocked if the resulting expected welfare is lower than if the firms are not allowed to merge, which in our model means they may form a cartel. So for a merger to be welfare-reducing, the cartel fighting needs to be sufficiently effective, i.e. enough money needs to be spent on detecting and punishing cartels.

Going back to the first stage, the CA determines whether to pay or not for merger control, and thereby how much to invest in cartel fighting. The following proposition gives the result of this trade-off:

Proposition 1. *There exists R^* such that the optimal competition policy consists of soft merger control and strict cartel fighting for $R < R^*$, but strict merger control and soft cartel fighting for $R \geq R^*$.*

Let us explain this result. For very few resources the choice is straightforward. Indeed, below $\widehat{R}$, the CA clears the inefficient merger even if the merger type is observed thanks to the initial investment M. As a result, there is no benefit in investing in merger control. The best policy mix consists therefore of no/soft merger control and the investment of the whole resources in the fight against cartels. With more resources ($R > \widehat{R}$), the benefit to invest in merger control becomes positive, since the CA will now prevent $\underline{e}$-mergers and thus avoid welfare losses. Thus the CA will face a trade-off between enforcing the toughest cartel fighting at the cost of not

[15]Price-fixing is not the dominant strategy of type $\underline{e}$ firms, since $\widehat{K}(\Delta) > 0$ always thanks to $\pi^M(\underline{e}) > \pi^C$.

controlling mergers, and being more lenient towards cartels (i.e. spend less than R on fighting them) so as to prohibit anticompetitive mergers. The outcome of this trade-off depends on the relative marginal benefit of investing in cartel fighting with or without merger control.

If the CA does not invest in merger control, then the expected welfare for the inefficient merger type writes $EW(R) = F(\widehat{K}(R))W^M + (1 - F(\widehat{K}(R)) [c(R) \cdot W^c + (1 - c(R)) \cdot W]$, and therefore an increase in the resources dedicated to fighting cartels has the following effect on the expected welfare:

$$\underbrace{(1 - F(\widehat{K}(R)) \cdot \frac{\partial c(R)}{\partial R} \cdot (W^c - W)}_{\text{detection effect, }>0} + \underbrace{f(\widehat{K}) \cdot \frac{\partial \widehat{K}}{\partial R} \cdot \left(W^M(\underline{e}) - [c(R) \cdot W^c + (1 - c(R)) \cdot W]\right)}_{\text{selection effect, }<0}$$

Spending one more euro on the fight against cartels improves their detection, which is always welfare-improving. This is the positive detection effect highlighted above. Yet, this tougher cartel scrutiny pushes firms to merge instead. This is the selection effect, negative for $R > \widehat{R}$ according to Lemma 1, which therefore reduces the benefit from investing in cartel fighting. The selection effect is basically the cost not to control mergers, and increases with the amount of resources spent on fighting cartels.

If, on the contrary, the CA does control mergers, then the expected welfare for the inefficient merger type writes $EW^{mc}(R) = c(R - M) \cdot W^c + (1 - c(R - M)) \cdot W$, and the impact of one more euro spent to fight cartels equals $\underbrace{\frac{\partial c(R - M)}{\partial R} \cdot (W^c - W)}_{\text{detection effect}}$.

Clearly, the merger control increases the marginal benefit of fighting against cartels, due to both a higher detection effect and the absence of the negative selection effect. In other words, both instruments tend to become complements and could induce the CA to split the resources between merger control and cartel fighting. However this is not the case for $R^* > R > \widehat{R}$. Indeed, over this range of resources, the benefit of paying M for a strict merger control is, although positive, still lower than that of allocating the whole R to cartel fighting. Only for $R > R^*$ does the payment of M yield a higher expected welfare, making the optimal competition policy a combination of (strict) merger control with cartel fighting.

4. Post-merger cartel and the impact of merger coordinated effect

We give up in this section the assumption that firms choose mergers over cartels or vice-versa. In other words, we replace this strict substitutability between the strategies of merger and cartel by their possible complementarity, i.e. the case of cartel formation following the merger. For this purpose we modify our framework in the following way:

Whenever the firms merge they also form a cartel detected with a probability $1-\delta c(\Delta)$ where $\delta \geq 1$. Parameter δ captures the higher stability of cartels for more concentrated markets, and therefore measures the size of the merger's coordinated effect. In case of cartel after merger, the joint profit is equal to $\pi^{MC}(e) > \pi^{C}$ and the consumers' welfare is equal to $W^{MC}(e)$. Similarly, let also $W^{MC}(e) > W^{C}$, thanks to the merger's efficiency gains[16]. If the firms do not merge, the probability for the cartel to be detected is still equal to $1 - c(\Delta)$. However, we assume now that if no resources are invested in cartel fighting, then the post-merger cartel goes undetected: $\delta c(0) = 1$. For simplicity, in what follows let $c''(\Delta) = 0$[17] and F uniform on $\left[0, \overline{K}\right]$. The timing of our game is unchanged.

As before, we start our analysis by deriving the CA's merger control decision as well as the firms' merger decision in the following lemma:

Lemma 2. *(i) If the merger is expected to be cleared at the final stage, there exists a cost threshold* $\widetilde{K}(\Delta)$ *such that the merger is notified iff* $K \leq \widetilde{K}(\Delta)$. $\widetilde{K}(\Delta)$ *is increasing with* Δ *for low values of* δ*, but decreasing with it for high values of* δ*.*

(ii) If the CA invests in merger control, there exists a threshold of resources $\widetilde{R}(\delta)$ *such that the CA blocks the merger for* $R > \widetilde{R}(\delta)$*. Moreover,* $\widetilde{R}(\delta) = M$ *for* δ *high enough.*

There are two substantial differences as compared with Lemma 1 where the merging firms do not form a cartel. First of all, increasing the severity of the anti-cartel fighting may have a different effect on the merger decision according to the size of the merger's coordinated effect. For a low coordinated effect, an improvement in the detection of cartels induces the firms to merge, as before. Nevertheless, the opposite obtains for a high enough coordinated effect, because the post-merger collusion may simply be the very reason why firms decide to merge in the first place. As a result, the tougher cartel fighting will reduce the benefit to merge and thus will deter more mergers. Secondly, a high enough coordinated effect may make the merger control beneficial even if no resources are available for cartel fighting, precisely because firms merge in order to form a cartel. Thus the merger control enables the CA to prevent cartels and as such has a positive return even if no resources are invested in cartel fighting itself.

[16] All our assumptions on welfare levels boil down to the following chain inequality for the $\underline{e}$-type: $W > W^{M}(\underline{e}) > W^{MC}(\underline{e}) > W^{C}$.

[17] Equivalently, let $c(\Delta) = \begin{cases} \frac{A-\Delta}{A}, \text{ for } \Delta \leq A \\ 0, \text{ for } \Delta > A \end{cases}$, where $A > 0$ and constant.

The next result shows how the optimal policy mix may change due to the possibility of post-merger cartel:

Proposition 2. *(i) For low δ, there exists a threshold $R^{**}(\delta)$ such that the optimal competition policy consists of soft merger control and strict cartel fighting for $R \leq R^{**}(\delta)$, but strict merger control and soft cartel fighting for $R > R^{**}(\delta)$;*

(ii) A high enough δ leads to $R^{**}(\delta) = M$, i.e. the optimal policy mix implies strict merger control and soft cartel fighting for any R.

As compared with Proposition 1, we show here that the introduction of the merger's coordinated effect may lead the CA to always invest in merger control even for a very low level of resources. This result arises because the high coordinated effect makes both policy instruments substitutable, while at the same time lowers the returns from cartel fighting. These two outcomes induce the CA to never invest all the available resources in cartel fighting only. To explain this result, let us start by comparing the marginal returns from cartel fighting with and without merger control in the case of inefficient merger projects:

- if the CA does not invest in merger control, then an increase in the resources allocated against cartels has the following marginal effect on the expected welfare:

$$\underbrace{\underbrace{\frac{\partial c(\Delta)}{\partial \Delta}}_{<0}\left[\frac{\left(\overline{K}-\widetilde{K}(\Delta)\right)}{\overline{K}}\cdot\underbrace{(W^{C}-W)}_{<0}+\frac{\widetilde{K}(\Delta)}{\overline{K}}\cdot\delta\,\underbrace{(W^{MC}-W^{M})}_{<0}\right]}_{\text{detection effect, always }>0}$$

$$+\underbrace{\frac{\partial \widetilde{K}(\Delta)}{\partial \Delta}\frac{1}{\overline{K}}\left[\left(W^{M}\cdot(1-\delta c(\Delta))+W^{MC}\cdot\delta c(\Delta)\right)-\left(W\cdot(1-c(\Delta))+W^{C}\cdot c(\Delta)\right)\right]}_{\text{selection effect}};$$

- if in turn the CA does pay M in order to control mergers, then the impact of a similar increase in the resources dedicated to cartel fighting is equal to: $\underbrace{\left[\frac{\partial c(\Delta)}{\partial \Delta}(W^{C}-W)\right]}_{\text{detection effect, }>0}$.

According to Lemma 2, the high coordinated effect leads to a positive selection effect from a tougher cartel fighting, because a larger share of inefficient mergers is now deterred ($\frac{\partial \widetilde{K}(\Delta)}{\partial \Delta} < 0$). In addition, the high coordinated effect also leads to a larger selection effect without merger control. It follows a higher marginal effect of cartel fighting when there is no merger control. In the same way, we can show that the return from merger control decreases with the amount of resources invested in cartel fighting. Again, this is due to the positive selection effect: when the CA invests a large amount of resources in cartel fighting, a large share of inefficient mergers is deterred despite the absence of merger control. In other words, both instruments tend to become substitutable, which may induce the CA to always invest the whole resources in one instrument only. Nevertheless, the coordinated effect also lowers the expected welfare with cartel fighting only ($\frac{\partial EW}{\partial \delta} < 0$). This eventually leads the CA to always invest in merger control. This result holds even if no money is available for cartel fighting. To see this consider the limit case where $R = M$. The expected welfare without merger control, equal to $\frac{(\overline{K}-\widetilde{K}(M))}{\overline{K}} \cdot ((1-\delta c(M))W^M + \delta c(M)W^{MC}) + \frac{\widetilde{K}(M)}{\overline{K}}((1-c(M))W + c(M)W^C)$, must be balanced against the expected welfare with merger control: $((1-c(0))W + c(0)W^C)$. The merger's coordinated effect has a double impact on this welfare comparison. On the one hand, a high enough δ leads to a very high $\widetilde{K}(M)$. Accordingly, spending only on cartels will deter to a large extent inefficient mergers. Moreover, cartel deterrence is high since all resources are dedicated to cartel fighting. But on the other hand, if the CA does pay M on merger control, then the CA will always block the $\underline{e}$-mergers, which are very inefficient precisely because of the high coordinated effect δ. Consequently, a high enough merger coordinated effect will optimally lead the CA to spend almost all available on controlling mergers, and hence implement a strict merger control. In short, with scarce resources and a high coordinated effect, the best way to fight against cartels is also to block mergers.

5. Conclusion

This paper examines the optimal enforcement competition policy mix in terms of merger control and anti-cartel policies, knowing that the observation of real-life market behavior indicates that firms typically react to the current enforcement focus of the competition agencies (against either mergers or cartels). When studying the interaction between the enforcement of merger control and cartel fighting, we accounted for the resulting incentives for firms, as well as for the budget constraint of the competition agency.

When mergers and cartels are substitutable from the point of view of firms (i.e. they choose one over the other), we obtain that cartel fighting and merger control are complementary. Given the comparison between their respective returns, this means that the CA will optimally invest in both branches of the competition policy for plenty enough resources, but only in cartel fighting if the budget is tight. This may change if one assumes that merger and cartel are complementary, as happens when firms merge first and then engage in collusion. In this case the returns from cartel fighting are higher without a strict merger control, meaning that the two instruments of competition policy become substitutable if the merger's coordinated effect is high enough, i.e. the probability for a post-merger cartel to go undetected is high enough. This induces the CA to never invest all the resources available in cartel fighting.

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6. Appendix

Proof of Lemma 1.

(i) The $\underline{e}$ firms choose to merge iff $c(\Delta)\pi^C + (1 - c(\Delta))\pi < \pi^M(\underline{e}) - K \Leftrightarrow$

$K < \widehat{K}(\Delta) = \pi^M(\underline{e}) - \left(c(\Delta)\pi^C + (1 - c(\Delta))\pi\right)$. This cost threshold is increasing with Δ :

$\frac{\partial \widehat{K}(\Delta)}{\partial \Delta} = -\underbrace{c'(\Delta)}_{<0} \cdot \underbrace{\left(\pi^C - \pi\right)}_{>0} > 0.$

(i) If at the first stage the CA invested M in merger control, then it observes the merger type, so type $\overline{e}$ is cleared while type $\underline{e}$ is blocked iff $c(R-M)W^C + (1-c(R-M))W > W^M(\underline{e})$. Note that the LHS of this condition is continuous and increasing with R. In addition, for R high enough the merger is blocked since $c(R-M) \to 0$, whereas for $R = M$ the merger is cleared. Therefore there exists a threshold $\widehat{R}$ such that the merger is blocked iff $R > \widehat{R}$.

■

Proof of Proposition 1.

It is obviously always optimal to apply as strict a cartel fighting as possible, i.e. always have $\Delta = R - M$. To determine the type of merger control, "soft" or "strict", let us compare below the expected welfare from dealing with the $\underline{e}$-type with and without merger control:

For $R < \widehat{R}$

With merger control:

$EW^{mc}(R; M) = F(\widehat{K}(R-M)) \cdot W^M(\underline{e}) + (1 - F(\widehat{K}(R-M)) \cdot [c(R-M) \cdot W^c + (1 - c(R-M)) \cdot W]$

Without merger control:

$EW(R) = F(\widehat{K}(R)) \cdot W^M(\underline{e}) + (1 - F(\widehat{K}(R)) \cdot [c(R) \cdot W^c + (1 - c(R)) \cdot W]$

Note that $EW(R) = EW^{mc}(R; M = 0)$, and that

$$\frac{\partial EW^{mc}(R;M)}{\partial M} = f(\widehat{K}) \cdot \underbrace{\frac{\partial \widehat{K}}{\partial M}}_{<0} \cdot \underbrace{\left(W^M(\underline{e}) - [c(R-M) \cdot W^c + (1 - c(R-M)) \cdot W]\right)}_{>0 \text{ from Lemma 1}}$$

$$+(1 - F(\widehat{K}(R-M)) \cdot \underbrace{\frac{\partial c(R-M)}{\partial M}}_{>0} \cdot \underbrace{(W^c - W)}_{<0} < 0.$$

Therefore $EW^{mc}(R; M) < EW^{mc}(R; M = 0) = EW(R)$.

For $R \geq \widehat{R}$

With merger control: $EW^{mc}(R) = c(R-M) \cdot W^c + (1 - c(R-M)) \cdot W$

where $\frac{\partial EW^{mc}(R)}{\partial R} = \underbrace{\frac{\partial c(R-M)}{\partial R}}_{<0} \cdot \underbrace{(W^c - W)}_{<0} > 0$

Without merger control: $EW(R) = F(\widehat{K}(R))W^M(\underline{e}) + (1 - F(\widehat{K}(R)) [c(R) \cdot W^c + (1 - c(R)) \cdot W]$

where $\frac{\partial EW(R)}{\partial R} = f(\widehat{K}) \cdot \frac{\partial \widehat{K}}{\partial R} \cdot \left(W^M(\underline{e}) - [c(R) \cdot W^c + (1 - c(R)) \cdot W]\right) + (1 - F(\widehat{K}(R)) \cdot \frac{\partial c(R)}{\partial R} \cdot (W^c - W)$

It is straightforward to check that

$$\frac{\partial EW(R)}{\partial R} - \underbrace{\frac{\partial EW^{mc}(R)}{\partial R}}_{>0} = f(\widehat{K}) \cdot \frac{\partial \widehat{K}}{\partial R} \cdot \left(W^M(\underline{e}) - [c(R) \cdot W^c + (1 - c(R)) \cdot W]\right)$$

$$+(1 - F(\widehat{K}(R)) \cdot \frac{\partial c(R)}{\partial R} \cdot (W^c - W) - \frac{\partial c(R-M)}{\partial R} \cdot (W^c - W) =$$

$$= f(\widehat{K}) \cdot \underbrace{\frac{\partial \widehat{K}}{\partial R}}_{>0} \cdot \underbrace{\left(W^M(\underline{e}) - [c(R) \cdot W^c + (1 - c(R)) \cdot W]\right)}_{<0 \text{ from Lemma 1}}$$

$$+ \underbrace{(W^c - W)}_{<0} \cdot \left[\underbrace{\left(\frac{\partial c(R)}{\partial R} - \frac{\partial c(R-M)}{\partial R} \right)}_{>0} \underbrace{- F(\widehat{K}(R)) \cdot \frac{\partial c(R)}{\partial R}}_{>0} \right] < 0.$$

Note that for very high R one has that $EW^{mc}(R) > EW(R)$, because $EW^{mc}(R) = W > EW(R) = \left(1 - F(\widehat{K}(R))\right) W + F(\widehat{K}(R)) \cdot W^M(\underline{e}) \Leftrightarrow W > W^M(\underline{e})$.

As a result, $\exists\, R^*$ such that for $R > R^*$, $EW^{mc}(R) > EW(R)$. ■

Proof of Lemma 2.

(i) The $\underline{e}$ firms choose to merger iff $\delta c(\Delta)\pi^{MC}(\underline{e})+(1-\delta c(\Delta))\pi^{M}(\underline{e}))-K \geq c(\Delta)\pi^{C}+(1-c(\Delta))\pi$ $\Leftrightarrow K \geq \widetilde{K}(\Delta) = \delta c(\Delta)\pi^{MC}(\underline{e}) + (1-\delta c(\Delta))\pi^{M}(\underline{e})) - \left[c(\Delta)\pi^{C} + (1-c(\Delta))\pi\right].$

Let now study the monotonicity of $\widetilde{K}(\Delta)$:

$\frac{\partial \widetilde{K}(\Delta)}{\partial \Delta} = \underbrace{\frac{\partial c(\Delta)}{\partial \Delta}}_{<0} \cdot \left[\delta \underbrace{\left(\pi^{MC}(\underline{e}) - \pi^{M}(\underline{e})\right)}_{>0} - \underbrace{\left(\pi^{C} - \pi\right)}_{>0}\right]$. Therefore $\frac{\partial \widetilde{K}(\Delta)}{\partial \Delta} > 0$ iff $\delta > \frac{(\pi^{C}-\pi)}{(\pi^{MC}(\underline{e})-\pi^{M}(\underline{e}))}$.

This is always true if $\left(\pi^{MC}(\underline{e}) - \pi^{M}(\underline{e})\right) > \left(\pi^{C} - \pi\right)$.

(ii) When the CA has invested in information acquisition to distinguish $\underline{e}$ from $\overline{e}$ (i.e. investment in merger control), it will clear or ban the $\underline{e}$-merger depending on the sign of $\left[W^{M}(\underline{e}) \cdot (1-\delta c(\Delta)) + W^{MC}(\underline{e}) \cdot \delta c(\Delta)\right] - \left[W \cdot (1-c(\Delta)) + W^{C} \cdot c(\Delta)\right]$. This expression is monotonic w.r.t. Δ and decreasing with it for $\delta \leq \frac{W-W^{C}}{W^{M}(\underline{e})-W^{MC}(\underline{e})}$. Moreover, it tends to $W^{M}(\underline{e}) - W < 0$ for $R \to \infty$, whereas for $R = 0$, it tends to $W^{MC}(\underline{e}) - W^{C} > 0$. Furthermore, it is unambiguously decreasing with δ. Thus there exists a unique $\widetilde{R}$ such that the expression is negative iff $R > \widetilde{R}$. For δ high enough, $\widetilde{R} < M$. ■

Proof of Proposition 2.

The expected welfare without merger control is equal to:

$EW(R) = \frac{1}{K}\left(\overline{K} - \widetilde{K}(R)\right)((1-c(R))W + c(R)W^{C})$
$+\frac{1}{K}\widetilde{K}(R) \cdot ((1-\delta c(R))W^{M}(\underline{e}) + \delta c(R)W^{MC}(\underline{e})) + ((1-\delta c(R))W^{M}(\overline{e}) + \delta c(R)W^{MC}(\overline{e}))$

The expected welfare with merger control is equal to:

$$EW^{mc}(R) = \begin{cases} EW(R-M), \text{ if } R < \widetilde{R}(\delta) \\ (1-c(R-M))W + c(R-M)W^{C} + \\ \left((1-\delta c(R-M))W^{M}(\overline{e}) + \delta c(R-M)W^{MC}(\overline{e})\right), \text{ if } R > \widetilde{R}(\delta) \end{cases}.$$

The linearity of $c(\Delta)$ and the uniform cumulative function F ensures the linearity w.r.t. R of $EW^{mc}(R)$ and $EW(R)$, which have therefore at most one crossing point if any. To determine the optimal policy mix, we compare their slope and their extreme values for $R = M$ and $R \to \infty$.

- for very high R, and therefore $R > \widetilde{R}(\delta)$, one has that $EW^{mc}(R) > EW(R)$, because:

$EW^{mc}(R) = W + W^{M}(\overline{e}) > EW(R) = \frac{1}{K}\left(\overline{K} - \widetilde{K}(\delta)\right)W + \frac{1}{K}\widetilde{K}(\delta) \cdot W^{M}(\underline{e}) + W^{M}(\overline{e})$

- for $R = M$, whenever $M \leq \widetilde{R}(\delta)$, that is for a low value of δ, $EW^{mc}(R = M) = EW(0) < EW(R = M)$, since in this case the competition policy necessarily involves a soft merger control if M is paid, thus this money is spent without any firms being prevented from merger, and therefore without any welfare gain.

As a result, by linearity, for δ low, there exists a unique $R^{**}(\delta)$ such that the optimal competition policy consists of soft merger control and strict cartel fighting for $R \leq R^{**}(\delta)$, but strict merger control and soft cartel fighting for $R > R^{**}(\delta)$.

- Slope comparison

Whenever $R > \widetilde{R}(\delta) = M$,

$EW^{mc}(R) = (1-c(R-M))W + c(R-M)W^C + ((1-\delta c(R-M))W^M(\overline{e}) + \delta c(R-M)W^{MC}(\overline{e}))$,

whereas:

$EW(R) = \frac{1}{\overline{K}}\left(\overline{K} - \widetilde{K}(R)\right)((1-c(R))W + c(R)W^C) + \frac{1}{\overline{K}}\widetilde{K}(R) \cdot ((1-\delta c(R))W^M(\underline{e}) + \delta c(R)W^{MC}(\underline{e}))$

$+((1-\delta c(R))W^M(\overline{e}) + \delta c(R)W^{MC}(\overline{e}))$

We deduce:

$$\frac{\partial[EW(R)-EW^{mc}(R)]}{\partial R}$$

$$= \underbrace{\frac{\partial c(\Delta)}{\partial \Delta}}_{>0}\frac{1}{\overline{K}}\widetilde{K}(R) \cdot \underbrace{\left\{\delta(W^{MC} - W^M) - (W^C - W)\right\}}_{>0 \text{ for } \delta \text{ high enough}} +$$

$$+ \underbrace{\frac{\partial \widetilde{K}(R)}{\partial R}}_{<0 \text{ for } \delta \text{ high enough}} \underbrace{\left[\left(W^M \cdot (1-\delta c(R)) + W^{MC} \cdot \delta c(R)\right) - \left(W \cdot (1-c(R)) + W^C \cdot c(R)\right)\right]}_{<0 \text{ for } R > \widetilde{R} = M}$$

Thus, for δ high enough we have $\frac{\partial EW(R)}{\partial R} > \frac{\partial EW^{mc}(R)}{\partial R}$ and $EW(R)$ lower than $EW^{mc}(R)$ for R very high. As a result, for δ high enough we have $EW^{mc} > EW$ for all R. ■