Three Essays on the Effectiveness of Merger Control

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von
Mag. iur. Miyu Choon-Kyong Lee, LL.M.

Präsident der Humboldt-Universität zu Berlin:
Prof. Dr. Jan-Hendrik Olbertz

Dekan der Wirtschaftswissenschaftlichen Fakultät:
Prof. Dr. Ulrich Kamecke

Gutachter:
1. Prof. Dr. Ulrich Kamecke
2. Prof. Dr. Tomaso Duso

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Abstract

The dissertation contains three papers on European merger control. The first two empirical papers discuss the estimation of deterrence effects in the merger control policy of the European Union, whereas the third theoretical paper examines the strategic interaction between competitor and authority by using a signaling model.

Zusammenfassung

Die Dissertation beinhaltet drei Arbeiten zur europäischen Zusammenschlusskontolle. Die ersten zwei empirischen Arbeiten befassen sich mit der Schätzung von Abschreckungseffekten der Zusammenschlusskontrollpolitik der Europäischen Union, und die dritte theoretische Arbeit untersucht die strategische Interaktion zwischen Wettbewerber und Behörde im Rahmen eines Signaling Modells.

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1 Introduction

Merger control became an instrument of competition policy in Germany and the European Union (EU) only fairly recently. While merger control in the U.S. had been introduced already in the early 20th century, Germany established a merger control in the 1970s, while the EU Merger Regulation was implemented 15 years later. In both jurisdictions, competition laws of a general nature preceded the introduction of merger control, meaning that mergers would sometimes fall into the scope of individual provisions without the laws setting forth an explicit ex ante review of mergers.

The core problem of the initial competition laws in Germany and the EU was that their wording was limited to already existing restrictions to competitions like cartels and at the abuse of a dominant position, but did not extend to the possibility that market dominance could be reached by concentration or acquisition of companies.[1] Thus, slowly but inevitably, a formal merger review became a necessity in Germany and the EU. Today, the ex ante control of mergers forms an indispensable part of competition policy and is regulated specifically.

Compared to other fields of law, it is a typical feature of competition law including merger control that it needs to adjust to industrial and technological developments more quickly and effectively, since it is the law applicable to constantly changing and transforming environments, i.e., industries and technologies. The legal history of German and EU competition laws shows that they had to undergo substantial revisions over time. Competition policy can be seen as the

[1] The European Court of Justice, after the *Continental Can* case, approved the ex post use of Article 86 of the Treaty of Rome to prevent mergers.

byproduct of political thinking and economic frameworks in a jurisdiction, rendering flexibility in its instruments and sanctions imperative. Each jurisdiction might have slightly different goals for employing competition policy, be it to attain economic efficiency, to maintain a common market without discrimination or to safeguard competition as such or to advance social objectives – these goals might change over time,[2] but in order to realise the goals, an effective policy is of importance.

There are different ways to examine the effectiveness of a legal institution: The analysis can focus on the letters of the law or its enforcement. It can hence examine the rules' scope of applicability or possible Type I and Type II errors of an authority's decision, its deterrence effects, or the procedural efficiency. The reason for testing the effectiveness is that an effective regulation is able to influence the future behaviour of its addressees into the desired direction in a more accurate and targeted manner, since the authority cannot police each individual case without committing inefficiently many resources in the first place and since the law cannot explicitly mention each conceivable case either in its provisions. The authority and the law it enforces should therefore send the right signals to firms, by taking the *right* decisions, conducting the *right* procedural steps and appealing to the *right* addressees. Ultimately and ideally, self-correction should be reached, holding violations within natural reigns without too much state intervention.

My dissertation is dedicated to analysing the effectiveness of EU merger control. After more than 20 years of merger control practice and more than 5000 notified mergers, there is case law and data available to reevaluate the existing rules and enforcement practice. While qualitative analyses have been already made in the past, such as explorative interviews or surveys based on which amendments to

[2] In Germany, for example, economic recession in the late 19th century allowed firms to form cartels to protect themselves against *brutal* capitalism, cut-throat competition and price warfare. While competition policy thus first had the objective to protect economic freedom and freedom of contracting, it slowly, by recognising the abusive potential of cartels, shifted to the neoliberal idea of a regulator guaranteeing the institutional framework for a free-market economy after the Second World War (*Ordnungspolitik*) which laid the basis for modern day competition policy in Germany.

the law have been made, the quantitative analysis of the data is lagging behind.

Chapters 2 and 3 will focus on the deterrence of merger decisions. The deterrence concept has been widely applied to criminal law. The main idea is that the right severity of punishment can deter potential criminals to commit the crime. The concept can to some extent be applied to merger control.[3] In a jurisdiction such as the EU, where merger control serves to maximize welfare, what the merging firms need to be deterred from is to file for mergers which are welfare-decreasing without discouraging them from notifying welfare-increasing mergers. The European Commission, by choosing the right decision or the right kind of remedies, can send meaningful signals to the outside world. Chapter 2 will first examine if there are deterrent effects on an industry level, while Chapter 3 will break the analysis down to the level of the merging firms. The central question of both analyses will be how well the different kinds of merger control decisions work to influence the subsequent merging behaviour of firms. An additional question is whether there are any differences in the effectiveness between Phase 1 and Phase 2 instruments. Phase 2 instruments take up more financial and personnel resources than Phase 1 instruments, and, while it might be good news if Phase 2 instruments worked well from a deterrence perspective, at the same time, it will be important to heighten the accuracy of Phase 1 instruments. In the long run, this will send the appropriate signals to the outside world to file less problematic mergers and a smaller selection of cases will in general end up in Phase 2. For the purpose of my analysis, Chapter 2 will distinguish between industries of low- and high-competition intensity and whether or not the Merger Control Reform in 2004 entailed a change in deterrent effects. Chapter 3 will, instead of working with high and low competition industries, identify each merger as anticompetitive or not and analyse their development over years in view of the decisions taken by the European Commission.

[3] As will be argued later in the relevant chapter, deterrence in merger control feeds to some extent on the commitment of errors by the authority. Therefore, both concepts, i.e., deterrence and Type I and II errors, have a stronger reciprocal relationship than in the criminal context.

Chapter 4 will focus on the procedural effectiveness of merger control, more precisely, whether or not the current involvement of competitors is efficiency-increasing. The main objective of the analysis will be to scrutinise the extent to which competitors can potentially abuse or strategically manipulate the decision by submitting misleading or false information. Depending on the result of the analysis, the involvement of competitors could then lead to a conflict between legal due process considerations and economic efficiency. An effective rule would avoid such conflict and align the interests of lawyers and economists in such way that both goals would be served without leaving any room to abusing the rule.

2 Deterrence in EU Merger Policy

This chapter is based on Clougherty et al. [2013b].

2.1 Introduction

The design and enforcement of competition rules is one of the cornerstones of European Union (EU) policy to support the European integration process and stimulate sustainable growth. In fact, the founding Treaty of Rome deemed that Member States would cede authority over competition issues to the European institutions, since this was considered to be essential for a well functioning internal market. Thus to support these objectives, the European Commission (Commission) has been granted enhanced powers of enforcement in this field [Neven, 2006].

The received wisdom among economists and policymakers is that competition matters when it comes to economic efficiency and innovation incentives [Nickell, 1996, Aghion et al., 2005]. Moreover, these benefits are even more relevant during times of economic crisis [Cole and Ohanian, 2004]. Effective competition, therefore, plays a fundamental role in promoting the welfare of an economy when markets cannot rely on substantial amounts of capital to stimulate economic growth. Furthermore, by producing consumer savings through lower prices and higher-quality products, competition can stimulate demand, lower inflation, and lead to concrete improvements in the purchasing power of consumers. Finally,

competition also reduces price levels in the wholesale and intermediary markets – markets that are fundamental to the greater economy.

While there is wide consensus that competition is welfare-enhancing during both prosperous and difficult economic periods, it is a bit more controversial to state that competition policy actually does a good job of effectively stimulating competition. In light of this uncertainty, a number of scholars have called for more research on whether and how actual competition is influenced by competition authorities [e.g., Crandall and Winston, 2003, Baker, 2003, Buccirossi et al., 2013].

Among the different areas of competition enforcement, we focus on merger policy in this study. Merger control plays a crucial role in competition policy because it is the only instrument via which authorities can engage in ex ante prevention of anticompetitive situations. Given that it is much harder to intervene ex post, competition law enforcement has not been extremely successful at stopping pre-existing firms from abusing any dominance they hold in a market or at hindering the occurrence of collusion [Kovacic, 2009]. Consequently, an effective merger policy is a pivotal component of a well functioning competition policy.

Despite the significance of merger policy, recent studies indicate that the Commission's enforcement of merger policy is far from perfect.[1] The EU courts have likewise agreed that a number of errors have been made in the conduct of merger policy. Namely, four prohibition decisions (*Airtours/First Choice*, *Schneider/Legrand*, *Tetra Laval/Sidel*, and *GE/Honeywell*) from the early 2000s were appealed by the merging parties, and in all four cases the EU courts identified problems with regard to the rigor of the Commission's economic analysis. The public attention engendered by these cases – and other related issues – led to a substantial modernization of the EU merger control institutions. In particular, Council Regulation 139 in 2004 aimed to reform the Commission's competition

[1] In a sample of 168 transactions over the 1990–2002 period, Duso et al. [2007] find that about one-quarter of the mergers and acquisitions (M&As) approved by the Commission were actually anticompetitive in nature. Using the same data, Duso et al. [2011] found that remedial actions – the most commonly employed merger intervention tool – only partially help in restoring effective competition.

policy in order to achieve a 'more economic approach' in the implementation of EU competition laws. In practice, this meant a case-by-case approach guided by economic principles instead of the application of *per se* legal rules.

While the policy debate and academic studies on the effectiveness of EU merger policy are often based on rulings regarding already proposed mergers (e.g., the presence of Type I and Type II errors in merger control), merger policy actually entails more than just direct effects from the detection, amelioration, and prohibition of anticompetitive merger activity. In particular, substantial indirect effects also possibly exist. Indeed, as many commentators agree [e.g., Nelson and Sun, 2002, Davies and Majumdar, 2002], direct effects might only represent the *tip of the iceberg* when it comes to the overall impact of merger control. Namely, indirect deterrence effects have been considered to be quite important, as firms are likely to internalise competition rules in their decision-making and thus alter the types and frequencies of the mergers they propose due to the presence – and changes in the tenor of – merger policy [Eckbo, 1992, Crandall and Winston, 2003]. Hence, an effective merger policy should create incentives that shape the behaviour of firms in violation of these rules, since no policy can be truly effective if its every application has to be policed [Baker, 2003]. Thus, the effects of merger policy are not limited to the specific firms targeted by merger control actions, but should surely also include all firms whose behaviour and performance might be affected – i.e., deterred – in the future by specific decisions and specific policies [Sørgard, 2009, Salop, 2013a]. In this vein, Joskow [2002, 99–100] notes that 'the test of a good legal rule is not primarily whether it leads to the correct decision in a particular case, but rather whether it does a good job deterring anticompetitive behavior.'

The principal aim of this paper, therefore, is to investigate the deterrence effects involved with EU merger policy over the past two decades. For that purpose, we have gathered information regarding all mergers notified to the Commission from 1990 until 2009 – over 4,200 mergers – and regarding the type and frequency of the

various merger policy actions taken by the Commission: i.e., clearances, remedies, and prohibitions. We are able to distinguish whether these merger policy actions took place in Phase 1 or Phase 2 of the Commission's merger review process. The ability to differentiate between different types of merger policy actions and the different timings is helpful, as these differences may involve different costs for firms and, therefore, generate distinct deterrence effects [Seldeslachts et al., 2009, Salop, 2013a]. The high level of detail involved with the Commission's merger reports suggests that our constructed database represents the best available data upon which to assess the deterrence effects involved with merger policy.[2]

We will study then the impact of the Commission's merger policy actions on the proclivity of firms to engage in future merger activity at the industry level. We concentrate specifically on the ability of different merger policy tools to generate forsaken merger activity; i.e., deals not proposed by potential merging parties. We will also consider how deterrence has evolved over time; in particular, whether the 2004 reforms in EU merger control resulted in substantial changes in terms of deterrence. We will further investigate whether EU merger policy involves more deterrence in low-competition industries – low competition as measured by both the Herfindahl-Hirschman Index (HHI) (akin to the Commission's initial screening) and the elasticity of firms' profit with respect to costs [Boone, 2008]. Our working assumption is that effective deterrence would involve merger policy actions in low-competition industries generating more robust deterrence effects as compared to high-competition industries, as mergers in low-competition industries would tend to be more anticompetitive.

The immediate tangible benefits of our study are threefold. First, we begin the process of factoring the deterrence effects of EU merger policy; thus, we begin the

[2] While recent empirical scholarship exists concerning merger policy deterrence, these studies tend to be broad and cross-jurisdictional in nature [e.g., Seldeslachts et al., 2009] or focused on U.S. merger control [e.g., Clougherty and Seldeslachts, 2013]. Furthermore, the data employed in those studies tends to be somewhat patchy due to the reluctance of most antitrust jurisdictions – including the U.S. – to provide high-quality information regarding their merger cases.

quantification of what has until now been unquantified in the European context in a comprehensive manner. Second, we are able to examine which particular merger policy instruments – and at what stage of the merger review process – tend to indicate substantial deterrence, and whether deterrence works better in those industries where it is potentially most necessary. As Crandall and Winston [2003, p. 4] argue, scholarship must 'explain why some enforcement actions [...] are helpful and others are not.' Third, by covering such a large timespan of EU merger control, we can investigate whether EU institutional merger reforms yielded any substantial improvement in the ability of merger policy to generate deterrence effects. In particular, we will be able to factor whether the 2004 reforms brought about enhanced deterrence effects.

Our empirical results indicate that only remedies applied during the initial investigation phase (Phase 1 Remedies) yield robust deterrence. Finding that Phase 1 Remedies – but not Phase 2 Remedies – involve deterrence may be explained by the fact that the Commission could have more bargaining power in the early stages of the merger review process. Accordingly, the Commission is able to extract greater concessions from firms in Phase 1, which lead then to more substantial remedies and, in turn, greater deterrence effects. Furthermore, the results also show that Phase 1 Remedies after the 2004 policy reform indicate relatively large deterrence. However, these post-2004 deterrence effects are not significantly different from pre-2004 periods. This may be because of two countervailing effects. The 2004 reforms made EU merger policy more efficient and transparent in some respects. On the other hand, its more economics-grounded case-by-case approach may have offset these gains in other aspects. Given that deterrence generally improves with certainty [Craswell and Calfee, 1986], the net effect of the reforms may have been close to zero. Finally, we find that Phase 1 Remedies involve greater deterrence in low-competition industries (measured by the HHI) than in high-competition industries – a finding which is consistent with EU merger policy mostly deterring anticompetitive mergers.

The remaining sections of the paper are structured as follows: Section 2 describes our deterrence framework. Sections 3 and 4 respectively explain the data and estimation strategy. Section 5 discusses the results, while Section 6 concludes and provides some policy insights.

2.2 A Deterrence Framework

We measure the deterrence effects of EU merger policy by employing the methodology from the economics of crime literature spawned by Becker [1968]. In this framework, enforcement actions make criminals update their probabilities of being caught and update their estimations of the punishments involved with being caught.[3] The proposal of an anticompetitive merger is, of course, no crime in the strict sense, but the deterrence mechanism is analogous in this environment as undesirable actions are *punished*. Accordingly, the methodological framework from the economics of crime literature provides a sound means for a specific analysis of the deterrence effects involved with different EU merger policy instruments. Indeed, we know that effective deterrence requires those tempted by anticompetitive actions to believe that transgressing those rules involves a reasonable probability of being caught and suffering consequences [Craswell and Calfee, 1986, Baker, 2003].

As outlined in the theoretical framework of Seldeslachts et al. [2009], changes in merger policy actions represent manifestations of actual merger policy changes. Hence, firms update their beliefs regarding the competition authority's stance when they witness upticks and downticks in policy actions. For example, increases in a particular merger policy action lead then to positive updating of the probability of eliciting such an action in the future. Sah [1991] shows that the

[3] The economics of crime literature rests on strong theoretical foundations [Becker, 1968], has been subject to a great deal of scholarship [see Cameron, 1994, Grogger, 1990, Cloninger and Marchesini, 2006, for reviews], and has elicited a healthy dose of criticism [e.g., Garoupa, 1997, Berk, 2005, Donohue and Wolfers, 2005]. Thus, this is a widely employed and well tested methodology.

above properties are indeed satisfied when perceptions are described by Bayesian inference.

With the above in mind, we can generate our empirical setup where we consider the impact of changes in merger policy actions on future levels of notified merger activity. Our framework is based on the idea that if deterrence is at play, then a positive change in merger policy actions should signal to future merging parties that the expected cost of proposing an anticompetitive merger has increased. In response to such changes, a proportion of the planned anticompetitive merger activity will be forsaken by merging parties. Accordingly, there should be a negative relationship between merger policy actions and levels of proposed merger activity in subsequent years. On the other hand, if there is no deterrence at play (e.g., if a particular merger policy instrument is not perceived by merging parties to be costly), then we should see no relationship between merger policy actions and levels of proposed merger activity in subsequent years. As an aside, we must, of course, control for potential confounding factors; hence, we will explain how we capture the merger wave in the next section, as this is an essential element in our empirical strategy to isolate deterrence effects. In essence, we empirically capture deterrence (i.e., forsaken merger activity) as the departure in merger activity levels from those levels that would otherwise be predicted by the merger wave.

While our main analysis considers whether the enforcement of merger control leads to forsaken merger activity in subsequent periods, we do not differentiate between competitive and anticompetitive mergers *per se*. It would be difficult to identify the precise level of anticompetitiveness for each particular merger proposal in a deterrence study with the scope of ours.[4] Yet, using changes in the number of notified mergers in order to elicit deterrence does raise the issue as to

[4] One could in principle use stock market data for both merging and rival firms – e.g., Duso et al. [2007, 2011] – in order to assess the competitive impact of a particular merger. However, this methodology is unfeasible in our context due to the scale of our study: where we desire to elicit the deterrence effects of different merger policy tools at the industry-sector level over a two-decade period.

which types of mergers tend to be actually forsaken by merging parties. Some scholars have expressed the specific concern that procompetitive mergers are often deterred [e.g., Eckbo, 1989, 1992]. It seems, however, more probable that altering the tenor of merger policy would have a greater impact on anticompetitive merger activity. For example, the Deloitte and Touche [2007] study for the UK Office of Fair Trading provides evidence via surveys that UK merger policy rarely deters procompetitive merger activity. More recently, Baarsma et al. [2012] completed a similar survey for the Dutch competition authorities and confirmed this point regarding the rarity of procompetitive mergers being deterred.

Clougherty and Seldeslachts [2013] considered similar issues when they examined changes in the composition (horizontals versus non-horizontals) of proposed merger activity in order to proxy for the competitive nature of U.S. merger notifications. Such an empirical strategy is enabled by the fact that U.S. authorities provide information on the number of horizontal and non-horizontal merger proposals (whereas the Commission does not). This empirical strategy is based on Stigler's [1966] factoring changes in the general composition of U.S. merger activity in the years following the 1950 amendment to the Clayton Act. Following Stigler's seminal work, and given the fact that U.S. antitrust authorities almost exclusively target horizontal merger activity as potentially anticompetitive, Clougherty and Seldeslachts [2013] question whether U.S. merger policy actions in targeted sectors lead both to reduced horizontal merger notifications and to unaffected non-horizontal merger notifications in those particular sectors. Such a result would be consistent with U.S. merger control mainly deterring anticompetitive mergers, as anticompetitive mergers are strictly a subset of horizontal merger activity in the U.S. context. That study did indeed find that changes in U.S. merger policy actions lead to decreased horizontal merger activity – and unaffected non-horizontal merger activity – in subsequent years.

Summarizing the above, preexisting empirical scholarship (e.g., surveys of European legal advisors and CEOs and evidence from U.S. merger policy) indicates

that anticompetitive mergers are principally affected by changes in the tenor of merger control. Nevertheless, we will be able to extend our basic framework in order to allow differentiation between high-competition and low-competition industries. Specifically, we will define high-competition versus low-competition industries on the basis of two indicators. First, we construct a traditional measure of industry concentration that is frequently employed in merger cases – the HHI. Second, we apply an alternative measure of competition intensity: namely, the relative-profits measure recently developed by Boone [2008] and empirically operationalised by Griffith et al. [2005]. This measure quantifies the elasticity of a firm's profits with respect to its average cost level – where higher elasticities (i.e., firm profits that are more responsive to costs) indicate more intense competition. These indicators will be explained in more detail below in the data section.

The prior that mergers occurring in low-competition industries are more likely to be anticompetitive resides behind these additional tests. For example, all else equal, a merger that reduces the number of industry competitors from three to two is likely to be more anticompetitive than a merger that reduces the number of industry competitors from ten to nine – a logic similar to that employed by the Commission in its initial merger screening process. Indeed, the Commission routinely clears mergers in competitive industries based on the HHI and market shares for the involved firms; though, it takes a closer look at the mergers notified in low-competition industries.[5]

Accordingly, if deterrence is to work effectively, then merger policy actions in low-competition industries should generate larger deterrence effects than would merger policy actions in high-competition industries. Moreover, it would seem likely that the Commission would want its merger policy actions to involve a larger effect in terms of deterrence in low-competition industries.

[5] In its guidelines concerning the assessment of horizontal merger activity [Commission, 2004, p. 6], the Commission states that 'The overall concentration level in a market may also provide useful information about the competitive situation. In order to measure concentration levels, the Commission often applies the HHI. [...] The absolute level of the HHI can give an initial indication of the competitive pressure in the market post-merger.'

2.3 Data

The data employed in this study are panel in nature (where each industry sector represents a panel with observations over the 1990–2009 period) and consist of matching data from two separate sources. First, the Commission's webpage yields data on the number of notified mergers per year and industry, and on the corresponding frequency of merger policy actions at the sector-year level of analysis. Second, Thomson Reuters Worldscope database allows generating the necessary merger wave controls at the corresponding level.

2.3.1 Merger and Merger Control Data

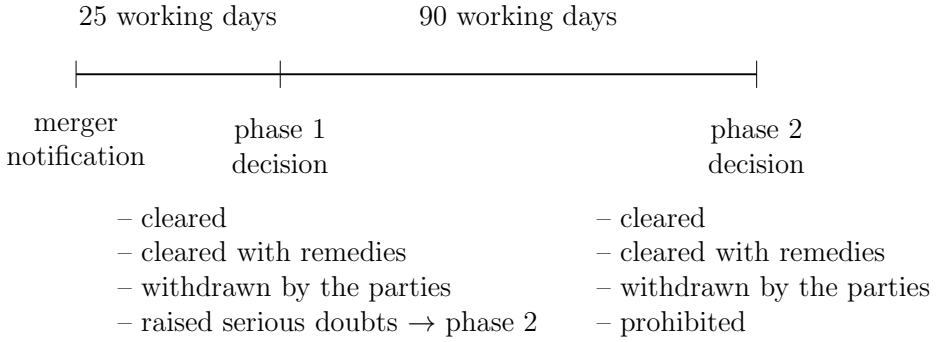
The principal source of information derives from the publicly accessible cases published by the Directorate-General Competition (DG Comp) of the Commission on its competition webpage.[6] The entire history of European merger control – from its inception with the 1990 EU merger regulation – is represented in these case files. To better understand the nature of this rich information, it is perhaps useful to briefly summarise the process of EU merger control.

Mergers that affect European markets must be notified to the Commission when the deal involves an EU community-wide dimension.[7] As pictured in Figure 2.1, after receiving notification of the merger, the Commission has 25 working days in which to make an initial assessment of the merger – the so-called Phase 1 Investigation. This phase can be extended to 35 working days when the notifying party submits potential remedies or if the Member States request (or are requested to) referral of the case. Following this preliminary investigation, the Commission

[6] Statistics on the notified mergers as well as reports for each of the Commission's decisions can be downloaded from the Commission's webpage: http://ec.europa.eu/competition/mergers/cases/.

[7] A merger has an EU community dimension if '(i) It takes place between firms with a combined worldwide turnover of at least 5 billion Euros and, (ii) a turnover within the European Economic Area of more than 250 million Euros for each of at least two of the participating firms (unless each merging firm achieves more than 2/3 of its aggregate community turnover within one and the same Member State).' (Council Regulation No. 139/2004 of 20 January 2004).

Figure 2.1: The Timing of European Merger Control



can unconditionally clear the proposed merger if it does not significantly impede effective competition (Phase 1 Clearance). Alternatively, the Commission can decide to accept remedies proposed by the merging parties in this first bargaining stage (Phase 1 Remedy). This occurs when the proposed commitments – e.g., selling some problematic assets to a competitor – would effectively attenuate the anticompetitive issues that are identified by the Commission. However, the Commission can also conclude that the proposed concentration raises serious competitive issues that are not solved by the proposed remedies. If this is the case, the Commission will then initiate a more in-depth analysis (Phase 2 Investigation). Finally, merging parties will sometimes withdraw their proposed merger during the initial investigation phase (Phase 1 Withdrawal).

Phase 2 Investigations can go for a maximum of 90 working days.[8] After this more detailed investigation, the Commission can again unconditionally clear the merger (Phase 2 Clearance), clear the merger conditional on commitments (Phase 2 Remedy), or prohibit the concentration (Phase 2 Prohibition). The merging parties may also decide to withdraw the merger in Phase 2 (Phase 2 Withdrawals). Commentators [e.g., Bergman et al., 2005] have argued that when

[8] The investigation can be extended to a maximum of 105 working days if the parties submit remedies later than 55 days after the start of Phase 2. Moreover, the Commission and the notifying parties can *stop the clock* for a maximum of 20 days subject to certain conditions: e.g., if the merging parties do not comply with requests for relevant information.

the merging parties withdraw a merger in Phase 2, this can be interpreted as a virtual prohibition. Indeed, merging parties will oftentimes formally withdraw the merger before the actual prohibition of the transaction is commuted. Given that both Phase 2 Prohibitions and Phase 2 Withdrawals suggest a failure to find a satisfactory remedy that alleviates anticompetitive concerns, we aggregate Phase 2 Prohibitions and Phase 2 Withdrawals into Phase 2 Preventions. Nevertheless, unreported analysis yields empirical results that are qualitatively identical if we keep both policy instruments separate.

We analyse the first two decades of EU merger control (1990–2009) where a total of 4,284 mergers have been notified to the Commission. For each of these merger cases, we have information on the name of the merging parties involved, the merger notification date, the type and date of the Commission's decision(s), and the main industry affected by the merger as identified by the Commission. These industries are identified with NACE codes: a classification scheme used by the EU to categorise economic activities.[9] We have annual data covering the years 1990–2009 for 88 NACE industry groups (m); hence, our unit of analysis is a particular industry in a particular year (t). For each of these industry-year combinations, we construct industry-level measures of merger activity and merger policy actions for the Commission. The first six rows of Table 2.1 report the exact definition of these different merger policy variables, where merger clearances serve as the benchmark and are not explicitly included in the analysis.

Figure 2.2 illustrates the total number of mergers notified by year across all industries. The figure shows that merger behaviour follows a characteristic wave-like pattern. During the 1990s, the number of merger proposals steadily increased. Yet following the burst in the dotcom bubble, we see a reversal in this trend

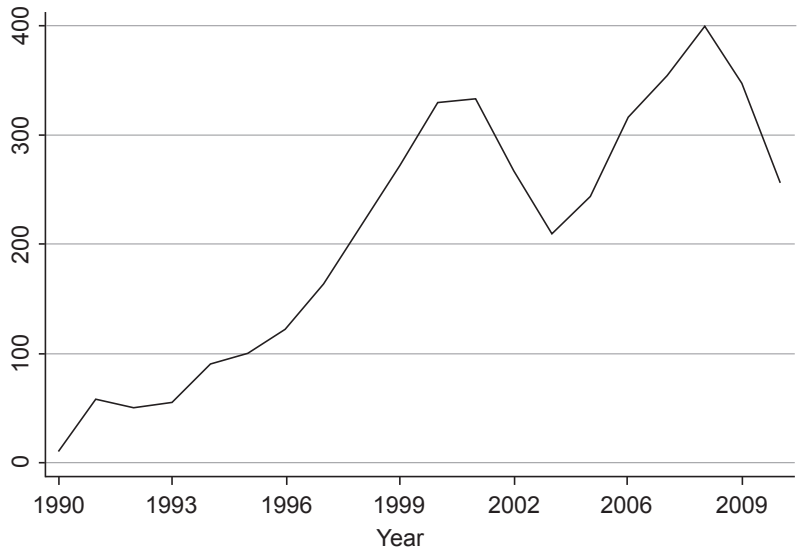
[9] While NACE industries can be as detailed as for example 'C10.7.3 – Manufacture of macaroni, noodles, couscous and similar farinaceous products', we have chosen a higher level of aggregation. For example, the above mentioned industry is aggregated (together with 17 others) into the group 'C10 – Manufacture of food products'. This is done to measure deterrence at a relatively broad level and has the additional advantage that it reduces the number of zero-observations for an industry-year combination.

Table 2.1: Definition of the Variables

Variable	Definition
N_{mt}	# of mergers notified to the Commission in industry m in year t
$R1_{mt}$	# of mergers cleared with remedies in Phase 1 in industry m in year t
$W1_{mt}$	# of mergers withdrawn by the merging firms after Phase 1 in industry m in year t
$R2_{mt}$	# of mergers cleared with remedies in Phase 2 in industry m in year t
$P2_{mt}$	# of preventions (sum of prohibitions and withdrawals) in Phase 2 in industry m in year t
A_{mt}	# of merger policy actions: $R1_{mt} + W1_{mt} + R2_{mt} + P2_{mt}$
Salesgrowth_{mt}	Mean of sales growth over a 2-years period for all firms i present in industry m in year t [as defined in Andrade and Stafford, 2004]: $(\text{sales}_{imt} - \text{sales}_{imt-2})/\text{sales}_{imt-2}$
Sharereturn_{mt}	Mean of annual return on shares for firms i in industry m in year t: $(\text{market value}_{imt} - \text{market value}_{imt-1})/\text{market value}_{imt-1}$
Tobinsq_{mt}	Mean Tobin's q for firms i in industry m in year t: $\frac{\text{asset value}_{imt} + \text{market value equity}_{imt} - \text{book value equity}_{imt}}{\text{asset value}_{imt}}$, where: $\text{market value equity}_{imt} = \text{common stock outstanding}_{imt} \times \text{average closing price}_{imt}$
HHI_{mt}	Herfindahl-Hirschman Index in industry m in year t based on the sales for all firms i in industry m in time t: $\text{HHI}_{mt} = \sum_{i \in m} \left(\frac{\text{sales}_{imt}}{\text{total sales}_{mt}} \right)^2$
Beta_{mt}	As in Griffith et al. [2005], this measure of competitiveness is captured by the time-industry-specific coefficients, Beta_{mt}, which are the time-industry-specific coefficient estimates from an OLS regression of variable profits on average costs for all firms i within industry m in year t: $\ln \pi_{imt} = \alpha + \text{Beta}_{mt} \frac{c_{imt}}{p_{imt}} + \varepsilon_{imt}$. Variable profits are defined as $\pi_{imt} \approx \text{sales}_{imt} - \text{cost of goods sold}_{imt}$, whereas average variable costs are defined as $\frac{c_{imt}}{p_{imt}} = \frac{c_{imt} q_{imt}}{p_{imt} q_{imt}} \approx \frac{\text{cost of goods sold}_{imt}}{\text{sales}_{imt}} = \text{AVC}_{imt}$.

Notes: We describe the main variables of interest of this study. While Worldscope variables are reported in the local currencies of the respective home country, we converted everything into US$ for consistency purposes. Furthermore, all variables are price adjusted according to the Consumer Price Index of the U.S. Bureau of Labor Statistics.

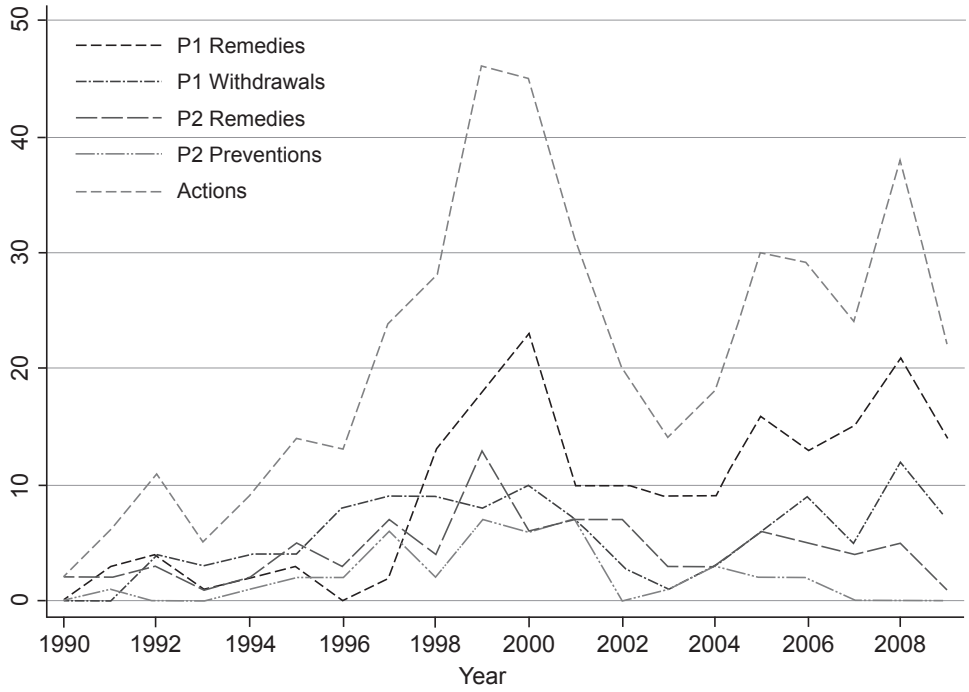
Figure 2.2: Total Yearly Notified Mergers across all Industries



through the 2000–2003 period. Merger activity levels rose again after 2004 and reached a peak in 2007; however, the number of merger proposals indicates a significant downward trend with the financial crisis of 2008–2009.

Similarly, Figure 2.3 displays the total number of yearly merger policy actions taken by the Commission. The activity levels for merger policy appear to correlate to some extent with the levels of merger activity. Some additional factors, however, are seemingly at play in the observed patterns. After the reversal of four prohibitions by the European courts in the early 2000s (*Airtours/First Choice*, *Schneider/Legrand*, *Tetra Laval/Sidel*, and *GE/Honeywell*), both the number of Phase 2 Preventions and the number of Phase 2 Remedies decrease. Additionally, both Phase 1 Remedies and Phase 1 Withdrawals occur more frequently over the same period. Accordingly, there appears to be some indications here of a trend whereby Commission officials are more actively using Phase 1 of the merger review process to settle merger cases. This potentially shows an improvement in reaching an early agreement, suggesting an increasing efficiency of communications between merging firms and the Commission. As noted by Lyons [2009,

Figure 2.3: Yearly Merger Control Actions across all Industries



p. 166], 'Reasons for this include experience, more written guidance, a more economic approach, and the impact of the Courts.' Alternatively, there may be a realisation by the Commission that they have more bargaining power in Phase 1, as will be later explained in more detail.

An initial consideration of our industry-based dataset indicates that many industries exhibit a dearth of merger policy actions. In other words, quite a few industries show a complete lack of activity in terms of merger policy. These industries will not help in identifying the deterrence effects involved with active merger policy enforcement, as deterrence in our framework functions via firms updating their beliefs about the Commission's stance through actual changes in merger policy actions. Therefore, we will exclude these inactive industries from our analysis.[10]

[10] In particular, we drop those industries where we observe 2 or less merger policy actions over the whole period of our sample (1990–2009). A simple logit procedure shows that the likelihood of being an inactive industry significantly increases with the HHI; i.e., industries

2.3.2 Control Variables

Industry-level economic and financial conditions have been widely recognised as important drivers of merger behaviour Harford [e.g., 2005]; thus, we must construct industry-level variables that control for the tendencies in merger activity levels. To do so, we use information on European firms from Thomson Worldscope databases over the 1990–2009 period. Doing so ensures that our firm-level data matches the European markets affected by the merger activity observed in our sample.[11] We aggregate this firm-level balance sheet and income-statement information at the industry-year level (m, t) and match these data with our relevant merger activity and merger policy constructs.[12] After this matching process, we are left with 72 industries spanning the 1990 to 2009 period.

with higher concentrations are more likely to be inactive in terms of merger policy. One might tentatively deduce that in highly concentrated industries firms do not propose a merger because they know that this merger will simply not be approved. While it is, of course, unclear whether this holds for all of our inactive industries, it is consistent with the fact that the mere existence of credible merger policy institutions could by itself have a deterrence effect in concentrated industries – a point that policymakers often make. For example, Coate [2005] states that a merger to monopoly is essentially never proposed and mergers of 2-to-3 and 3-to-4 have very little chance of not being challenged in the U.S. Baker [2003, p. 38] further indirectly supports such *indirect deterrence* when he presents a historical perspective of U.S. merger policy, and concludes that 'studies of firm behaviour [...] demonstrate that without antitrust, firms can and do exercise market power, to the detriment of consumers and other buyers.' Aaronson [1992] provides some examples of UK industries where a sort of shutdown in both merger and merger policy activity has taken place over a period of time – these are industries where competition authorities have signalled that horizontal M&As are simply unwelcome in the foreseeable future.

[11] We use data from firms broadly defined to include all countries of the European Economic Area, plus Turkey. In particular, we include firms located in the following countries: Austria, Belgium, Bulgaria, Channel Islands, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

[12] The primary industries of activity for firms in Worldscope are identified through the U.S. SIC codes, while the industry merger activity is categorised according to the EU NACE codes. We, therefore, match these different industries by using the U.S. census bureau table of conversion (http://www.census.gov/eos/www/naics/concordances/concordances.html). To avoid double counting, we employ a 1 to 1 matching procedure. However, this conversion table sometimes allocates the same SIC industry into different NACE industries. Hence, as a robustness check, we also define the industries via an alternative m to 1 matching procedure and show in Appendix A, that qualitative results do not change when using this allocation process. This should come as no surprise, since these industry control variables capture broad changes in industry trends, which are only partially affected by the possible misallocation of some firms.

We follow Andrade et al. [2001], Harford [2005], and Clougherty and Seldeslachts [2013] by constructing a set of variables which have been found to be important drivers of merger waves: the industry median sales growth (Salesgrowth$_{mt}$), the industry median return on shares (Sharereturn$_{mt}$), and the industry median market-to-book ratio or Tobin's q (Tobinsq$_{mt}$). The second part of Table 2.1 reports the precise descriptions of these three control constructs, as well as the descriptions for the additional control variables described below.

The three industry-level controls represent primary factors influencing merger activity levels. First, Andrade et al. [2001] find that industries with substantial sales growth tend to experience greater merger activity levels. Several related explanations exist behind this relationship; yet in essence, once an economic shock occurs to sales growth in an industry, the collective reaction of firms is such that industry assets are reallocated via merger activity. Mergers will tend then to cluster in time, as managers simultaneously react to similar shocks by competing for the best combinations of assets. Second, industries with higher share prices or market-to-book ratios often indicate greater merger activity levels. The motivations behind this relationship come from the so-called misvaluation explanations, which tend to build on stock market overvaluation. Proponents of this rationale argue that acquirers with temporary overvalued shares will tend to exchange these shares for real assets in undervalued targets: where the target shareholders accept such a proposition due to having shorter time horizons [Harford, 2005, Shleifer and Vishny, 2003].

Furthermore, in order to account for the competitive conditions in the relevant industries, we construct a traditional measure of industry concentration: the Herfindahl-Hirschman Index (HHI$_{mt}$). The HHI measure is currently employed by the Commission as a means to initially screen merger cases [Commission, 2004]. That said, employing the HHI does involve some shortcomings when it comes to measuring competition, as its theoretical foundations are based on quantity competition and thus often fail to capture the competitive conduct of firms [see, e.g.,

Buccirossi et al., 2009, for an overview]. In light of these shortcomings, we also employ a measure of competition that was recently developed by Boone [2008] and empirically operationalised by Griffith et al. [2005]. This relative-profits measure quantifies the elasticity of a firm's profits with respect to its cost level (Beta_{mt}). More negative values for this Beta indicate more intense competition since firm profits will be more (negatively) related to costs. Boone et al. [2007] show that this Beta is a reliable construct representing the development of competition over time for several models of competition, particularly with oligopolistic markets. Oligopolistic markets are quite relevant from a competition policy perspective; hence, this Beta indicator of competition represents an interesting means for our study to elicit information on the level of competition in an industry.

Table 2.2 reports preliminary statistics for our estimation sample; notice that – as will be explained below – we lose some two years of data due to our employing two-year lagged variables as regressors. Merger activity levels average some 5 proposals per year per industry, while merger policy actions occur slightly more than once every two years (0.57 merger policy actions per year on average). Phase 1 Remedies represent the most common merger policy action, followed by Phase

Table 2.2: Preliminary Statistics Estimation Sample

	Mean	S.D.	Min	Max
Merger Proposals	5.176	5.296	0	28
P1 Remedies	0.259	0.569	0	3
P1 Withdrawals	0.143	0.388	0	3
P2 Remedies	0.116	0.379	0	3
P2 Preventions	0.055	0.248	0	2
Merger Policy Actions	0.572	0.956	0	7
HHI	0.132	0.123	0.013	0.751
Beta	−2.157	3.246	−27.229	23.743
Salesgrowth (yearly mean)	0.156	0.293	−0.715	1.785
Tobinsq (yearly mean)	4.161	34.727	0.382	853.553
Sharereturn (yearly mean)	0.130	0.407	−0.574	5.790
Observations	637			

1 Withdrawals, and then by Phase 2 Remedies. In terms of observable industry characteristics, the average HHI is 0.132, but the variance across industries is quite large; e.g., 0.751 represents the maximum concentration. A similar pattern of variation across industries can be observed for the Beta – which measures intensity of competition as an elasticity of profits with respect to costs.

2.4 Estimation Strategy

2.4.1 Main Analysis

The focused aim of this project is to investigate the deterrence effects involved with the various EU merger policy instruments. Thus, we study the impact of different EU merger policy actions on the proclivity of firms to engage in future merger activity at the industry level. As observed in the data description, mergers manifest in wave-like patterns. Accordingly, holding the merger wave constant represents a crucial feature in empirically eliciting deterrence effects [see Seldeslachts et al., 2009, Clougherty and Seldeslachts, 2013]. In particular, the departure in merger activity levels from the merger wave represents deterrence; i.e., the merger wave represents the fundamental counterfactual via which deterrence is captured. In order to ensure that we have a well specified merger wave, we will control for the wave via a variety of means: year fixed-effects, control variables from the finance literature on merger waves, and a dynamic panel data approach.

First, we include year dummy variables in order to capture economy-wide period-specific shocks which are common across industries and which might trigger macro-level merger waves. In addition, most of our regression specifications will employ industry-level dummy variables in order to control for time-invariant industry-specific heterogeneity in merger behaviour.

Second, we also include relevant measures that capture time-varying industry factors that explain merger activity levels as indicated by the above-mentioned

scholarship in finance. While much of the research in economics has failed to consider merger activity in its proper wave-like context, research in finance has advanced our understanding of merger waves [e.g., Harford, 2005]. In particular, the finance literature found that both economic and financial factors – such as market concentration, sales growth, return on shares, and market value – tend to drive merger activity levels at the industry level. Our methodological approach builds upon this finance literature, as we take the wave-like nature of merger activity in our analysis explicitly into account.

Third, we include lagged dependent variables as right-hand-side regressors; hence, past merger activity levels are deemed to partly explain current merger activity levels. Two causal forces underlie the role of lagged dependent variables in our autoregressive specification. For one, industrial organization theory has identified strategic complementarities between merger decisions, as individual mergers induce further mergers that would otherwise not occur. Specifically, subsequent mergers may benefit from higher product-market price increases after a first merger has occurred; thus, an initial merger may induce additional mergers [Banal-Estañol et al., 2010]. Second, initial mergers may lead to further mergers due to rational informational cascades [Banerjee, 1992]. In essence, firms positively update their beliefs about the profitability of merging when they see other firms merge. Once enough mergers have occurred, any prior firm-specific negative views may be cancelled out by the cascade of positive news received from the market for mergers. Accordingly, firms that would not have merged otherwise will tend to also merge in this context.

In sum, our methodological approach explicitly takes the wave-like nature of merger activity into account. By doing so, we can empirically capture deterrence (i.e., forsaken merger activity), as being the departure in merger activity levels from those levels that would otherwise be predicted by the merger wave. The proper setting of the merger wave allows us then to set the pivotal counterfactual: what would merger activity levels be like in the absence of EU merger

policy.

With the above in mind, our first empirical tests involve investigating whether merger policy actions as a whole involve deterrence effects. Accordingly, our first regression specification is the following:

$$\begin{aligned} \ln N_{mt} = \alpha_0 + \alpha_1 \ln N_{mt-1} + \alpha_2 \ln N_{mt-2} + \alpha_3 \ln A_{mt-1} + \alpha_4 X_{mt-1} \\ + \eta_m + \eta_t + \varepsilon_{mt}, \end{aligned} \tag{2.1}$$

where N_m represents the number of merger proposals submitted to the Commission, A_m represents the total number of merger policy actions, and X_m represents the vector of industry-specific characteristics. The terms $\boldsymbol{\eta_m}$ and $\boldsymbol{\eta_t}$ are industry and time fixed-effects, respectively. Furthermore, extensive testing indicates that a model with two lagged dependent variables best captures merger waves in our samples of merger activity levels. This finding is in line with the precedents in the literature [Seldeslachts et al., 2009, Clougherty and Seldeslachts, 2013] – literature which similarly include two lags of the dependent variable. We will also correct the error term $\boldsymbol{\varepsilon_{mt}}$ by clustering at the industry level. Assuming clustered standard errors over the panel mitigates to some extent any remaining serial correlation in the merger series, and also represents the preferred current practice in the deterrence of crime literature [Donohue and Wolfers, 2005].

We lag the Merger Policy Actions variable and the industry control factors by one year for two reasons. First, due to the matching of different datasets and slightly different year bases (fiscal year versus calendar year), it is the easiest means to ensure that the explanatory variables precede the dependent variable. Second, it remedies to some extent the potential endogeneity of the explanatory variables due to simultaneity bias. For example, industry concentration may go up due to increased levels of merger activity. Moreover, our merger policy variables potentially involve simultaneity-based endogeneity since merger policy actions are a likely function of the number of notified mergers. Accordingly, we follow best practices in the deterrence literature where scholars have begun to lag

the deterrence variables to mitigate endogeneity issues [e.g., Katz et al., 2003].[13]

Finally, we log-transform our merger frequency and merger policy variables in order to yield additional estimation advantages. In particular, Donohue and Wolfers [2005] point out that measuring deterrence requires the consideration of scaling issues. It should also be noted that by employing the log of the absolute number of merger policy actions, our regression specification departs slightly from the conditional probabilities setup indicative of many empirical studies of deterrence that follow Becker [1968] and Ehrlich [1973]. However, constructing conditional probabilities would generate a linked variable in the construction of both the left-hand-side and right-hand-side variables; i.e., the number of notified mergers would show up both in the dependent variable and in the merger policy variables. As is extensively argued – first, by Klein et al. [1978] and, more recently, by Donohue and Wolfers [2005] – any measurement error in these linked variables could potentially lead to biased coefficient estimates that would favour empirically finding deterrence effects.

After investigating whether merger policy actions as a whole involve deterrence effects, our second set of empirical tests involves considering in detail how different merger policy instruments affect future merger activity levels. By doing so, we not only consider merger policy actions in more detail, but also investigate the implications of shifting from one merger policy instrument towards other merger policy instruments. Such substitutions between instruments may also impact deterrence, as different merger policy tools might send different signals to firms about the toughness of the competition authority. Accordingly, we estimate the

[13] Although lagging our explanatory variables eliminates correlation with contemporaneous error terms and substantially reduces the potential for bias in these coefficient estimates, lagged variables may still be potentially correlated with past error terms. If this is the case, then lagged explanatory variables are predetermined. However, this is less of a problem as compared to having endogenous variables. Predetermined variables can also potentially yield biased coefficient estimates [Bond, 2002], but they involve far less bias than do endogenous variables, as is extensively shown in Arellano [2002].

following regression specification:

$$\begin{aligned}\ln N_{mt} = \alpha_0 + \alpha_1 \ln N_{mt-1} + \alpha_2 \ln N_{mt-2} + \beta_1 \ln R1_{mt-1} + \beta_2 \ln W1_{mt-1} \\ + \beta_3 \ln R2_{mt-1} + \beta_4 \ln P2_{mt-1} + \alpha_4 X_{mt-1} + \eta_m + \eta_t + \varepsilon_{mt},\end{aligned} \tag{2.2}$$

where the different merger policy actions are now included separately in the specification (see again Table 2.1 for an exact definition).

2.4.2 Estimation Issues

We will first estimate our two basic models with the OLS method: the benchmark upon which to consider two additional estimation methods. We will also fully estimate our two models (1 and 2) by employing the fixed-effects estimation method, hence the coefficient estimates for these estimations should be considered within estimators. One issue regarding the estimation of this specification, however, is that the lagged dependent variables are endogenous by construction [Nickell, 1981, Arellano and Bond, 1991]. Hence, the endogenous nature of lagged merger proposals should in principle be taken into account in order to obtain consistent coefficient estimates. Thus while our main results hinge on the fixed effects within estimators, our third estimation method will involve employing a dynamic panel data model by means of the system GMM estimator proposed by Arellano and Bover [1995]. This instrumental variables estimator mainly takes advantage of the so-called 'internal instruments' – by using the lags of levels and the lags of differences as instruments for the lagged dependent variables – to converge on an unbiased estimator.[14] This methodology has become the standard in the literature to deal with dynamic panel data and is advocated by, e.g., Bertrand et al. [2004] as apt in such an empirical context. However, the Arellano and

[14] The GMM estimators can in principle also be used to instrument for our other explanatory variables, i.e., the merger policy and industry control variables. However, we do not engage in this estimation strategy. The system GMM estimator can easily use too many moment conditions with respect to the number of available observations when instrumenting for more than the lagged dependent variables, which could bias results for our merger policy variables.

Bover [1995] estimator only works well in situations where the number of periods is small and the number of panels is large. Furthermore, this estimator may suffer from overfitting due to the application of too many instruments [Roodman, 2009]. We will keep the number of instruments limited in order to ameliorate the potential for overfitting, and our sample seemingly satisfies the necessary criteria (with its 37 panels and 18 periods). Nevertheless, in light of the potential concerns regarding GMM estimation, we will cautiously interpret our estimation results.

In sum, we will present results based on OLS, fixed-effects, and system-GMM estimators for our base regression specifications (2.1) and (2.2). We believe that our results should be robust if they hold irrespectively of the estimation procedure.

2.4.3 Merger Waves and the 2004 Merger Policy Reform

Our next step involves fully taking into account the different phases of the merger wave (Figure 2.2). To do so, we employ a more flexible specification structure that allows the lagged dependent variables and the merger policy variables to have a time-dependent effect on future merger activity levels. Specifically, we consider the differential effect of lagged merger proposals and EU merger policy instruments during three separate periods: 1990–1999 ($p = 1$), 2000–2003 ($p = 2$), and 2004–2009 ($p = 3$). For this purpose, we interact the various policy variables with the dummy variables for these periods. We therefore estimate – with the fixed-effects estimator – the following regression specification, where I_p is an indicator variable set equal to 1 if the relevant wave period is p:

$$\begin{aligned}\ln N_{m,t} = \alpha_0 &+ \alpha_1 \ln N_{m,t-1} + \alpha_2 \ln N_{mt-2} \\ &+ \sum_{p=1}^{3} \beta_{1p} \ln R1_{mt-1} I_p + \sum_{p=1}^{3} \beta_{2p} \ln W1_{mt-1} I_p \\ &+ \sum_{p=1}^{3} \beta_{3p} \ln R2_{mt-1} I_p + \alpha_4 X_{mt-1} + \eta_m + \eta_t + \varepsilon_{mt}.\end{aligned} \tag{2.3}$$

As indicated, the additional advantage of this last regression specification is that it allows accounting for possible changes over time in the deterrence properties of EU merger policy. In particular, the third period witnessed a fundamental change in the merger control institutions, as this correlates with the period after the 2004 reforms. The 2004 reforms introduced a new substantive test that evaluates the competitive effects of mergers (the Significant Impediment of Effective Competition test); and also involved improved timetables and guidelines, a new efficiency defence for mergers, and the introduction of a Chief Competition Economist. All in all, the goal of the reforms was to bring EU merger policy closer to economic principles and further from *per se* rules (see, e.g., Lyons, 2009, Röller and de la Mano, 2006, and Duso et al., 2013). Thus, it should prove interesting to investigate whether these reforms yielded additional deterrence effects for the various merger policy instruments.

2.4.4 Competitive Conditions

We further extend our basic framework to differentiate between high-competition and low-competition industries – a distinction which allows us to investigate whether EU merger policy generates more deterrence in low-competition industries. As argued above in Section 2, our underlying working assumption is that mergers occurring in low-competition industries will be more likely to be anti-competitive, as compared to mergers occurring in high-competition industries.

We define high-competition/low-competition industries on the basis of two indicators. First, we use the traditional measure of industry concentration: the HHI. In particular, we use the HHI value employed by the Commission (HHI ≥ 0.2) in order to define a low-competition industry. Indeed, for values where the HHI is higher than 0.2, mergers are generally challenged by the Commission when they would lead to a small HHI increase (i.e., ΔHHI $= 0.015$). Given that this threshold is also known to the population of firms, this is a natural benchmark to separate high- and low-competition industries for the purposes of studying EU

merger policy. Thus, the 0.2 HHI threshold should well represent the perceptions of firms (both merging and non-merging) when considering what constitutes a low- or high-competition industry.

Yet given the potential shortcomings of the HHI measure in capturing industry competitiveness, we also apply the alternative measure of competition intensity discussed above; i.e., the relative-profits measure recently developed by Boone [2008]. Yet unlike with the HHI measure, there is no such natural threshold to apply for Boone's measure. Thus, we use the median value of this measure as a threshold to differentiate between high- and low-competition industries. To implement these estimations, we separately estimate equation (2.2) in the subsamples of high-competition and low-competition industries.[15]

2.5 Results

2.5.1 Main Results

Table 2.3 reports the empirical results for the three regression estimations – OLS, fixed-effects, and GMM – of the first specification, where we consider the deterrence effects involved with merger policy actions in general. Before considering our variables of principal interest, we first discuss the appropriateness of our estimation models and the relevance of the control variables. For all three specifications, the lagged dependent variables – as well as some of the merger wave control variables – appear to affect merger activity in subsequent years and indicate the expected signs. Hence, our empirical setup appears to be appropriate as it is able to account for the wave-like pattern in merger behaviour. Moreover, the two lagged dependent variables for merger activity levels appear to be relevant. The first lagged dependent variable is positive and highly significant in all three estimations. The second lagged dependent variable is positive in all three

[15] We estimate these models via a sandwich estimator to take into account covariances between industries and to easily compare the impact of high versus low-competition industries; see, e.g., White [1996] for a discussion of sandwich estimators and their properties.

Table 2.3: Main Analysis – Aggregated Actions

	OLS	Fixed Effects	System GMM
	(1)	(2)	(3)
Merger Proposals$_{t-1}$	0.419***	0.125**	0.458***
	(0.037)	(0.0534)	(0.163)
Merger Proposals$_{t-2}$	0.323***	0.0306	0.1000
	(0.041)	(0.0561)	(0.0711)
Merger Policy Actions$_{t-1}$	−0.071	−0.0509	−0.302
	(0.050)	(0.0456)	(0.213)
HHI$_{t-1}$	−0.528**	0.373	−2.243
	(0.255)	(0.355)	(3.735)
Beta$_{t-1}$ (×100)	−0.857	−0.968	−0.491
	(0.924)	(0.791)	(1.080)
Salesgrowth$_{t-1}$ (×10)	−0.084	0.167	0.534
	(0.392)	(0.448)	(0.140)
Tobinsq$_{t-1}$ (×100)	−0.012	−0.061**	−0.067
	(0.030)	(0.029)	(0.057)
Sharereturn$_{t-1}$	0.133**	0.128***	0.243***
	(0.053)	(0.045)	(0.089)
Constant	0.508***	1.524***	0.673*
	(0.113)	(0.170)	(0.380)
Observations	637	637	637
R^2	0.608	0.459	
# of instruments			47
Sargan test			0.8655
Arellano-Bond test			0.1521

Notes: In column (1) we report the estimate from an OLS regression. In column (2) we report the results from a panel fixed-effects regression. In column (3) we report the results from the system GMM estimation to account for the dynamic nature of our model. The dependent variable is the log of Merger Proposals. All merger policy action variables are expressed in logs. In all regressions, we include year fixed-effects. In columns (1) and (2) heteroskedasticity robust standard errors clustered at the industry level are reported in parentheses. In column (3) heteroskedasticity robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% significance levels is represented by ***, **, * respectively. For the fixed-effects estimates in column (2) we report the R^2 within. We report the p-values for the Sargan test of overidentification restrictions and for the Arellano-Bond test of zero autocorrelation in first-differenced errors.

estimations, but only significant for the OLS estimation. Yet, the inclusion of two autoregressive terms is appropriate as the test for serial correlation in the error term performs better with the inclusion of the second lag. Of the three merger wave control variables (Salesgrowth, Sharereturn, and Tobinsq), Sharereturn appears to yield the most robust effect on future merger activity levels – a positive and significant effect that provides support for the misvaluation theories of merger behaviour.

Our competition measures (HHI and Beta) generally indicate a negative, though insignificant, impact on merger activity levels. This negative coefficient estimate is in line with the idea that the Commission scrutinises less competitive industries more closely. Hence, firms will be more hesitant to propose a merger in such industries. Andrade and Stafford's [2004] empirical study of merger waves also expands on this logic. Yet the insignificance of these variables is likely due to the fact that industries are quite heterogeneous in terms of competitiveness – an issue which we will later discuss in more detail when we consider industry subsamples.

For our GMM estimations, the appropriateness and validity of the GMM instruments requires two testable assumptions. First, in order to reach identification, the disturbances must be serially uncorrelated – which is equivalent to having no second-order serial correlation in the first-differenced residuals. The Arellano-Bond test find that the null hypothesis of no second-order autocorrelation on the error differences cannot be rejected, thus suggesting that serial correlation does not exist ($\boldsymbol{p \geq 0.86}$). Second, the instruments must be uncorrelated with the first-differenced residuals – an issue which can be tested using the Sargan test of overidentifying restrictions. The Sargan test yields evidence that one cannot reject the hypothesis of no correlation between the instruments and the error term (p-value 0.15). Accordingly, the GMM regression estimation passes the necessary diagnostics and appears to be well specified.

Finally, our variable of principal interest – the Commission's merger policy actions – indicates a negative impact on future merger activity levels; yet, this

effect is insignificant in all three estimations. These results suggest that merger policy actions as a whole do not involve significant deterrence effects. With these sobering results in mind, we move to our second specification where we disaggregate the merger policy actions.

Table 2.4 presents the results for our estimations of the second regression specification. The two diagnostic tests (Arellano-Bond and Sargan) for the GMM estimator again indicate that the necessary assumptions are present; hence, the model appears to be relatively well specified. As can be seen from Table 2.4, the coefficient estimates for the common constructs – the lagged merger proposals variables, merger wave control variables and industry competitiveness measures – are consistent with the results from the previous specification. For brevity purposes, we will not discuss these common results here. We can thus look at the empirical results while focusing on the variables of principal interest: the relationship between the various merger policy tools and future merger activity levels.

First, negotiated remedies taken in the initial investigation phase indicate a negative impact on future merger activity levels in all three estimations – a coefficient estimate that is significant at the 1% level for the fixed-effects estimation, the 5% level for the OLS estimation, and the 10% level for the GMM estimation. Second, the withdrawals that occur in Phase 1 are negative per expectation in two estimations, but indicate insignificance in all three estimations. Third, remedies in Phase 2 are positive, though insignificant, in all three estimations. Fourth, Phase 2 Preventions are positive, though insignificant, in all three estimations.

The consistent negative impact of the Phase 1 Remedies variable indicates that increasing the number of remedies in the early stages of merger control leads to reduced merger activity levels in subsequent years. Thus, this result suggests that a spike in the relative use of this particular merger policy instrument tends to send a clear signal to firms that the Commission will be tougher in the application of merger policy in the future. In terms of economic significance, if one were to take

Table 2.4: Main Analysis – Disaggregated Actions

	OLS	Fixed Effects	System GMM
	(1)	(2)	(3)
Merger Proposals$_{t-1}$	0.417***	0.126**	1.040***
	(0.036)	(0.053)	(0.285)
Merger Proposals$_{t-2}$	0.322***	0.026	−0.278
	(0.042)	(0.055)	(0.300)
P1 Remedies$_{t-1}$	−0.146**	−0.157***	−0.421*
	(0.057)	(0.051)	(0.242)
P1 Withdrawals$_{t-1}$	−0.020	−0.039	0.243
	(0.098)	(0.076)	(0.786)
P2 Remedies$_{t-1}$	0.008	0.077	0.106
	(0.109)	(0.098)	(0.782)
P2 Preventions$_{t-1}$	0.028	0.031	0.720
	(0.148)	(0.120)	(1.704)
HHI$_{t-1}$	−0.533**	0.367	−0.210
	(0.254)	(0.355)	(0.513)
Beta$_{t-1}$ (×100)	−0.897	−0.979	2.430**
	(0.906)	(0.770)	(1.230)
Salesgrowth$_{t-1}$ (×10)	−0.099	0.162	0.096
	(0.389)	(0.455)	(0.581)
Tobinsq$_{t-1}$ (×100)	−0.007	−0.057**	0.147***
	(0.029)	(0.027)	(0.056)
Sharereturn$_{t-1}$	0.127**	0.121***	−0.037
	(0.051)	(0.043)	(0.099)
Constant	0.522***	1.551***	0.396
	(0.114)	(0.163)	(0.493)
Observations	637	637	637
R^2	0.609	0.464	
# of instruments			47
Sargan test			0.995
Arellano-Bond test			0.131

Notes: In column (1) we report the estimate from an OLS regression. In column (2) we report the results from a panel fixed-effects regression. In column (3) we report the results from the system GMM estimation to account for the dynamic nature of our model. The dependent variable is the log of merger proposals. All merger policy action variables are expressed in logs. In all regressions, we include year fixed-effects. In columns (1) and (2) heteroskedasticity robust standard errors clustered at the industry level are reported in parentheses. In column (3) heteroskedasticity robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% significance levels is represented by ***, **, * respectively. For the fixed-effects estimates in column (2) we report the R^* within. We report the p-values for the Sargan test of overidentification restrictions and for the Arellano-Bond test of zero autocorrelation in first-differenced errors.

the coefficient estimate for Phase 1 Remedies from the first estimation (0.146) and consider the impact of a 1% increase in the application of that merger policy action, then merger activity would tend to decrease in subsequent years by about 0.15% in a focal industry.

2.5.2 Results over Time

When we consider the empirical results for our third specification (model 3) – where the merger policy variables are interacted with the period dummies – we find additional evidence that Phase 1 Remedies uniquely involve deterrence effects. Table 2.5 reports the results for the estimations of this third regression specification, and the results clearly indicate that Phase 1 Remedies are the only merger policy instrument that appears to involve consistent and robust deterrence effects. While Phase 1 Remedies indicate the expected negative effect on future merger activity levels for all three periods, this influence is only significant at the 5% level for the first (1990–2000) and last periods (2005–2009). In addition, the coefficient estimate for the last period is greater than that in the first period (-0.213 versus -0.15); though, this difference is not statistically significant. It can thus be tentatively concluded that the 2004 merger reforms did not yield significantly greater deterrence effects when it comes to merger policy – a result which will be further discussed in the next section on policy implications.

2.5.3 Results for Low- versus High-Competition Industries

We will now take a more detailed look at whether merger policy actions generate a differential impact in industries due to the levels of competitiveness in the industry. First, we divide industries into high-competition and low-competition in terms of their HHI. Recall that we employ a cut-off point of HHI = 0.2, as this is the threshold used by the Commission in classifying industries for merger policy.

Table 2.5: Time Periods

	1990–2000	2001–2003	2004–2009
	(1)	(2)	(3)
Merger Proposals$_{t-1}$	0.100	0.078	0.236***
	(0.063)	(0.076)	(0.075)
Merger Proposals$_{t-2}$	0.070	−0.014	−0.056
	(0.060)	(0.073)	(0.098)
P1 Remedies$_{t-1}$	−0.150**	−0.116	−0.213**
	(0.064)	(0.118)	(0.103)
P1 Withdrawals$_{t-1}$	0.094	0.034	−0.339
	(0.096)	(0.172)	(0.242)
P2 Remedies$_{t-1}$	0.132	0.020	−0.080
	(0.134)	(0.172)	(0.183)
P2 Preventions$_{t-1}$	0.145	−0.091	−0.055
	(0.143)	(0.232)	
HHI$_{t-1}$		0.392	
		(0.342)	
Beta$_{t-1}$ (×100)		−0.927	
		(0.810)	
Salesgrowth$_{t-1}$ (×10)		0.094	
		(0.495)	
Tobinsq$_{t-1}$ (×100)		−0.072***	
		(0.026)	
Sharereturn$_{t-1}$		0.122**	
		(0.045)	
Constant		1.562***	
		(0.208)	
Observations		637	
R^2		0.473	

Notes: We report the estimate from a panel fixed-effects regression. The dependent variable is the log of merger proposals. All merger policy action variables are expressed in logs. In all regressions, we include year fixed-effects. Heteroskedasticity robust standard errors clustered at the industry level are reported in parentheses. For reading purposes, we report the coefficients' estimates of the interaction between the variable of interest and a dummy indicator for the three periods in the upper part of each column. The coefficients' estimates for the control variables (HHI, Beta, Salesgrowth, Tobinsq, and Sharereturn) are instead not interacted with the time periods dummies and are thus the same for all time periods; therefore, they are reported only once. Significance at the 1%, 5%, and 10% significance levels is represented by ***, **, *. We report the R^2 within.

As such, this classification can perhaps be best viewed as whether firms *perceive* industries to be competitive or not according to the Commission's estimation, as mergers falling in industries that are above this threshold will be subject to heavy scrutiny by the Commission (at least in the initial stages of the merger review process). As can be seen from the first two columns of Table 2.6, Phase 1 Remedies induce a reduction in future merger activity levels in both low and high-competition industries. However, deterrence effects appear to be greatest in low-competition industries, as the coefficient estimate (-0.32) for Phase 1 Remedies in low-competition industries is significantly lower than the coefficient estimate (-0.104) for Phase 1 Remedies in high-competition industries.

The fact that Phase 1 Remedies involve more substantial deterrence in low-competition industries as compared to high-competition industries is indeed encouraging. This result indicates that deterrence effects manifest where it is most desirable from a welfare perspective. In particular, low-competition industries are more likely to involve anticompetitive mergers, thus it would seem that low-competition industries would be most influenced by changes in the tenor of merger policy. Furthermore, this result provides some credibility for our methodological approach in the sense that the empirical results are consistent with the idea that it is anticompetitive mergers that are mostly deterred by merger policy.

We move now to the empirical results for our second indicator of industry competitiveness: Boone's Beta. This measure might better capture an industry's competitiveness; though, it should be noted that the HHI measure does align relatively well with EU merger control practice, and particularly with how industries are initially screened by the Commission. According to the Boone classification of industry competitiveness, Phase 1 Remedies also yield a more robust impact in low-competition industries as compared to high-competition industries. However, neither coefficient estimate is significant. Thus, Phase 1 Remedies yield significantly more deterrence in low-competition industries when the traditional HHI classification is employed; yet, Boone's measure of industry competitiveness

Table 2.6: High Competition versus Low Competition

	HHI (Threshold 0.2)		Beta (Threshold Median)	
	High Competition	Low Competition	High Competition	Low Competition
	(1)	(2)	(3)	(4)
Merger Proposals$_{t-1}$	0.093	0.040	0.003	0.157**
	(0.061)	(0.113)	(0.059)	(0.070)
Merger Proposals$_{t-2}$	0.046	−0.283***	−0.067	0.039
	(0.058)	(0.080)	(0.070)	(0.081)
P1 Remedies$_{t-1}$	−0.104*	−0.320**	−0.090	−0.131
	(0.056)	(0.139)	(0.060)	(0.089)
P1 Withdrawals$_{t-1}$	−0.036	0.020	−0.114	0.174**
	(0.080)	(0.229)	(0.123)	(0.085)
P2 Remedies$_{t-1}$	0.119	0.285	0.055	0.0551
	(0.096)	(0.266)	(0.119)	(0.154)
P2 Preventions$_{t-1}$	−0.057	0.741***	0.046	0.0484
	(0.115)	(0.280)	(0.145)	(0.183)
HHI$_{t-1}$	−1.357	0.359	−0.727	0.740**
	(0.847)	(0.542)	(0.520)	(0.363)
Beta$_{t-1}$ (×100)	−0.630	−0.700	−0.543	−1.760
	(0.951)	(1.040)	(0.888)	(1.110)
Salesgrowth$_{t-1}$ (×10)	0.991	−0.433	1.390*	−0.129
	(0.723)	(0.493)	(0.808)	(0.564)
Tobinsq$_{t-1}$ (×100)	0.291***	−0.073***	−0.082***	−0.012
	(0.060)	(0.020)	(0.027)	(0.024)
Sharereturn$_{t-1}$	0.210***	0.107***	0.321***	0.054
	(0.077)	(0.041)	(0.095)	(0.041)
Constant	1.508***	2.293***	2.321***	1.809***
	(0.206)	(0.285)	(0.223)	(0.355)
Observations	532	105	320	317
R^2	0.660	0.686	0.662	0.673

Notes: We report the estimate from a panel fixed-effects regression. The dependent variable is the log of merger proposals. All merger policy action variables are expressed in logs. In all regressions,we include year fixed-effects. The threshold for high vs. low competition is chosen to be the median in the case of beta, while for the HHI we use the threshold value adopted in the EU competition policy to define the concentrated-market region (HHI = 0.2). Heteroskedasticity robust standard errors clustered at the industry level are reported in parentheses. Significance at the 1%, 5%, and 10% significance levels is represented by ***, **, *.

yields no such statistically significant differences.

2.6 Conclusions and Policy Implications

We set out here to investigate the deterrence effects involved with EU merger control. In particular, our aim was to uncover which specific merger policy instruments lead to forgone merger activity in subsequent years. The striking and consistent finding from our empirical results is that Phase 1 Remedies appear to uniquely involve deterrence in the European context. On the other hand, merger policy actions as a whole – as well as preventions, Phase 2 Remedies, and Phase 1 Withdrawals – do not appear to yield substantial deterrence effects.

Several potential related explanations exist as to why Phase 1 Remedies yield significant deterrence effects while Phase 2 Remedies do not. First, the Commission has higher bargaining power in the initial stage of the merger review process, since merging firms are generally eager to reach a deal relatively quickly and avoid the costs involved with waiting for the consummation of the merger in Phase 2 of the review process. As Clougherty [2005] notes, a delay represents a holdup to the intended strategy of the merging firms, hence higher levels of scrutiny that push off the benefits of the transaction reflect higher costs for merging firms. Salop [2013a] also argues that delays are costly as they increase the likelihood of failure for merging firms. Given that merging firms have a substantial interest in getting their transaction approved as quickly as possible, they are likely to agree to relatively substantial remedies in the early stages of the merger review process [Dertwinkel-Kalt and Wey, 2012]. Following this logic, the remedies agreed to during the initial stage should be remedies that involve a substantial cost to merging parties. Thus, an uptick in these types of remedies will represent a significant deterrent to future merger behaviour.

Phase 2 Remedies, however, do not indicate significant deterrence effects in our various regression estimations. This result could be based on the same logic as

above concerning bargaining-power being a function of the potential to delay the onset of the merger. Once a merger has reached Phase 2 of the merger review process, then much less scope exists for the Commission to delay the onset of the merger. Instead, the only recourse at this stage given to the Commission is the ability to threaten a potential prohibition. However, the Commission – and other competition policy authorities – rarely employ prohibitions as an instrument of merger policy; e.g., Clougherty and Seldeslachts [2013] report that only 0.072% of notified merger transactions receive a prohibition in the U.S. context. With prohibitions being a relatively rare event, this suggests then that the bargaining power of the Commission will be severely curtailed in Phase 2. Consequently, the remedies offered up by merging parties in Phase 2 will be generally less substantial than those offered up in Phase 1. Thus, these Phase 2 Remedies will be less likely to represent a deterrent to future merger behaviour in that focal industry. In line with these priors, Duso et al. [2011] find that remedies negotiated by the Commission in Phase 1 tend to be more effective at reducing anticompetitive effects, as compared to remedies negotiated by the Commission in Phase 2.

Furthermore, not only do prohibitions tend to be rare events in all jurisdictions, they have become increasingly rare in the EU context after several setbacks in the courts in the early 2000s. In fact, for quite some time the Commission has been quite weary to employ preventions as a merger policy tool.[16] Thus, it is fair to conjecture that drawn-out negotiations that get relatively close to the 90-day deadline will tend to find the Commission's bargaining power to substantially diminish. In essence, the only *real* option for the Commission in these later stages of the merger review process is to accept the less substantial remedies being offered by the merging parties before the negotiation phase ends.

In addition to Phase 2 Remedies, Phase 1 Withdrawals and Phase 2 Preventions also do not involve substantial deterrence effects. The fact that preventions

[16] In recent years, this has changed again. But these years are not included in our dataset.

do not yield deterrence seems somewhat surprising, as preventions impose the highest possible cost on merging firms. However, the fact that preventions have been seldom employed over the last twenty years by the Commission potentially explains why our analysis is unable to detect any significant deterrent effect for this particular policy instrument. Furthermore, the lack of substantial deterrence effects for Phase 1 Withdrawals may be due to the fact that withdrawals do not send a clear signal about the Commission's stance in that particular industry. A number of withdrawals in the initial stage of the merger review process may be due to internal reasons to the merging parties – rationales that are independent of EU merger policy. Accordingly, an uptick in the number of Phase 1 Withdrawals might very well be a noisy signal that does not provide clear information to firms about the actual costs involved with navigating the merger review process. As such, the lack of clear deterrence effects for this merger policy instrument makes intuitive sense.

In terms of policy prescriptions, our results indicate that maximising deterrence – at least according to the current EU merger policy regime – requires the use of Phase 1 Remedies. Phase 1 Remedies should be applied relatively frequently, as this is simply the only merger policy instrument which appears to involve robust deterrence effects. The Commission's behaviour does tend to partially conform to these priors, as Phase 1 Remedies are employed more than twice as frequently as Phase 2 Remedies. Furthermore, the application of more preventions in Phase 2 of the merger review process may lead to greater deterrence effects for Phase 2 Remedies. Indeed, if firms believe that preventions are a relatively likely outcome when negotiations break down during Phase 2, then these firms would perhaps be more willing to accept tougher remedies during these later stages of negotiation. In addition to this indirect effect regarding Phase 2 Remedies, an increase in preventions would also, of course, impose the highest possible cost upon merging firms. Thus, it would likely induce more deterrence in a direct manner. Accordingly, the very recent turn in EU merger policy to reembrace

the employment of preventions (*Aegean Airlines/Olympic Air* in 2011, *Deutsche Börse/NYSE Euronext* in 2012, *TNT express/UPS* in 2013, and *Ryanair/Air Lingus* in 2013) would be a healthy practice in terms of generating deterrence effects.

We do not find that the 2004 merger reforms towards using more economics in competition policy have an additional impact on deterrence. This result adds an element to the continuing debate on how merger policy should ideally work. Legal scholars often argue that deterrence works best when policy is predictable and more certain [Calfee and Craswell, 1984, Craswell and Calfee, 1986]. Thus according to legal scholarship, the case-by-case approach favoured by economists, would add too much unpredictability to the merger review process. Economists, on the other hand, argue that the application of economic principles will increase the efficiency and correctness of individual decisions, and therefore reduce the errors in assessing the anticompetitiveness of mergers. This, in turn, should enhance the deterrence effects involved with merger policy actions. Indeed, errors in decision-making typically lead to less deterrence [Davies and Majumdar, 2002]. Our results suggest that both argumentations may contain some element of truth: switching to a more economics-based approach has not increased nor decreased deterrence effects.

Finally, we find that the deterrence effects involved with Phase 1 Remedies work best in the low-competition industries: where the HHI is above 0.2, the cut-off level employed by the Commission in order to define an industry as exhibiting a lack of competition. This result is, in our view, encouraging for two reasons. First, it indicates that EU merger policy actions involve greater deterrence in low-competition industries according to the Commission's definition. This is, of course, desirable as these industries are already highly concentrated and it would be beneficial to discourage further merger activity in these industries. Furthermore, this result is consistent with Phase 1 Remedies deterring mostly anticompetitive mergers. Indeed, all else equal, mergers in more concentrated industries

are by definition more anticompetitive. Taken together, we can tentatively conclude that deterrence takes place mainly in those industries where it matters most, and that this deterrence is desirable in terms of which type of mergers are being deterred. This previous result – and our subsequent deductions about the type of mergers being deterred – is also in line with a recent study by Duso et al. [2013]. In a small sample of 368 mergers being scrutinised by the EC over the 1990–2007 period (mergers which represent a subsample of our dataset), they consider the share prices of non-merging rival firms in order to identify whether a particular merger is anticompetitive or not. Using this methodology, Duso et al. [2013] find that if the Commission applies more Phase 1 Remedies, then the likelihood that a proposed merger is anticompetitive is reduced. This result, however, only holds for the period after the 2004 reforms. Combining their results with the results from our study would suggest that Phase 1 Remedies induce firms (i) to propose fewer (anticompetitive) mergers in subsequent years and (ii) to propose mergers that are less damaging in terms of consumer welfare.

Perhaps more sobering is the fact that when we classify industries on the basis of Boone's Beta (a measure based on a firm's elasticity of profits with respect to costs), we do not find greater deterrence effects in low-competition industries. This could indicate that both the Commission act and merging firms only react optimally in terms of welfare conform industry concentration measures (the HHI), while perhaps more sophisticated measures of competition would perhaps give a different picture. Of course, to know whether this is really the case, clearly more research in this dimension is needed.

In sum, we find Phase 1 Remedies to be effective and Phase 2 Remedies and preventions to be ineffective in the deterrence of future merger frequencies. The weak deterrence implications of Phase 2 Remedies and preventions may be a concern for EU competition policy in light of the fact that this suggests that the Commission does not appear to generate robust deterrence from any of its enforcement efforts that take place in the later stages of the merger review process.

To the degree that EU competition authorities are concerned about the deterrence implications of merger policy, our results suggest that they may want to move more enforcement actions to the initial stages, or employ more preventions in order to create more bargaining power in the secondary stage.

3 European Merger Control and Deterrence: A Firm-Level Analysis

'Deterrence is the art of producing in the mind of the enemy ... the FEAR to attack!' – Dr. Strangelove in 'Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb' (1964)

3.1 Introduction

Competition policy may be defined as 'the set of policies and laws which ensure that competition in the marketplace is not restricted in such a way as to reduce economic welfare' [Motta, 2004, p. 30]. European competition policy is mainly rooted in Articles 101 and 102 Treaty on the Functioning of the European Union, with first efforts towards cross-border competition rules dating back to the 1950s. Article 101[1] related to anticompetitive agreements and Article 102[2] to the abuse of a dominant position. Merger control, therefore, was initially not an explicit part of European competition policy. To apply either provision so as to include mergers was highly uncertain to say the least, if not ruled out in general.

At the same time, it was widely recognised among academics and practitioners that mergers could have important effects on competitive conditions [Russo et al.,

[1] Formerly Article 81 Treaty Establishing the European Community (TEC).
[2] Formerly Article 82 TEC.

2010] and, despite possible positive synergy effects, required ex ante policing and control. As a result of such considerations, the Merger Regulation 1989[3] was adopted, requiring firms to notify mergers to the European Commission (Commission). European merger control hence formally has existed since 1990 when the Merger Regulation 1989 was implemented and the first European merger case was notified.[4]

Further practice made it necessary to extend the scope of Merger Regulation 1989 in the new Merger Regulation 2004,[5] which set forth a new standard to assess the competitive impact of mergers, commonly referred to as the SIEC test.[6] The new standard widens the grounds to prohibit a merger, that is, independent of the creation or strengthening of a dominant position, mergers which might significantly impede effective competition will be barred.

In the course of the past years, landmark cases have become responsible in further shaping competition policy in Europe. For example, the grounds on which mergers would be prohibited for fear of coordinated effects in the market have been specified.[7] The central enforcement body of merger control, the Directorate-General for Competition in the European Commission (DG Comp), further saw the need to set forth guidelines for nonhorizontal mergers in 2008 as anticompetitive instances of vertically integrating businesses increasingly took place.[8]

[3] Council Regulation (EEC) No. 4064/89 on the control of concentrations between undertakings, OJ L 395/1, as amended.

[4] *Renault/Volvo* OJ 1990 C254/04, Case M.4.

[5] Council Regulation (EC) No. 139/2004 on the control of concentrations between undertakings OJ L24/1. References, unless otherwise noted, relate to the Merger Regulation 2004.

[6] Article 2(3), Significant Impediment of Effective Competition (SIEC test), see also Commission Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings OJO C 31/5.

[7] For example, *Nestlé/Perrier* Commission decision 92/553/EEC [1992] OJ L 356/1, Case IV/M.190; *Airtours/First Choice* Commission decision 2000/276/EC [1999] OJ L 93/1, Case IV/M.1524; *Sony/BMG* Commission decision 2005/188/EC [2004] summary of the decision in OJ L 62/30, Case COMP/M.3333; see also summaries in Vickers [2004] and Bellis [2009].

[8] Guidelines on the assessment of nonhorizontal mergers under the Council Regulation on the control of concentrations between undertakings OJ C 265/6; for example, *Worldcom/MCI* Commission decision 99/287/EC [1999] OJ L 116/1, Case COMP/M.1069; *Tetra Laval/Sidel* Commission decision 2004/124/EC [2004] OJ L 43/13, Case COMP/M.2416: *Google/DoubleClick* Commission decision 2005/590/EC [2005] summary of the decision in

With more than 20 years of European merger control practice and enforcement, the central question thus arises whether competition policy in general and merger control in particular has ex post met its initial objectives and has had a socially beneficial effect [Buccirossi et al., 2013]. An important question related to the above is with which methods one could possibly measure the effectiveness, while at the same the prevailing view is that no really convincing empirical evidence about the effectiveness of the antitrust enforcement regime has yet been found [Baker, 2003, Crandall and Winston, 2003, Carlton, 2009].

Given the publicly accessible information on all notified European mergers during the last 20 years, an empirical ex post analysis – next to a purely qualitative review – of merger policy becomes increasingly meaningful and to some extent imperative. In addition, as the legislative history reflects, merger control has gained greatly in significance and it has been widely recognised among theorists and practitioners as having large implications on all other areas of antitrust [Kovacic, 2009].

Ex post measurement of the effectiveness of merger control may be approached from different angles. It has been proposed to assess the strength and quality of legal enforcement by examining more closely any potential (over- or under-)deterrence and Type I and Type II errors when enforcing and interpreting the rules [Buccirossi, 2010].

The central rationale for considering deterrence is the fact that a merger decision not only has direct effects on the filing parties, but conceivably also indirect effects on future filings of other firms observing the merger decision [Sørgard, 2009, Salop, 2013b]. From a policy perspective, the right deterrent effects should increase future effectiveness and efficiency of merger control since the outside world would pick up the proper signals sent by the authority and subsequently adjust its filings accordingly. As a result of firms internalizing the rules and policy actions, less and less case-by-case regulation will become necessary. Ultimately,

OJ C 184/10 [2008]; *ENI/EDP/GDP* Commission decision 2005/801/EC [2004] summary of the decision in OJ L 302/69, Case COMP/M.3440.

in a world of a perfect merger control with no errors of judgment and a complete degree of deterrence, the merger authority would in fact receive only *good* or welfare-increasing merger filings and no *bad* filings. The degree of intervening, prohibiting, and remedying mergers by the authority would be reduced to nil. While such scenario sounds as yet unrealistic and we can assume that some amount of imperfect enforcement [Buccirossi, 2010] will persist[9] in the long run, a well-established deterrence system means in any case that the authority will be able to save manpower and resources and shift its efforts on (the few remaining) ambivalent or complex cases.

Type I and Type II errors refer to the extent the authority is able to correctly make a decision in accordance with the policy goals it wishes to achieve. In a merger context, an effective authority should try to maximise welfare by neither clearing systematically too many welfare-decreasing mergers[10] nor prohibiting too many welfare-increasing mergers, and it should strive to influence the future merging behaviour of the companies in such way that less *bad* and more *good* mergers are notified.

While the quality of merger control depends on both the error proneness of the authority and the deterrent effects of its enforcement [Sørgard, 2009], this paper will focus on the deterrent aspect of enforcement.

The foremost difficulty with adequately assessing deterrence is its absence of data. By definition, deterrence implies that some decisions which would have manifested themselves publicly once they were taken were not made by the parties. The sample we have publicly available representing the merger data of the last 20 years must qualify as the outright antithesis of deterrence or rather the *tip of the iceberg* [Seldeslachts et al., 2009] in the sense that it fails to reflect the

[9] In the same vein, deterrence in merger control by definition feeds to some extent on Type I errors of the authority: Over- and underdeterrence might stem from varying degrees of severity in remedies decisions, but not from prohibitions *per se*. Prohibitions which would not exist in the *perfect world* would then be made in the form of Type I errors thereby potentially deterring outsiders to make a filing.

[10] Whatever the Commission's welfare standard may be.

full extent of merger policy effects [Davies and Ormosi, 2012]. It is the prevailing view, however, that the full extent of deterrent effects must be large.

In the face of data limitations, my paper addresses a first methodical step towards an incrementally refined measurement of deterrence. To approximate the extent of deterrence, I estimate the probability of notifying an anticompetitive merger given the past policy actions of the Commission and other explanatory control variables. The novelty in this approach is that units of observations are broken down to the merger level, whereas past papers used variables aggregated by industry or time [Duso et al., 2013]. This is a unique step as it combines firm-level information of the involved merging firms with information on the merger case covering a timespan of the past 20 years. From a methodological point of view, this is an obvious starting point for a more precise measurement of deterrence. My approach, albeit a necessary first step, falls short of measuring the complete extent of deterrence inasmuch as such measuring implies the inclusion of the whole iceberg – not only its tip.

Section 2 discusses the concept of deterrence in merger control and its inherent measuring challenges and provides an overview of past literature; Section 3 introduces the model for the estimation equation, while Section 4 describes the data and variables which were used for the estimation. The section will also briefly summarise the merger procedure of the European Commission and furnish some basic statistics on the merger decisions covering the entire merger history. Section 5 will discuss results of the estimation, while I will draw conclusions from the estimation in Section 6.

3.2 Deterrence

Early research into deterrent effects of competition policy focused on simple before/after comparisons of notified mergers. Stigler [1966], for example, by looking at changes in the composition of U.S. mergers before vs. after the 1950 anti-merger

amendment to the Clayton Act, found that the amendment must have had a deterring effect on horizontal mergers, since the share of horizontal mergers shrunk considerably. Stigler did not run any regressions at that time, which makes it difficult to draw any valid conclusions from his statistical exercise. Nevertheless, the merit of his analysis lies in the fact that he was one of the first scholars to form a connection between merging behaviour and government action so as to grasp potential deterrent effects of legal enforcement. Eckbo and Wier [1985] followed Stigler's approach and compared mergers before and after the U.S. Hart-Scott-Rodino Act to gain insights about deterrent effects. Measuring the outside (rival) firms' stock market premiums before and after the reform, their results suggest that less anticompetitive mergers were filed after the reform. The results still put into doubt the fact that those mergers which were picked up by the authority for investigation after the reform tended to be more anticompetitive than those not investigated; Eckbo and Wier did not find conclusive evidence that the reform had led to a more efficient identification and selection process of anticompetitive mergers.

The deterrence concept of public enforcement originally stems from the economics of crime literature and is based on the idea that the punishment of criminals is observed and probabilities of being captured and punished are being updated by potential offenders [Becker, 1968]. The deterrence of criminals thus depends on whether the expected profit of a crime exceeds the expected punishment. According to this strand of literature, criminals posit a detection probability for their decision with such probability being a function of the authority's past performance which they have observed. Effective deterrence then means that the severity of punishment and the high detection probability renders the crime unprofitable.

The concept can be applied to the merger context analogously: Firms contemplating a merger observe the policy decisions taken by the European Commission to decide whether or not to file for an intended merger [Seldeslachts et al., 2009].

They will update their expectations on the Commission's actions and adjust their decisions accordingly. It is not enough to deter any merger – with the appropriate merger policy, firms should be encouraged to notify procompetitive mergers and deterred to notify anticompetitive mergers. Seldeslachts et al. [2009], instead of using conditional probabilities, used absolute numbers of actions and looked at their impact on the frequency of mergers over 28 antitrust jurisdictions between 1992–2005. Their unit of observation is a jurisdiction. Their main result is that prohibitions have a deterrent effect on future merger frequencies, while other merger policy tools have no impact. As they outline, firms make inferences as to antitrust stances, i.e., the parameters eliciting a specific kind of action, given the past decision history and the imperfect information on the parameters of previously proposed mergers. They react to and update their expectations in the face of a jurisdictional change, as it means that jurisdictional decision thresholds might have shifted and probabilities for specific decisions altered.

Clougherty and Seldeslachts [2013] made further advances into this topic by applying the conditional probabilities methodology employed by the economics of crime literature. They regressed conditional probabilities as explanatory variables[11] constructed from the U.S. Department of Justice and the Federal Trade Commission data against the number of horizontal mergers and composition of mergers between 1986–1999. The unit of observation is the 2-digit Standard Industry Classification (SIC) industry. Their result was that merger challenges[12] had a strong deterring effect on horizontal mergers.

Clougherty et al. [2013b] take a frequency-based and industry-level approach towards deterrence: Using the entire merger data from the European Commission and matching the data at an industry level with aggregated firm data, they run regressions of merger notifications against the Commission's merger decisions differentiated in kind. They find Phase 1 Remedies sending strong signals into

[11] E.g., the investigation rate, i.e., the number of investigations divided by the number of prohibitions.

[12] E.g., policy actions divided by the number of investigations.

the market, whereas merger policy actions as a whole do not seem to have a significant deterrent effect. With respect to Phase 1 Remedies, the result is that they work best in low-competition industries. They use the Herfindahl-Hirschman Index and Boone's Beta to measure the degree of competition in the respective industries. Clougherty et al. [2013b] control for merger waves, industry-specific determinants of mergers, and industry and time fixed-effects.

Duso et al. [2013] depart from the past deterrence approach by identifying anticompetitive mergers in their sample. As part of an overall economic assessment of the 2004 European merger reform look at how past decisions affect the probability of a merger to be anticompetitive by estimating a probit equation. They use a subsample of the EU merger dataset of 326 mergers and add information on competitors. Their identification strategy for anticompetitiveness is to look at stock market reactions to merger announcements.[13] As a novelty in the methodical approach, the authors undertake to measure not only the quantitative (frequency) side, but also the qualitative effects of deterrence, that is, whether merger control has been able to deter *bad* mergers and encourage *good* mergers (good deterrence). They find a negative and significant effect of Phase 1 Remedies and prohibitions in the period before the reform on anticompetitive mergers. There seems to have been a policy shift after 2004 where the number of prohibitions went down radically; after the reform, withdrawals and abortions seems to have partially substituted for prohibitions in its deterrent effect.

This paper is similar in approach as Duso et al. [2013], but then combines a more comprehensive range of merger cases with the corporate financial data of Thomson Reuters Worldscope and the Thomson Reuters SDC M&A data. Identifying past mergers as competitive or anticompetitive according to the profit differentials method discussed below, it measures the effect past merger decisions have had on the probability of filing an anticompetitive merger. Duso et al. [2013], while not only using a small subsample of the merger database for their

[13] Cumulative aggregate abnormal returns, CAARs.

analysis, identified anticompetitive mergers with stock market reactions; I employ a different measure to tag anticompetitive mergers by achieving a one-to-one match of the merging firms with external commercial data.[14] The match with external data has furthermore the advantage that it mitigates potential endogeneity issues arising out of regressing with data derived from information which the merger authority uses for its decision [Bergman et al., 2005].

As mentioned above, this paper signifies a first step which needs to be taken towards the measurement of deterrence beyond the tip of the iceberg. This would mean that we ultimately estimate the probability for filing a merger given merger and market characteristics and the firm's expectations about how the Commission will decide. As suggested by [Seldeslachts et al., 2009], to model deterrence as the probability to merge given specific expectations of the merging parties shall bring deterrence estimation considerably closer towards describing the iceberg and thus going around the empirical self-selection problem.

3.3 Model

Merger notifications can be seen as a result of the firms' reaction to the authority's merger policy and its decisions or a positive manifestation of the filing firms' internal merger decision process. The merger database does not constitute a representative sample of the true distribution of all contemplated mergers, as those truly deterred, i.e., contemplated and abandoned even before a filing took place,[15]

[14] Konings et al. [2001], while they only tackle deterrence indirectly, nevertheless take an approach worth mentioning in this context: they investigate the impact of competition policy in two European countries on the markets and the firms' behaviour in the markets. One of the notable features in the paper is that they use firm- level data. As the authors point out, for an effects-based analysis of competition policy, disaggregating data becomes important to increase the reliability and efficiency of the results by increasing the number of observations and by better being able to grasp firm-level heterogeneity. Other studies on the indirect effect of competition policy on firms' market behaviour include: Crandall and Winston [2003], Block et al. [1981], Warzynski [2001]; and Hoekman and Kee [2003]. They will not be discussed as the results of all named papers do not specifically address deterrent effects directly, independent of regulatory effects.

[15] Including mergers which were abandoned after pre-notification consultations with the Commission.

are not included. Davies and Ormosi [2012] mention that rarely are also mergers included in an analysis which are undeterred, but undetected, or undeterred, detected, but uninvestigated. The self-selection bias stems from the fact that the sample will on average include more welfare-increasing mergers, and tend to rule out *highly doubtful* or *controversial* mergers. An accurate measurement of deterrence would have to capture the change in the amount of (i) deterred mergers, and, following Davies and Ormosi's taxonomy, also mergers which were (ii) not deterred but not detected as anticompetitive, (iii) detected but not further investigated mergers, and (iv) detected as well as investigated mergers. Most studies derive their analysis from the last or third and last group of mergers, whereas it may be assumed that the first and second group could be of considerable size.

3.3.1 Logistic Regression Model

I start with a binary response model, where I define

$$d_{it} = \begin{cases} 1: & \text{if merger } i \text{ at time } t \text{ is anticompetitive,} \\ 0: & \text{otherwise.} \end{cases}$$

d_{it} is the realisation of the random variable D_i which takes values 1 and 0 with probabilities π_{it} and $1 - \pi_{it}$. The Bernoulli distribution of D_{it} is

$$\Pr\{D_{it} = d_{it}\} = \pi_{it}^{d_{it}}(1 - \pi_{it})^{1-d_{it}}.$$

For my model, I assume that the probabilities depend on a vector of observed covariates in an inverse logit form:

$$\text{logit}(\pi_{it}) = \mathbf{I}'_{\mathbf{it}}\boldsymbol{\alpha} + \mathbf{M}'_{\mathbf{it}}\boldsymbol{\beta} + \mathbf{P}'_{\mathbf{i,t-1}}\boldsymbol{\delta} + \mathbf{Z}'_{\mathbf{it}}\boldsymbol{\gamma}.$$

Since the dataset is cross-section in nature rather than a panel (see more detailed explanations below under Merger Data), I have allocated time-industry-

specific controls or time-specific policy variables to each merger i individually.[16] For clarity's sake, I have grouped the explanatory variables to M_{it} (merger variables), which contain information about the merging firms' case experience, I_{it} (industry variables), which contain information about the merging firm's industry, $P_{i,t-1}$ (policy variables), our main focus of interest, which relate to the decision history which can be allocated to each merger i and Z_{it} (time- and industry-effect variables), which control for time trends and industry effects.[17] I have replaced $P_{i,t-1}$ with $A_{i,t-1}$ in some regressions where I summed up all individual policy variables to one general Action Variable to see the aggregated effect. D_{it} is an indicator variable of a merger's anticompetitive nature ($D_{it} = 1$ in case of anticompetitiveness). Thus the γ coefficients in this logit equation are of main interest. The aim of the estimation is to find indications whether or not some past decisions have had a negative effect on the probability of filing an anticompetitive merger with the Commission.

The transformed equation will be:

$$\pi_{it} = \Lambda(\mathbf{I'_{it}}\boldsymbol{\alpha} + \mathbf{M'_{it}}\boldsymbol{\beta} + \mathbf{P'_{i,t-1}}\boldsymbol{\gamma} + \mathbf{Z'_{it}}\boldsymbol{\delta}) = \frac{e^{\mathbf{I'_{it}}\boldsymbol{\alpha}+\mathbf{M'_{it}}\boldsymbol{\beta}+\mathbf{P'_{i,t-1}}\boldsymbol{\gamma}+\mathbf{Z'_{it}}\boldsymbol{\delta}}}{1 + e^{\mathbf{I'_{it}}\boldsymbol{\alpha}+\mathbf{M'_{it}}\boldsymbol{\beta}+\mathbf{P'_{i,t-1}}\boldsymbol{\gamma}+\mathbf{Z'_{it}}\boldsymbol{\delta}}}.$$

For the estimation, I use the likelihood function

$$f(d_{it}|\mathbf{I_{it}}, \mathbf{M_{it}}, \mathbf{P_{i,t-1}}, \mathbf{Z_{it}}) = p_{it}^{d_{it}}(1 - p_{it})^{1-d_{it}}, \quad d_{it} = 0, 1,$$

where $p_{it} = \Lambda(\mathbf{I'_{it}}\boldsymbol{\alpha} + \mathbf{M'_{it}}\boldsymbol{\beta} + \mathbf{P'_{i,t-1}}\boldsymbol{\gamma} + \mathbf{Z'_{it}}\boldsymbol{\delta})$.

[16] The dataset is strictly speaking a repeated cross-section over T time periods, encompassing J industry sections in each time period. Hence, time effects and industry effects need to be accounted for to a certain extent.

[17] The industry effects constitute of dummy variables for each NACE section (A, B, C, ...).

The log likelihood function is

$$\mathcal{L}_N(\boldsymbol{\beta}) = \sum_{i=1}^{N} \Big\{ d_{it} \ln \Lambda(\mathbf{I}'_{\mathbf{it}}\boldsymbol{\alpha} + \mathbf{M}'_{\mathbf{it}}\boldsymbol{\beta} + \mathbf{P}'_{\mathbf{i,t-1}}\boldsymbol{\gamma} + \mathbf{Z}'_{\mathbf{it}}\boldsymbol{\delta}) + (1 - d_{it}) \ln(1 - \Lambda(\mathbf{I}'_{\mathbf{it}}\boldsymbol{\alpha} + \mathbf{M}'_{\mathbf{it}}\boldsymbol{\beta} + \mathbf{P}'_{\mathbf{i,t-1}}\boldsymbol{\gamma} + \mathbf{Z}'_{\mathbf{it}}\boldsymbol{\delta})) \Big\}.$$

The maximum likelihood first-order conditions are set equal to zero and converge to the estimated coefficients.[18]

3.3.2 Anticompetitiveness

Effective deterrence in the context of merger control does not mean that mergers are undiscriminatingly discouraged, but that less anticompetitive mergers and more procompetitive mergers are notified over time. In order to implement the described model specification, it is necessary to classify each merger as anticompetitive or non-anticompetitive. To that end, I employ the methodology of Gugler et al. [2002] who compare the merging firms' aggregated profit and sales differentials before and after the merger with the same differentials of the merger's industry. Gugler et al.'s approach is closely linked to the theory of oligopoly; they assume that mergers which increase market power and are thus anticompetitive[19] show post merger that their profits increase while their post-merger sales decrease. This should apply to any merger – horizontal, vertical, or conglomerate.

I therefore allocate sales and profits data taken from Worldscope and SDC to the firms participating in a merger, if possible, for the whole timespan between 1990 and 2009 with respect to each merger. The matching process consisted of

[18] A probit regression of the equation delivered results very close to the logit results. Using the same selected specification for both probit and logit, the probit model showed a log likelihood of -636.81, while the logit model had a log likelihood of -636.85. The displayed standard errors are the result of the robust (or sandwich) estimator of variance (VCE). They were clustered for years to account for correlation over time.

[19] The paper notes that the net effect of the merger is meant with market power increase. All mergers eliminate competition in a strict sense, but the net effect may increase efficiency (in which case the merger would be procompetitive) or market power (in which case it will be anticompetitive).

several rounds, the first round being an exact firm name match and the next rounds involving *fuzzy* matching to account for spelling inconsistencies between the databases, abbreviations and country-specific alterations. I was able to match 2574 of the 4148 mergers of the EU merger database. I then determine profit and sales differentials between 1 year before merger and 1 year after merger:[20]

$$\Delta\pi_{i,t} = \pi_{i,t+1} - \pi_{i,t-1},$$

with $\pi_{i,t}$ being defined as net income divided by assets.

For sales, I have

$$\Delta\text{sales}_{i,t} = (\text{sales}_{i,t+1} - \text{sales}_{i,t-1})/\text{sales}_{i,t-1}.$$

I aggregate the differentials on merger level and tag those mergers where the profit differential – relative to the the mean industry profit differential – is positive and the sales differential – relative to the mean sales profit differential – is negative, i.e.,

$$\Delta\Pi > 0, \quad \Delta\text{S} < 0.$$

3.3.3 Learning Effects

I account for learning effects of the merging companies by taking into account the companies' individual merger history in my regressions. I create two variables which account for the number of cases the acquirer firm and the target firm, respectively, have been involved up to the current case. By adding learning effects, I control for the fact that firms who have already been a party to merger notifications have profited from the experience in terms of know-how, and it may be assumed that the higher the number of cases, the greater is the effect

[20] Maximal 2 years before and after the merger if profit or sales data were missing. 2 year forward lags were used in the case 1 year forward lags were missing, and 2 year lags were used if 1 year lags were missing. I turned this process around by using 1 year (forward) lags only in the case of 2 year (forward) lags which brought less significant results.

of learning. The experience could range from improving know-how concerning contacts with the authorities, improved knowledge of the law and procedure to preparing merger notifications in a more effective way, i.e., increasing the chances of being cleared.

3.4 Data

3.4.1 European Merger Control and Data

Merger Procedure

The merger procedure is formally being initiated by the notification of the merger by the parties. Mergers need to be notified to the Commission if certain statutory turnover thresholds for worldwide sales and in the EU are exceeded.[21] Once a notification is filed, the Commission has to follow a strict timeline for assessing and evaluating the merger. A notification entails a first period of evaluating the merger (Phase 1, 25 working days) and a second period of more detailed appraisal if the Commission has 'serious doubts as to its compatibility with the common market' (Phase 2, 90 working days).[22] Informally, the merger procedure usually starts earlier with pre-notification contacts between the notifying parties and the Commission. Pre-notification contacts give the parties the opportunity to discuss without precedence and in confidence the intended merger. Hence, despite its informative nature for deterrence purposes, no data is available on how many intended mergers were abandoned after pre-notification talks with the Commission.

[21] Combined worldwide turnover of at least 5 billion euros and a EEA-wide turnover of more than 250 million euros for each of at least two of the participating firms (unless each merging firm achieves more than 2/3 of its aggregate EEA turnover within one and the same EU member state).

[22] Article 6(1)c.

The bulk of notifications is decided or closed in Phase 1[23] and most Phase 1 cases is cleared with or without remedies.[24] In Phase 1 the Commission must either clear the merger with or without remedies, declare the merger to be out of scope or, in case of *serious doubts*, open Phase 2 proceedings.[25] The Commission must conclude Phase 2 either by clearing the merger with or without remedies or by prohibiting it.[26] If the Commission decides to clear a merger subject to remedies, these can either be structural or behavioural. Structural commitments require a party to divest a business or sell stakes, whereas behavioural commitments lead a party to change its behaviour for the sake of promoting competition in the market.[27]

A table summarising the types of decisions with a reference to the respective provision in the Merger Regulation 2004 is outlined below.

Table 3.1: Merger Decision Types

	Phase 1 decision 25 working days	Phase 2 decision 90 working days
Outside Scope	6.1a	n.a.
Clearance (with or without remedies)	6.1b or 6.2	8.1b or 8.2
Prohibition	n.a.	8.3 or 8.4

Note: Withdrawals by the parties are possible during Phase 1 and Phase 2.

[23] 96% of all notifications.

[24] 96% of all Phase 1 decisions including withdrawals in Phase 1.

[25] Article 6. To this end the Commission has the power to request information in what is referred to as *Article 11 letters* and investigative powers where it may examine books, other business records and the undertakings' premises.

[26] Article 8. Compared to Phase 1, the Commission has more extensive investigative powers. A prohibition is issued after a Statement of Objections has first been communicated to the parties to which they may reply formally and request the right for an oral hearing. In both phases, parties can withdraw from the notification. Of all Phase 2 decisions over the relevant period, 23% were prohibitions (including withdrawals in Phase 2), 77% therefore clearances with or without remedies. Third parties such as consumer associations and competitors also have the right to be heard.

[27] Behavioural commitments could, for example, be to terminate exclusivity agreements or to open access to technology. The Commission adopted a Notice on Remedies to provide more guidance on this issue in 2000 (updated in 2008).

Merger Data

The merger data was downloaded from the publicly accessible merger database of the European Commission which is made available by the website of the DG Comp.[28] The database contains 4253 cases between 1990 and 2009, that is, notifications which were filed by the merging parties with the Commission even if they were withdrawn at a later stage. Each case contains brief information on the notification such as parties, date, case number, industry classification, and the decision history such as type and date of decision(s).[29]

According to the development of the total number of notifications in the relevant time period (Figure 3.1), the number of notifications grew continuously, especially between 1995 and 2000 and after a peak in 2000, dropped in 2003 which is attributed to the dotcom bubble burst; it afterwards reached a new peak in 2007 after which it continually dropped, as the 2008 financial crisis. As can be seen, Figure 3.1 displays a wave-like pattern [Clougherty et al., 2013b].

By comparison, Figure 3.2 shows the number of matches which formed the estimation sample, which reflects a pattern very similar to the total number of notifications as represented by Figure 3.1.

Figure 3.3 shows the ratio of anticompetitive mergers to the total number of notifications combined with the ratio of preventions to notifications. A caveat of the graph must be made to the fact that the numbers on this graph reflect the estimated sample only and not the complete European merger database. The graph still reflects the feature that the peaks of anticompetitive mergers correlate with the dips in preventions and vice versa. This can be seen quite clearly around 1998 and again in 2002–2004. One explanation for this phenomenon could indeed

[28] http://ec.europa.eu/competition/mergers/cases/.

[29] 10 cases were listed as notified with no further details. I assumed that the parties had withdrawn from the merger and included the cases in the Phase 1 Withdrawals. 40 cases concerned referrals to Member States (Articles 4.4, 9.3, or 9.4 Merger Regulation 2004) (dropped). 1 case concerned an out-of-scope decision (Article 6.1a) (dropped). 7 cases on fines (Article 14) and 1 case on Article 21 (applicability) were dropped, as the corresponding notification entries had already existed in the database.

Figure 3.1: Notified Mergers per Year

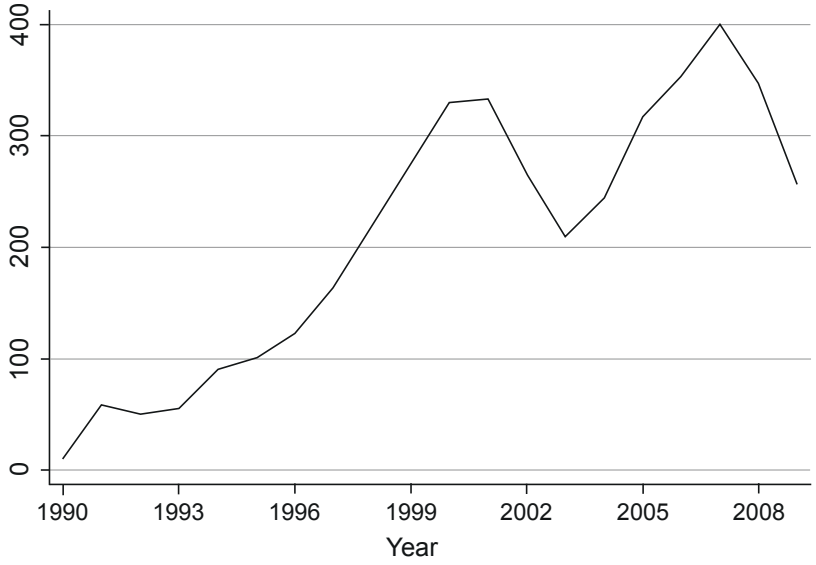


Figure 3.2: Estimation Sample

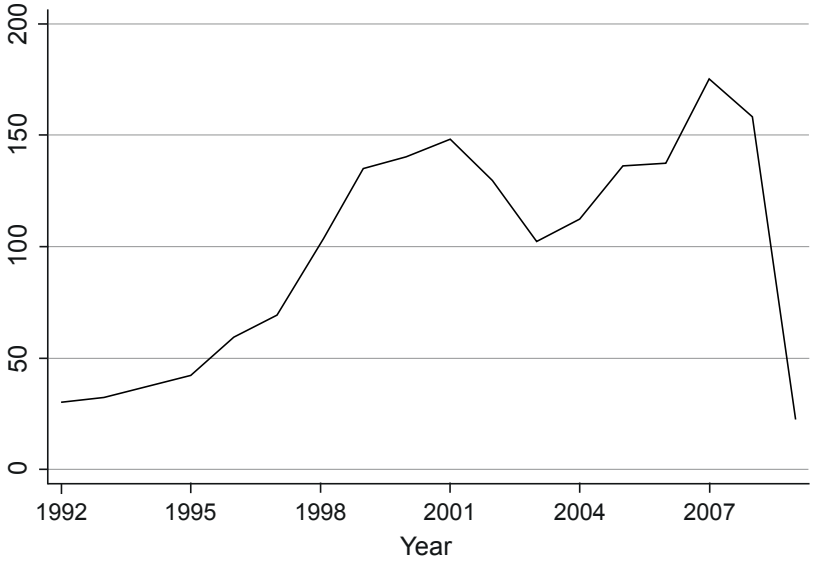
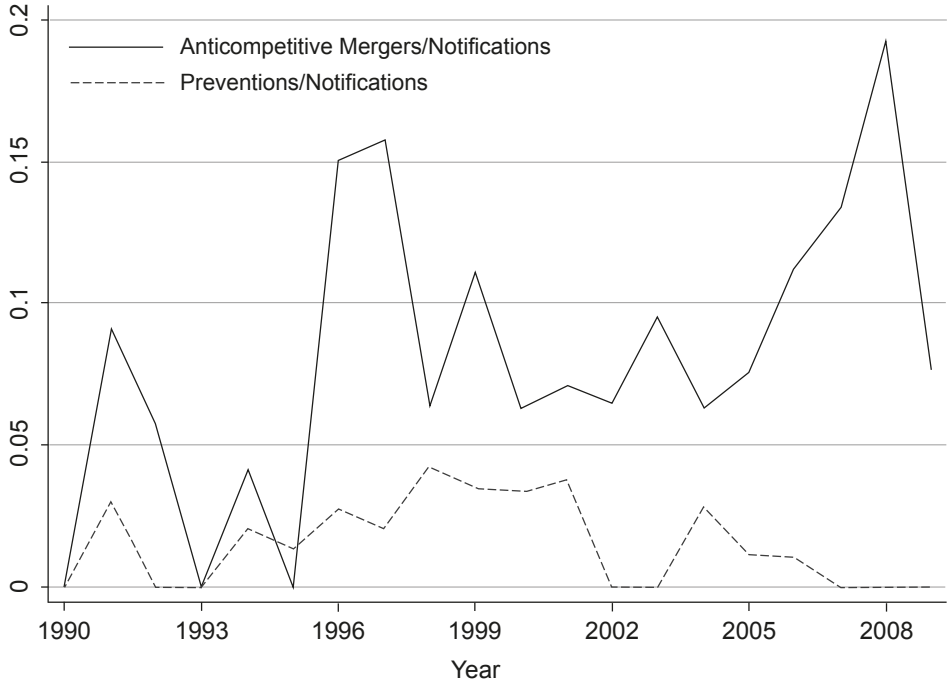


Figure 3.3: Ratios of Anticompetitive Mergers and Preventions



be that notifications react to the decision practice of the Commission. After the early 2000s, when some prohibition decisions were reversed by four seminal European Court of First Instance judgments,[30] the number of preventions drops significantly, while the number of anticompetitive mergers increases constantly and shows a few peaks in line with the general merger waves.

Table 3.2 shows the distribution of the decision types in Phase 1 and Phase 2 (after kicking out nonessential decision types as described above). All Phase 2 decisions are included in the Phase 1 decisions (as 6.1c decisions).

I have used the merger case data and allocated to each case the policy variables $P_{i,t-1}$ which will serve as explanatory variables to my equation. Each merger i at time t therefore has a set of policy variables on the sum of decisions of last year from the date of notification of same merger (e.g., Sum of Phase 1 Remedies or $R1_{i,t-1}$, etc.). I also add the Sum of Notifications lagged by one year, or $N_{i,t-1}$,

[30] *Airtours/First Choice*, M.1524; *GE/Honeywell*, M.2220; *Schneider/Legrand*, M.2283; *Tetra Laval/Sidel*, M.2416

Table 3.2: Phase 1 and 2 Decisions

	Frequency	Percent
Phase 1 decision		
6.1b (cond./uncond. clearance)	3855	92.94
6.1c (Phase 2)	175	4.22
6.2 (cond. clearance)	6	0.14
withdrawn	112	2.70
TOTAL	4148	100.00
Phase 2 decision		
8.1 (clearance)	20	11.36
8.2 (cond./uncond. clearance)	114	64.77
8.3 (prohibition)	17	9.66
8.4 (prohibition)	1	0.57
withdrawn	24	13.64
TOTAL	176*	100.00

Note: * The difference in 1 case is due to M.308 (*Kali+Salz/MDK/Treuhand*) which was cleared after successfully appealing against a Phase 2 Remedies decision.

to control for merger wave effects [Clougherty and Duso, 2009]. To this, data on the industries each merger belongs to were matched as well (see under Control Variables). As mentioned, the dataset I create is not panel or time series in nature. The dataset consists of a selection of cases from the combined datasets which could be identified as anticompetitive or not with the result that the sample is a repeated cross-section where each time period t contains a different selection of non-anticompetitive and anticompetitive mergers i with merger-, time- and industry-specific variables [Cameron and Trivedi, 2005]. Similar to true panel data and in view of the time/industry dimension of some variables, I will therefore control for time- or industry-specific effects by using time trend variables and industry-specific dummies.

3.4.2 Control Variables

I have created industry-level variables, aggregated on the NACE level, and matched them against the merger cases, using the common NACE codes and the relevant year of notification. Market characteristics and financial conditions have an influence on the merging behaviour of firms [Harford, 2005]. From the Thomson Reuters Worldscope and Thomson Reuters SDC Platinum databases, I aggregate the firm-level balance sheet and profit&loss data variables[31] to construct NACE-level variables Salesgrowth$_{it}$, Sharereturn$_{it}$, Tobinsq$_{it}$, MarkettoBook$_{it}$.

The control variables are identical with the control variables constructed in Clougherty et al. [2013b] and are described in more detail in Table 3.3.[32]

The control variables further contain indicators for the competition intensity in the industries: The Herfindahl-Hirschman Index (HHI$_{it}$), which is a widely applied competition index but, as Griffith et al. [2005] point out, not always indicative of the real intensity of competition, as it ignores the output reallocation effect to more efficient firms. I therefore also use a competition indicator developed by Boone [2008] and applied by Griffith et al. [2005], the relative-profits measure (Beta$_{it}$). It measures the semi-elasticity of a firm's variable profits against its variable costs and accounts for the fact that more efficient firms have higher price-cost margins and higher profits and that in a competitive industry, inefficient firms are punished more severely in terms of profits. Empirically, as Griffth et al. show, the relative profits measure is captured by estimating the equation $\ln \pi_j = \alpha + \beta(c_j/p_j) + \varepsilon_j$ for each firm j belonging to the same industry and its estimated coefficient β_j as an indicator of how much inefficient firms are pun-

[31] Of all firms belonging to Austria, Belgium, Bulgaria, Channel Islands, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

[32] As in Clougherty et al. [2013b], the Worldscope/SDC variables which are categorised by SIC codes had to be allocated to the European mergers' NACE codes by a self-generated SIC/NAICS/NACE conversion key. The conversion was made in such way that many SICs could point to one NACE, but not to several NACEs at the same time (SIC:NACE=m:1).

ished with lower relative profits.[33] A more negative Beta_{it} thus indicates higher competition and relative variable profits.

As a final step, the control variables were then allocated to the identified mergers by industry and year. I used control variables which were lagged one year compared to the year of the merger case.

With a view to Clougherty et al. [2013a], I made an attempt in constructing acquirer- or target-specific variables or variables pointing out differences between the two out of the sample. Due to missing data and the fact that not all firms could be identified as acquirer or target, the majority of observations would be lost in the subsequent estimation (more than 80%). Reducing the sample to the observations where acquirer and/or target were identified did not change the results significantly; using other acquirer/target characteristics constructed from another database might be a worthwhile addition in the future.

Table 3.3 describes in detail the variables used for the estimation. Table 3.4 reports the preliminary statistics for the sample. We have approximately 270 notifications on average per year, with Phase 1 Remedies being the most taken decision (12 per year). The average number of Preventions (i.e., prohibitions and Phase 2 Withdrawals) is 2.8 per year with 8 being the maximum. I was able to identify 1773 of the 2574 mergers in terms of anticompetitiveness. The majority of mergers can be classified as non-anticompetitive. The acquirer has on average been involved in 5 previous merger cases, while the target's case experience amounts on average to 2 cases.

The regressions will mainly focus on the coefficients of the Policy variables and the marginal effects respectively, and whether or not the corresponding signs will be negative and significant. As mentioned above, the Commission's merger policy will have an impact on the firms' decision whether to file for an anticompetitive merger and thus on the firms' expectations on how the Commission will decide given a specific merger. It could be expected that the sign for Prohibitions is

[33] The above equation represents the semielasticity of absolute costs against relative profits. Using $\ln(c_j/p_j)$ would give us the elasticity.

negative, meaning that the Commission's decision to ban a merger would have a negative impact on the likelihood of notifying an anticompetitive merger. Duso et al. [2013] suppose that Phase 2 Withdrawals might have similar impacts as prohibitions so that I expect preventions which combines prohibitions and Phase 2 Withdrawals to be overall negative. It is likely that a Policy variable aggregating all actions taken by the Commission other than Clearance might have a deterrent influence as well. As for the other Policy variables, the impact could be less obvious. Clougherty et al. [2013b] find that Phase 1 Remedies might have a negative impact. Phase 2 Remedies should constitute a more aggravating factor for potential merging firms, since proceedings will become much more lengthy and costly. As for preventions in the past year of the same industry, a negative impact should be expected.

Table 3.3: Definition of Variables

Variable	Definition	Variable Group
D_{it}	Indicator variable classifying merger i at time t into competitive or anticompetitive	Dependent variable
$\text{ExperienceAcq}_{it}$	Number of cases firm 1 of merger i has been in up to the current case at time t	$M_{i,t}$ (Merger variables)
$\text{ExperienceTar}_{it}$	Number of cases firm 2 of merger i has been in up to the current case at time t	
PastYIndprev_{it}	Sum of preventions (Prohibitions and Phase 2 Withdrawals) in the merger i's industry in the past year of time t	
$N_{i,t-1}$	Lagged sum of Notifications for merger i	$P_{i,t-1}$ (Policy variables)
$R1_{i,t-1}$	Lagged sum of Phase 1 Remedies for merger i	
$W1_{i,t-1}$	Lagged sum of Phase 1 Withdrawals for merger i	
$R2_{i,t-1}$	Lagged sum of Phase 2 Remedies for merger i	
$S_{i,t-1}$	Lagged sum of Simplified Procedures for merger i	
$P_{i,t-1}$	Lagged sum of Preventions (Prohibitions and Phase 2 Withdrawals) for merger i	

Table 3.3 (continued)

Variable	Definition	Variable Group
$A_{i,t-1}$	Lagged sum of Phase 1 Remedies, Phase 2 Remedies, Withdrawals, and Preventions for merger i	$A_{i,t-1}$ (Action variables)
Salesgrowth_{it}	Average sales growth at time t over a 2 years period in merger i's industry [Andrade and Stafford, 2004]: $(\text{avsales}_i - \text{2L.avsales}_i)/\text{2L.avsales}_i$	$I_{i,t}$ (Industry variables)
Sharereturn_{it}	Average market capitalisation in merger i's industry at time t: $(\text{avmarketcap}_i - \text{L.avmarketcap}_i)/\text{L.avmarketcap}_i$	
Tobinsq_{it}	Mean Tobin's q in merger i's industry at time t: $\sum_{j\in m} \frac{\text{marketcap}_j + \text{totdebt}_j}{\text{totassets}_j} \Big/ m$	
MarkettoBook_{it}	Mean market-to-book ratio in merger i's industry j at time t: $\sum_{j\in m} \frac{\text{marketcap}_j}{\text{totassets}_j} \Big/ m$	
HHI_{it}	Herfindahl-Hirschman Index in merger i's industry based on sales of all firms in an industry at time t: $\text{HHI}_{it} = \sum_{j\in m} \left(\frac{\text{sales}_{jt}}{\text{totsales}_{jt}}\right)^2$	
Beta_{it}	As in Griffith et al. [2005], this measure of competitiveness is captured by the coefficients, Beta_{it}, which are the coefficient estimates from an OLS regression of variable profits on average costs for all firms within merger i's industry at time t: $\ln \pi_{jt} = \alpha + \beta_{jt}\frac{c_{jt}}{p_{jt}} + \epsilon_{jt}.$	

Table 3.3 (continued)

Variable	Definition	Variable Group
	Variable profits are defined as $\pi_{jt} \approx \text{sales}_{jt} - \text{cost of goods sold}_{jt}$, whereas average variable costs are defined as $\frac{c_{jt}}{p_{jt}} = \frac{c_{jt}q_{jt}}{p_{jt}q_{jt}} = \text{AVC}_{jt}$.	

Notes: Some Worldscope variables are reported in the local currencies of the respective home country, which were converted into US$. All variables (except the HHI and the Beta) are price-adjusted according to the Consumer Price Index of the U.S. Bureau of Labor Statistics. Policy and action variables are either lagged by year or by quarter. Industry variables either cover the last year (starting with *1y ...*) or the second to last year (starting with *2y ...*) before the time of merger i.

Table 3.4: Preliminary Statistics of Estimation Sample

	Count	Mean	Sd	Min	Max
Notifications/year	1773	269.8539	88.40383	50	394
Ph1 Remedies/year	1773	12.4749	6.221555	0	25
Ph2 Remedies/year	1773	5.454597	2.299229	0	10
Ph1 Withdrawals/year	1773	4.988156	3.351388	0	23
Preventions/year	1773	2.777778	2.903882	0	8
Simplifieds/year	1773	108.2504	83.93919	0	237
Actions/year	1773	27.44783	12.26288	5	55
Notifications/quarter	1764	69.089	25.49282	10	135
Ph1 Remedies/quarter	1764	3.223923	2.394045	0	10
Ph2 Remedies/quarter	1764	1.378118	1.151289	0	4
Ph1 Withdrawals/quarter	1764	1.242063	1.194533	0	4
Preventions/quarter	1764	0.7040816	0.9783622	0	3
Simplifieds/quarter	1764	27.78912	22.60115	0	76
Actions/quarter	1764	6.997166	3.808891	0	19
Industry Preventions	1773	0.0806543	0.3055787	0	2
Anticompetitive (dummy)	1773	0.0642978	0.2453519	0	1
Experience Acq.	1773	4.472645	5.299278	1	51
Experience Tar.	1773	1.554992	1.347577	1	19
HHI	1773	0.1076911	0.1073669	0.0134254	0.7506976
Boone Beta	1773	−2.330902	3.254902	−31.18965	17.89905
Salesgrowth	1773	0.092346	0.1579531	−0.6829271	1.519308
MarkettoBook	1773	3.27254	29.12174	0.3258478	853.0021
Tobinsq (log)	1773	0.5156815	0.7902815	−4.049794	6.748981
Sharereturn	1773	0.1313744	0.5403851	−0.6657033	5.789873
(N)	1773				

3.5 Results

The results in Appendix B, Table B.1 and Table B.2 report marginal effects of the logit estimations. First off, the results are to some extent similar when the Policy variables were lagged by years, half years, or quarters. Only the results when years or quarters were used are reported for comparison's sake. The year results show more informative and significant results than the quarter results. This would make sense since it takes some time for the firms to react to a decision, be it for analysing the merger decision or for preparing a merger notification thereafter. It is conceivable in any case that a yearly lag seems to be more realistic than a quarterly lag. I have used five different specifications, integrating the Action or Policy variables in five different variations: the first one uses only the control variables Merger variables and Industry variables, the second includes the aggregated Action variable along with Industry Preventions, the third further includes individual Policy variables of 2 lags, the fourth Policy variables of 1 lag, while the fifth uses only the Merger and Policy variables of 2 lags with no Industry variables.

Based on the year results, Phase 2 Remedies of last year and preventions of the last 2 years have a significant effect on the probability that a notified merger is anticompetitive at the 5% level. Both Preventions and Phase 2 Remedies have a negative sign, as expected. Firms will see Phase 2 Remedies as an unwelcome hurdle to having their mergers cleared. They will anticipate extended and more costly proceedings along with the fear that the conditions which the Commission imposes might be unduly restrictive.[34]

While preventions showed negative significance for notifications of anticompetitive mergers, Industry Preventions have negative signs without being significant.[35]

[34] In the regressions with variables lagged by quarter, Phase 2 Remedies are not significant but (at least with 2 lags) show a negative sign, whereas preventions with 2 lags are weakly significant in their deterrent effect and show negative signs throughout all specifications.

[35] Industry Preventions further show a weak deterrent effect in the logit estimation by quarter lags, where they are deterrent at the 10% level.

Phase 1 Remedies show a weakly significant negative effect with 1 year lags and negative signs with 2 year lags. This seems to indicate that already remedies decision in an early stage of the merger process could have a deterrent effect on the future filing of anticompetitive mergers, similar to Phase 2 Remedies. Although Phase 1 Remedies do not entail proceedings as extended as Phase 2 Remedies and it rather means that the merger will be cleared, firms might be afraid of too many concessions they need to make in order to obtain clearance.[36]

Phase 1 Withdrawals seem to have a positive effect, especially when lagged by 2 years; a possible explanation is that they are being received as a positive signal to the firms, since they see that controversial or potentially problematic mergers can be aborted at a comparatively early stage upon notification which makes filing less risky. The overall effect of Phase 1 Withdrawals remains a bit unclear, nevertheless. When lagged by 1 year, Phase 1 Withdrawals show a negative effect, while lagging them by 2 years makes them positively significant. With respect to decisions which were taken in a simplified procedure, one would expect an encouraging effect on the propensity to file for anticompetitive mergers. However, the results point towards simplified decisions lagged by 1 year having a significantly negative impact. The effect is lost when lagged by 2 years. One possible explanation could be that firms, when contemplating to notify an anticompetitive merger, do not expect the merger to run through the simplified procedure in the first case. It is a well-known fact that only mergers which are evidently unproblematic are channeled through the simplified procedure.

Overall, some of the Policy variables show impacts as expected. Decisions entailing a negative or at least prolonged outcome such as Preventions, Industry Preventions, and Phase 2 Remedies show significantly negative or negative signs towards the probability of notifying an anticompetitive merger, so do Phase 1 Remedies, while the effect of Phase 1 Withdrawals and Simplified Decisions is not clear.

[36] In the quarter regressions, Phase 1 Remedies have negative signs when lagged by 1 quarter.

The results also reveal that past merger experience of the acquirer firm appears to have a positive impact on the decision to notify an anticompetitive merger. In almost all specifications and time periods, merger experience shows a positive significant effect, at least at the 10%-level.

I tested the null hypothesis whether the linear combination of the coefficients pertaining to the two lags of each Policy variable or Action variable amounted to zero.[37] The results are shown in Table 3.5. The null hypothesis cannot be rejected with respect to the coefficients of the lags for almost all Policy variables, except Ph1 Withdrawals where the null hypothesis can be rejected at the 5% level. The linear combinations for Ph2 Remedies and Preventions (both on a per year basis) should be slightly negative.

Table 3.5: Test Results – Linear Combinations of Coefficients for Lags 1 and 2

	Coeff.	Se	z	$P > \|z\|$	95% Conf.	interval
Ph1 Remedies/year	0.0196	0.0822	0.24	0.812	−0.1415	0.1807
Ph2 Remedies/year	−0.2390	0.1509	−1.58	0.113	−0.5347	0.0568
Ph1 Withdrawals/year	0.1680	0.0853	1.97	0.049	0.0009	0.3351
Preventions/year	−0.2455	0.1268	−1.94	0.053	−0.4940	0.0030
Simplifieds/year	−0.0100	0.0100	−1.00	0.317	−0.0295	0.0095
Actions/year	−0.0133	0.0129	−1.03	0.303	−0.0385	0.0120
Ph1 Remedies/quarter	−0.0451	0.0637	−0.71	0.479	−0.1700	0.0798
Ph2 Remedies/quarter	0.0267	0.1168	0.23	0.819	−0.2021	0.2556
Ph1 Withdrawals/quarter	0.0680	0.1117	0.61	0.542	−0.1508	0.2869
Preventions/quarter	−0.1285	0.0993	−1.29	0.196	−0.3232	0.0662
Simplifieds/quarter	−0.0136	0.0087	−1.56	0.119	−0.0307	0.0034
Actions/quarter	−0.0055	0.0318	0.17	0.863	−0.0568	0.0677

[37] This test was carried out with the STATA lincom command.

3.6 Conclusion

This paper marks a first step in the direction of a comprehensive measurement of deterrent effects. Constituting the measurement of effects related to past policy actions on the propensity to notify anticompetitive mergers, it would methodically precede the estimation of decision probabilities of the authority which would then ultimately be used to estimate the firms' decision probability to merge or not to merge. As discussed above, this paper does not correct for the fact that only the data of mergers actually filed is used.

Nevertheless, the results of the first step already show some indication of the individual effects some decisions have: Phase 2 decisions such as prohibitions, withdrawals or remedies show a deterrent effect on the notification of anticompetitive mergers, while the effect is less clear with Phase 1 decisions other than remedies. Therefore, the instruments in Phase 2 of the Commission seem to work well in principle.

From a policy perspective, however, it might be desirable to increase the effectiveness of Phase 1 decisions and communication during Phase 1. On the one hand, this would reduce the number of costly, resource-intensive and lengthy Phase 2 decisions as firms might increasingly refrain from filing potentially problematic mergers or promptly withdraw before Phase 2. If the quality of Phase 1 scanning were improved so as to identify hopeless cases more readily, less decisions will actually enter Phase 2; at the same time, however, as discussed in the results above, firms might not necessarily be deterred to file an anticompetitive merger in the first place, as the fact that they could comparatively quickly and easily withdraw a merger in Phase 1 if resistance were felt might reduce the cost and time risk attached to a filing. While improvement of Phase 1 scanning could thus encourage firms to file for anticompetitive mergers, at the same time the question needs to be asked if the initiation of Phase 2 proceedings *per se* has a deterrent effect on the firms. Logit regressions using a variable aggregating all Phase 2 actions only show no or a very weak negative significant effect, similar to

the Actions variable which has been used to aggregate all Phase 1 and 2 actions. This could suggest that Phase 2 actions as such do not deter; rather it must be the individual decisions in Phase 2 sending certain signals to the firms' merging behaviour. Phase 1 Withdrawals might have a slightly encouraging effect in the short term as can be seen in the quarterly results; however, that does not imply that Phase 1 scanning shall not be improved, since the effect of Phase 2 actions as such is negligible as just mentioned. Considering the fact that any Phase 2 proceeding ties up personnel and other resources for a period of many months, the potential for savings is enormous by simply reducing the need to initiate Phase 2. Ideally, this might lead to Phase 2 actions *per se* having a significant deterrent effect, overriding any encouraging effect the possibility to withdraw the notification early might have. Once the Phase 1 scanning system works perfectly, a potential increase of anticompetitive notifications encouraged by Phase 1 Withdrawals would be manageable given the quality of the scanning; on the contrary, it may then be expected that Phase 1 scanning will take over as a sufficient deterrent device for the firms without further involving Phase 2 instruments.

4 Competitors in Merger Control: Shall they be Merely Heard or also Listened To?

This chapter is based on Giebe and Lee [2014].

4.1 Introduction

Both in the European Union (EU) and the U.S., competitors have gained significance in merger control proceedings. EU merger law presently entitles competitors to submit their views on the notified merger in writing and in a formal hearing before the European Commission (Commission) makes a final decision. Additionally, competitors have been increasingly involved in the Commission's fact-finding and market investigation process. In the U.S., competitors' claims were traditionally treated restrictively but both the Department of Justice and the Federal Trade Commission have recently started to widen the extent of competitor participation in merger proceedings by conducting an 'open door' policy.

These recent procedural developments in merger control have motivated us to explore potential policy deficiencies which might arise out of a conflict between legal due process and economic efficiency aspects: while, on the one hand, we have regulatory, procedural, and practical reasons to take into account the competitors' opinions such as their legal right to be heard or the authority's past heavy reliance on third-party input resulting from its information deficit due to limited resources; on the other hand, from an efficiency standpoint, there is reason to believe that a

certain degree of temptation exists on the part of the competitors to manipulate the authority so as to achieve a decision maximising their own profits rather than total welfare.

Our goal in this paper will be to present in a tractable game-theoretic model to what extent the rule, or best practice, depending on the jurisdiction, of hearing competitors' opinions can be used and abused. Relevant literature is mentioned throughout the paper. Section 4.2 will discuss the legal background and the procedural aspects of hearing competitors' views; Section 4.3 will describe the model setup and the game; Section 4.4 will provide interpretation and policy recommendations based on the results of the game. Appendix C, will contain all lemmas and proofs, and empirical data on EU merger cases.

4.2 Competitor Involvement in Merger Control

4.2.1 European Union

Competitor involvement in EU merger control is explicitly set forth in the European merger law provisions: Within 7–10 days after receiving a merger notification the Commission sends out Article 11[1] letters to the filing parties and 'interested third parties.' The law defines the latter usually as being competitors, suppliers, and customers.[2] The so-called Article 11 letters' main purpose is to gather information on the market in Phase 1. The Best Practice Guidelines further set forth that the Commission may consult third parties on methodological issues regarding data and information gathering in the relevant economic sector.[3] Third parties showing sufficient interest may request in Phase 1 to be heard orally.

In Phase 2, the Commission sends to the involved third parties a nonconfidential version of the Statement of Objections[4] after which the third parties have the right

[1] Merger Regulation 139/2004.
[2] Art. 11(c) of the Regulation 802/2004 (Implementing Regulation) implementing the Merger Regulation 139/2004, i.e., setting forth details on notifications, time limits, and hearings.
[3] Best Practices on the conduct of EC merger control proceedings 2004, para. 28.
[4] Art. 16(1) Implementing Regulation.

to express their view in writing or orally in a formal hearing.[5]

Finally, the Commission states in its Best Practice Guidelines that it welcomes any individual submission apart from direct replies from questionnaires where third parties provide 'information and comments' considered relevant for the merger assessment. It may also invite those parties for meetings to discuss or clarify such issues further.[6]

The prevailing view among scholars and practitioners is that in most cases, the Commission will lack the internal market expertise upon receiving a notification, thereby granting a 'considerable scope' of comment to and relying heavily on the information provided by the third parties.[7] Hearing Officers Durande and Williams of the Cabinet of the Commissioner agree that although the right for a formal hearing may in principle be denied by the Commission, the rights of the 'other involved third parties' which includes competitors must be considered as being much closer to those of a defendant in terms of procedural guarantees.[8]

4.2.2 U.S.

The U.S. has been traditionally more reserved in granting rights to competitors in merger proceedings. The responsible authorities, the U.S. Department of Justice (DoJ) and the Federal Trade Commission (FTC), took the view that competitors were more likely to complain about mergers which would render the market more competitive post merger.[9] To competitors who tried to challenge a merger by way of an injunction[10] or sue for damages, the Supreme Court usually denied standing to the competitors.[11]

[5] Art. 16 and 18 Implementing Regulation.
[6] Para. 35.
[7] Bellis [2005, p. 861]; Hamilton [2004, p. 4].
[8] As compared to rights of a complainant in antitrust matters. See Durande and Williams [2005, p. 22].
[9] Diesenhaus [1987, p. 2059]; Van Arsdall and Piehl [2014].
[10] Sec. 16 Clayton Act, 15 U.S.C. § 26.
[11] *Cargill v. Monfort of Colorado, Inc.*, 107 S.Ct. 484 (1986).

However, while the DoJ and FTC were once resistant to hear competitors in pending merger proceedings, the practice has markedly changed in the recent years. The most prominent case was AT&T Inc.'s contemplated acquisition of T-Mobile USA, Inc. in 2011.[12] Competitors Sprint Nextel and Cellular South opposed the merger and the agencies supported their efforts in gaining access to the documents relating to the merger.[13] After their strong objections which were also supported by the U.S. and several states, AT&T ultimately abandoned its efforts to acquire T-Mobile USA.

Given the recent shift in the agencies' stance towards competitors, practitioners in the U.S. have become conscious about the 'right strategy' competitors could take in merger proceedings, stating that the bigger role in merger review 'necessitates an additional layer of planning and strategy.'[14]

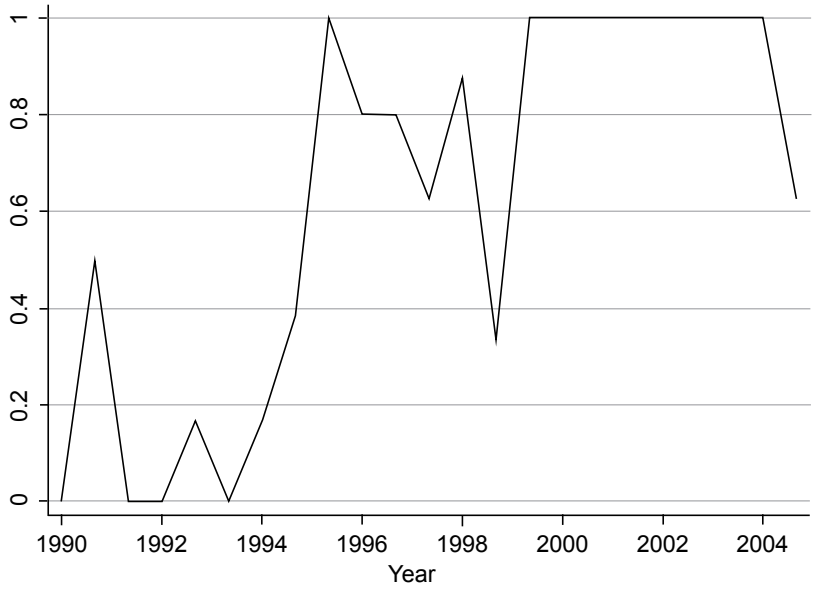
4.2.3 Legal and Strategic Considerations in Competitor Involvement

Apart from information-gathering purposes, the involvement of competitors as set forth by EU laws is partly motivated by the legal principle of granting anyone the right to be heard before an individual measure which would affect such person adversely is taken[15] and partly by due process considerations. Legislators and legal scholars might have taken a naive view upon drafting the rules that the competitors would always report truthfully to the deciding agency. A competitor raising serious doubts about a merger would thus be a reason to view the merger more critically.

While the competitors' right to be heard can be seen as a *softer version* of the usual rights of defence,[16] practice shows that their participation is crucial if

[12] AT&T Inc., Description of Transaction, Public Interest Showing and Related Demonstrations, WT Docket No. 11-65 at 1, FCC filed April 21, 2011.
[13] See detailed case discussion in Hundt [2011]; Stucke and Grunes [2012, p. 196].
[14] Van Arsdall and Piehl [2014, p. 2].
[15] Art. 41 Charter of Fundamental Rights of the European Union.
[16] Durande and Williams [2005, p. 23].

Figure 4.1: Competitor Participation as a Share of Phase 2 Cases, EU, 1990–2013



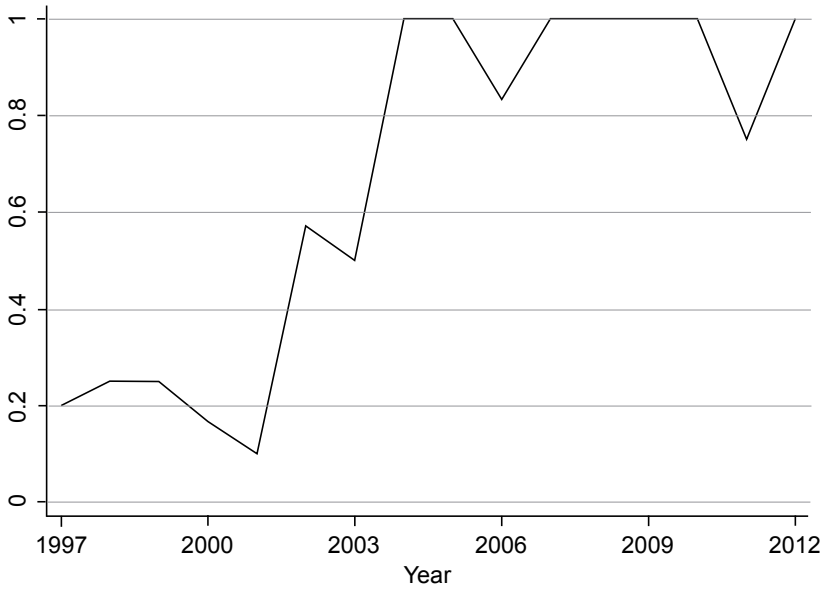
not essential in merger proceedings, as their involvement in Phase 2 proceedings shows:

We have looked into all Phase 2 proceedings between 1990 and 2013 and identified those cases where competitors were given the opportunity to voice their opinions.[17] As can be seen in Figure 4.1 which plots the ratio between competitor participation and Phase 2 cases, competitor involvement has radically increased since the reform and the ratio has stayed continuously at 1. One can assume presently that all Phase 2 proceedings will entail the involvement of competitors, whereas in the past, that was not necessarily the case.

We have further plotted the ratio of competitor objections to only those Phase 2 cases where competitors have been involved for the years from 1997 until 2013, see Figure 4.2. In other words, only those instances were captured where competitors had a negative opinion on the merger proposed. As can be seen, competitors have been increasingly voicing concerns in the past years. Could it be because competitors have realised the strategic potential in merger proceedings or because more competition-enhancing mergers have been notified in the past years which

[17] See Section C.3 for additional empirical data.

Figure 4.2: Competitor Objections as a Share of Phase 2 Cases with Competitor Involvement, EU, 1997–2003



did not find the competitors' approval?

In any case, scholars and practitioners now agree that competitors' opinions in merger proceedings shall be viewed with skepticism (see, e.g., Motta, 2004, p. 240). The Commission has recently proceeded to add in its decisions a footnote saying that information furnished by third parties will not be taken at face value since 'the opinion provided might be biased to influence [its] decision-making process.' The footnote further states that the Commission will thus analyse competitors' opinions very carefully as they 'might have an interest in making the transaction of their competitors [...] more difficult.'[18]

The FTC stated already 25 years ago in an amicus brief that competitors 'stand to benefit from, and have no incentive to challenge, acquisitions that may lead to supracompetitive pricing. [They] have a substantial incentive to challenge acquisitions that will make their rivals more efficient, make their industry more competitive, and reduce the prices they can charge their customers. [...] [Com-

[18] See, for example, the decision in *Ryanair/Aer Lingus III*, M.6663, Feb. 27, 2013, para. 28, footnote 18.

petitors must be] prevented from using the antitrust laws for anticompetitive purposes.'[19]

At the same time, the authorities are by definition market outsiders and must to some extent rely on the information provided by market insiders. They further face time and cost constraints which make it even more difficult to assess the state of a market or to anticipate the implication of a proposed merger on the market. Once competitors are playing a role in the market assessment, however, there is a potential risk for strategic abuse of the legal possibility to express their opinions by sending distorted signals to the authorities in order to promote their own interests.

From an economic standpoint, this creates ample room for efficiency losses post merger:

It is possible that a merger creates efficiency gains for the merged company. Unit cost savings lead to lower prices offsetting a market power gain. As a result, the competitors' profits decrease when a merger has sufficiently large efficiency gains and thus a positive effect on welfare. In such case, it is profit-maximising for the competitors to object to the merger, since its interests are in conflict with the authority's goal of maximising welfare and the merging parties' merger proposal. Hence, competitors will have a strong incentive to complain when the merger is likely to decrease prices.[20]

It is further possible that a merger merely increases market power without creating large enough efficiencies. There is ample literature showing that such a merger in an oligopolistic market benefits the competitors more than the merging firms, both in Bertrand and Cournot markets. In a Bertrand market, both merging and non-merging firms will have an interest in a merger since both will profit from increased prices, while in a Cournot market, the non-merging firms will free ride on the output reduction of the merging firms, leading to higher profits and

[19] Brief for the United States and the Federal Trade Commission as Amici Curiae, *Cargill v. Monfort*.
[20] Motta [2004, p. 240].

even losses to the merging firms.[21] In the case of such a merger, competitors will have a strong incentive to convince the authority that the merger be cleared.

The aforementioned cases are mere examples where the interests of the authority and the competitor are not aligned and hence great care needs to be exercised in considering the information provided by the competitors. Further conceivable types of mergers shall be discussed in the next section. The examples already give an indication of the competitors' great potential to use its role in merger proceedings purely strategically, rather than truthfully.

Our paper is the first to set up a formal game-theoretical model for the strategic interactions between competitor and authority in merger proceedings.[22] We have found the signaling game setup a particularly fitting model since it best captures the procedural and informational features of merger review.[23] It is safe to assume that the authority faces incomplete information on the merger proposed, while the competitor, as a market insider, is in a position to send informative signals to the decisionmaker. We further assume that the competitor before making its statement has an idea of the authority's prior information, through press releases, communication with the authority, and, especially in the EU, the Statement of Objections. The goal of this paper shall be to outline the full extent of abuse so that authorities and policymakers get a toolkit about how to distinguish between cases where competitors may be heard, but should not be listened to, whereas in other instances, competitors should be heard and listened to as well.

[21] Theoretically, firms would thus typically never merge in a Cournot market. Managerial misjudgement could still be a reason why mergers in Cournot markets could still take place. Salant et al. [1983, p. 195]; Sørgard [2009, p. 444, footnote 12]; Duso et al. [2011, p. 985]; Bester [2007, p. 153].

[22] Lagerlöf and Heidhues [2005] derive optimal merger control institutions in order to induce merger insiders to invest into the production of hard evidence about efficiency gains. They assume that a merger is always profitable for the insiders. Milgrom and Roberts [1986] discuss on a general level the problem of a decisionmaker who has to rely on the information of (and competition between) better informed parties. Any information revealed is assumed to be verifiable.

[23] In this first step, our goal is to examine the existing institution and its implications rather than to set up the optimal information extraction process from involved parties in a merger process as part of institutional or mechanism design.

4.3 Model and Analysis

In this section, we shall motivate our model before introducing it formally. Our model sets out to capture the characteristic interaction between the competitor(s) and the competition authority. In particular, we need to take into account the information which is available to each side, including the fact that there might be common and diverging interests on the kind of decision the authority will take in a merger case. Our game starts after a merger has been notified. We do not include the merging firms as strategic players in the model as we assume that they always have an interest in getting the merger cleared. Any signals they might send to the authority will be unequivocally positive towards the merger. The merging firms' competitors, on the other hand, will have an incentive to send truthful signals or distorted signals, depending on their own profit effects of the merger. In some cases, their own positive profit effects might go along with positive welfare effects or their negative profit effects with negative welfare effects, thus aligning both sides' interests towards a specific decision. As a consequence, the question when and under which conditions the competitor's signals should be taken at face value arises more imminently and in two more dimensions than in the analysis of an interaction between merging firms and the authority.

In the next subsection, we will describe the merger types which we will use in our analysis. We assume that the competitor knows the type of the currently notified merger. This gives credit to the fact that the competitor as market insider is typically better informed than the authority concerning the likely consequences of a cleared merger. The authority is supposed to have common-knowledge information derived from its own information-gathering efforts.[24]

Thus, in terms of timing we assume that a merger of a given type is first notified. The competitor then observes such type and conveys a message to the authority. We further assume that the competitor will show a clear preference

[24] As mentioned before, this information is assumed to be available to the competitor, e.g., through the Statement of Objections.

towards prohibition or clearance so that only two messages are possible, i.e., a recommendation to clear or to prohibit a notified merger. After observing the message, the authority takes either a clearance or prohibition decision.[25] Our analysis derives the pure- and mixed-strategy equilibria of this signaling game and derives policy recommendations.

4.3.1 Merger Types

The starting point of our model is the fact that mergers have implications on the merging firms' profits (π^M), competitor's profits (π^C), and on welfare (W), as measured by the welfare standard applied. We shall neglect the merging firms' decision in our model in the sense that merging firms will not strategically interact with competitors or the authority in this game. We then assume that the authorities posit a welfare standard for their merger decisions and that competitor firms operate as profit maximisers. For our analysis, it does not matter whether the authority, say, applies a total or a consumer welfare standard. Denote by Δ the change of a given variable due to clearing a merger. Mergers then can carry all kinds of combinations of $\Delta\pi^C$ and ΔW and in all degrees, such as slightly positive $\Delta\pi^C$ while having vastly negative ΔW, etc. It is therefore useful to visualise a grid with four quadrants with $\Delta\pi^C$ and ΔW on the axes. Mergers can then be plotted in all four quadrants based on their implications on $\Delta\pi^C$ and ΔW. The origin of that grid is understood as the status quo, which prevails if the merger is blocked by the authority.

Our analysis thus distinguishes four merger types, where, for simplicity we restrict to $\Delta\pi^C, \Delta W \in \{-1, 1\}$, modeling the *direction* in which a clearance decision would alter welfare and the competitor's profit. This is, naturally, a very simplifying assumption, but it allows us to keep the analysis straightforward and get clear results while still tackling the relevant strategic issues. Apart from that, it might already be a challenging task in practice to place a given merger correctly

[25] For the sake of simplifying the model, we leave out the option of a clearance decision with remedies, either in Phase 1 or Phase 2.

within our four-quadrant model. From a policy perspective, it might also not be practicable to analyse a more general model where $\Delta\pi^C$ and ΔW are distributed on a finer grid, as this would require the authority to attach probabilities to each of the many types.

This taxonomy of merger types has the advantage that it is complete as it covers all conceivable types, independent of their practical relevance. Moreover, it allows us to distinguish types based on the two sides' (the competitor's and the authority's) preferences, which might be aligned or not. The practical relevance of each merger type is captured by the authority's prior information which attaches a probability to each conceivable type.

In this context, it may be illustrative to draw upon the taxonomy of mergers, proposed by Clougherty and Duso [2011, p. 314]. They use the general IO framework to distinguish between four different types of mergers, depending on the merging firms' post-merger profits (π^M) and the competitors' post-merger profits (π^C):

Table 4.1: Merger Taxonomy

	$\Delta\pi^M > 0$	$\Delta\pi^M < 0$
$\Delta\pi^C > 0$	collusion-based synergistic	nonsynergistic
$\Delta\pi^C < 0$	efficiency-based synergistic	value-destroying

The taxonomy cannot be applied directly to our purposes since, as just mentioned, we regard π^C and W (instead of π^M). In the case of collusion-based synergistic mergers, the increase in market power absent efficiency gains leads to higher prices and profits both with the merging firms and the competitors. Consumers get hurt by the raised prices so that consumer surplus will fall. It may be expected that total welfare also falls as a result. Efficiency-based synergistic mergers enable the merging firms to decrease their prices due to efficiency gains

which hurts the competitors' profits.[26] Consumers will benefit from lower prices and we can expect total welfare to rise as a result.

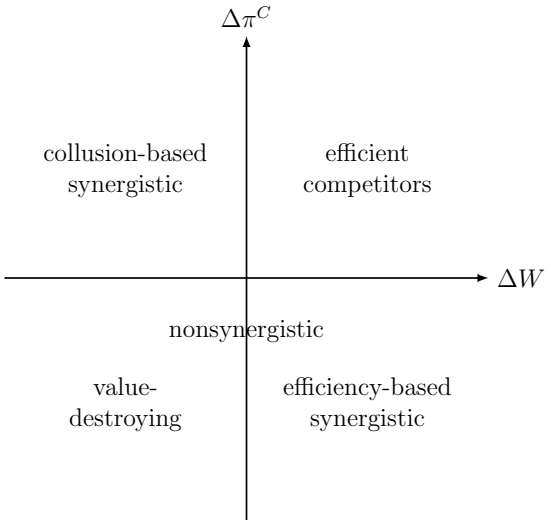
If $\Delta\pi^M < 0$, Clougherty and Duso [2011] speak of value-decreasing or unprofitable mergers. Their explanation for these mergers can hardly be found in IO theory, since firms would not merge if profits were negative, but rather in the fact that managers make errors or overestimate post-merger profits. Managerial hubris or incompetence, political reasons, empire-building are some reasons why mergers are still notified in practice.[27] Non-synergistic mergers are mergers where the merging firms lose while the competitors gain; in most cases, these are mergers where the expected synergies did not materialise and thus the merger was unprofitable.[28] Competitors could profit from a weakening of the merging firm's power since it creates a competitive opportunity. It is not evident what the total welfare effects in such case would be but we can expect welfare to decrease rather than increase, as consumers will not benefit from the competitors' gain. Finally, value-destroying mergers constitute such group of mergers where both merging firms and competitors make losses. According to the literature, such mergers entail efficiencies to the detriment of competitors but also high integration costs for the merging firms themselves.[29] Total welfare is likely to decrease.

Mergers with positive $\Delta\pi^C$ and positive ΔW may not necessarily be intuitive to substantiate: However, Heubeck et al. [2006, p. 38] give an example where this might still happen, namely if the more efficient firm in a market is an outside firm and the merging firms do not realise any cost efficiencies, but average marginal costs in the market fall when the merging firms will reduce their output, while the efficient competitor will raise output. In spite of rising prices, total welfare will then rise.

The types proposed by Clougherty and Duso [2011] can be – roughly – fitted into our grid without claiming completeness, see Figure 4.3.

[26] Farrell and Shapiro [1990].
[27] Clougherty and Duso [2011, p. 313] with further references.
[28] Amir et al. [2009].
[29] Clougherty and Duso [2011, p. 314] with further references.

Figure 4.3: Taxonomy of Merger Types



4.3.2 Model Setup

We set up a signaling game, i.e., a sequential game with players S (also referred to as sender or competitor) and R (also referred to as receiver or authority), and a nonstrategic player *nature*. The timing, actions, and information in this game are as follows:

1. Nature draws the type t_i of the merger from the set $T = \{t_1, t_2, t_3, t_4\}$ with corresponding prior probabilities $p(t_i) > 0$ where $\sum_{t_i \in T} p(t_i) = 1$.[30]

2. S observes t_i and chooses a message m_j from the set $M = \{m_A, m_B\}$. We refer to S's actions synonymously as reports or recommendations. We assume that S can only send one of two messages, interpreted as either a recommendation to prohibit or clear the merger.

3. R observes m_j but does not observe t_i, and chooses a decision d_k from the set $D = \{d_P, d_C\}$, i.e., the decision either prohibits or clears a merger.

4. Referring to the merger types discussed above, we assume four different merger types with four possible combinations in competitors' profit and

[30] We assume strictly positive prior probabilities for each type in order to simplify the analysis. This should not be a restrictive assumption as these probabilities can be arbitrarily small.

welfare implications. While a prohibition is profit- and welfare-neutral, since it constitutes the status quo, a clearance has profit and welfare effects equal to either 1 or -1, depending on the type.[31] Thus, payoffs $U^R(t_i, d_k)$ and $U^S(t_i, d_k)$ are realised, where

$$U^R(t_i, d_k) = \begin{cases} W_i & \text{if } d_k = d_C, \\ 0 & \text{if } d_k = d_P, \end{cases} \qquad U^S(t_i, d_k) = \begin{cases} \Pi_i & \text{if } d_k = d_C, \\ 0 & \text{if } d_k = d_P, \end{cases}$$

$$(W_1, W_2, W_3, W_4) = (-1, 1, 1, -1), \qquad (\Pi_1, \Pi_2, \Pi_3, \Pi_4) = (1, 1, -1, -1).$$

Hence, the competitors have an incentive to send self-interested signals to the authority for types 1 and 3, whereas they have no incentive to distort signals for types 2 and 4. With respect to type 1, the competitors will be tempted to recommend a clearance of the merger, whereas from a welfare standpoint the merger should be blocked. Similarly, a type 3 merger increases efficiency and will increase welfare, while it will hurt the competitors so that the latter will be inclined to recommend blocking the merger.

In the following, we focus on pure strategies only. Later on, we will discuss mixed strategies as well (the formal analysis of mixed strategies is done in Section C.2).

A pure strategy of S is a function $m(t_i)$, $t_i \in T$, a pure strategy of R is a function $d(m_j)$, $m_j \in M$. Conditional on observing message $m_j \in M$, R's belief about the merger type is denoted by the probability distribution $\mu(t_i|m_j) \geq 0$, $t_i \in T$, with $\sum_{t_i \in T} \mu(t_i|m_j) = 1$. Denote by $T_A \subset T$, resp. $T_B \subset T$, the merger types for which S sends the message m_A, resp. m_B in any given equilibrium (candidate). Thus, T_A and T_B together represent a partitioning of the type set.

Our equilibrium concept is pure-strategy perfect Bayesian equilibrium. Therefore, in addition to the above belief system, we require that R's decision $d_k \in D$

[31] In order to simplify notation, we will refer to profit Π and welfare W throughout the formal discussion. In a strict sense, that should mean the respective *changes* in profit and welfare, $\Delta\pi^C$ and ΔW, discussed previously.

is payoff-maximising, i.e, the optimal decision $d^*(m_j)$ conditional on observing message m_j solves

$$\max_{d_k \in D} \sum_{i=1}^{4} \mu(t_i|m_j) U^R(t_i, d_k).$$

Similarly, S's message $m_j \in M$ must be optimal, given the observed type t_i and $R's$ optimal choice $d^*(m_j)$, i.e., the optimal message m_j solves

$$\max_{m_j \in M} U^S(t_i, d^*(m_j)).$$

Finally, for each message $m_j \in M$ that is played by S on the equilibrium path, R's beliefs on the information set corresponding to m_j must follow from Bayes's rule and S's strategy. Formally, for each message $m_j \in M$ for which there is a type $t_i \in T$ with $m^*(t_i) = m_j$ (or, equivalently, $T_j \neq \emptyset$),

$$\mu(t_i|m_j) = \frac{p(t_i)}{\sum_{t_s \in T_j} p(t_s)}.$$

An equilibrium is denoted by the players' complete strategies and R's belief system.

$$\{\{m^*(t_1), m^*(t_2), m^*(t_3), m^*(t_4)\}, \{d^*(m_A), d^*(m_B)\}, \{\mu(t_i|m_j)\ \forall t_i \in T, m_j \in M\}\}$$

4.3.3 Default Decision

We develop a default decision d^{default} to be used as a benchmark for R's decisions under the different equilibria. There, d^{default} is the authority's optimal decision under complete ignorance of S's reports.

Without any signals by S, it is optimal for R to implement the decision that implies a higher expected welfare, based on its priors. In particular, the notified merger should be cleared (d_C) if the merger is more likely to be welfare-improving rather than welfare-decreasing, i.e., $p(t_2) + p(t_3) \geq p(t_1) + p(t_4)$, and prohibited ($d_P$) otherwise.

Therefore, the default decision is

$$d^{\text{default}} = \begin{cases} d_C & \text{if } p(t_2) + p(t_3) \geq p(t_1) + p(t_4), \\ d_P & \text{otherwise.} \end{cases} \tag{4.1}$$

The corresponding expected welfare (change) is

$$E[\Delta W | d^{\text{default}}] = \begin{cases} -p(t_1) + p(t_2) + p(t_3) - p(t_4) & \text{if } d^{\text{default}} = d_C, \\ 0 & \text{otherwise.} \end{cases} \tag{4.2}$$

4.3.4 Pure-Strategy Equilibria

The pure-strategy equilibrium candidates can conveniently be distinguished by the *size* of the sets T_A and T_B, i.e., the *number* of types for which S sends the same message. This results in three classes of equilibrium candidates which we formally develop in Lemmas 1 to 3 in Appendix C, below.

Pure-strategy equilibrium candidates can be distinguished by S's pure strategy (m_i, m_j, m_k, m_l), with $m_i, m_j, m_k, m_l \in M$, where the first entry is the message sent if the merger type is t_1, the second for merger type t_2, etc. Therefore, there are 16 possible pure-strategy equilibrium candidates.

As there are only two different messages, m_A and m_B, the informational content of each pure strategy of S corresponds to a partitioning of the type set in two subsets, e.g., the pure strategy (m_A, m_B, m_A, m_A) partitions the type set into $T_A \in \{t_1, t_3, t_4\}$ and $T_B = \{t_2\}$. Therefore, the merger type 2 is fully revealed in this equilibrium candidate, whereas the other three types are *bunched* together. As a consequence, the pure strategy (m_A, m_B, m_A, m_A) has the same informational content as (m_B, m_A, m_B, m_B) and will implement the same equilibrium decision. For further analysis, therefore, it suffices to distinguish only half of the 16 candidates, i.e., eight pure strategies of S (Table 4.2). In Appendix C, we will formally solve for all equilibria in Lemmas 1 to 3 by denoting the messages with

Table 4.2: Pure-Strategy Equilibrium Candidates, $m_x, m_y \in M$, $m_x \neq m_y$

No.	Candidate	Interpretation	Lemma
1	$\{m_x, m_x, m_x, m_x\}$	uninformative (babbling)	1
2	$\{m_y, m_x, m_x, m_x\}$	fully reveals type 1	2
3	$\{m_x, m_y, m_x, m_x\}$	fully reveals type 2	2
4	$\{m_x, m_x, m_y, m_x\}$	fully reveals type 3	2
5	$\{m_x, m_x, m_x, m_y\}$	fully reveals type 4	2
6	$\{m_x, m_x, m_y, m_y\}$	reveals profit maximising types (1+2)	3
7	$\{m_x, m_y, m_y, m_x\}$	reveals welfare maximising types (2+3)	3
8	$\{m_x, m_y, m_x, m_y\}$	reveals common interest (2+4)	3

m_x and $m_y, m_x, m_y \in M$, $m_x \neq m_y$. The middle column in Table 4.2 gives an interpretation of each equilibrium candidate.

The above leads to a simple structure of the equilibria candidates. We describe and explain our findings in the following, while Appendix C, contains the formal proofs. Apart from the babbling equilibria, the basic intuition is as follows: To *make use* of the competitor's message, the authority takes a specific decision after observing m_x or m_y, while taking the opposite decision conditional on observing the other message m_y or m_x.[32] But given such reaction on the part of the authority, the competitor has a clear incentive to send the *wrong* message, which means that it has an incentive to deviate from the equilibrium candidate strategy, whenever a truthful report implements a decision that is not in line with the competitor's preferences. The reason is that, first, sending the other message will change the decision, and, second, for any given decision, there is generally a merger type for which the competitor does not *like* the decision. The only exception is the equilibrium candidate (no. 6 in Table 4.2) where the competitor sends a purely selfish message in the sense that it reveals whether or not the merger increases the competitor's profit and the authority implements the competitor's preferred decision. In this candidate, the competitor obviously never

[32] Clearly, the only alternative to this is ignoring the messages, i.e., taking a message-independent decision.

has an incentive do deceive the authority.

Uninformative Equilibrium

First, there is the uninformative or babbling equilibrium (no. 1 in Table 4.2), i.e., S always sends the same message independent of the type which thus has no informational content, and R decides independent of S's message and takes the default decision (see section 4.3.3). The decision is thus made according to the prior beliefs the authority has over the probabilities of each merger type. R thus clears the merger if the expected welfare based on the prior beliefs is positive (and prohibits if negative). A requirement for this equilibrium is that R also takes the default decision after observing an off-equilibrium message. For this, it is sufficient but not necessary that the authority applies the prior beliefs off the equilibrium path. What matters is that R implements the default decision whenever S has a potential incentive to deviate to the off-equilibrium message.

One-Type Revealing

Suppose that S sends one of the messages for one type and the other message for all other types (no. 2–5 in Table 4.2). Therefore, S reveals one of the types truthfully while the other three cannot be distinguished by the message. Obviously, in case of that single revealed type, R has a unique optimal decision as it learns the true type of the merger. This optimal decision must necessarily be implemented in any equilibrium.

In principle, the authority has two options. First, R might ignore the messages and implement the default. This is indeed the best response and constitutes an equilibrium for certain constellations of R's prior information. More precisely, as mentioned above, R must always implement the optimal decision for the single revealed type. Therefore, ignoring S's message can only be an equilibrium if R's optimal decision is the same for that single type and for the group of three mergers represented by the other message. If, however, the optimal decisions

corresponding to the two messages are different, then there is no equilibrium where the authority ignores S's message.

Second, the authority might block the merger after one of the messages and clear it after observing the other message. Then S can manipulate the decision whenever this increases S's profit. As three of the types carry the same message and therefore the same decision, for one of those three types S must have an incentive to deceive the authority. This is because, intuitively, for every decision of the authority, there are exactly two types for which S likes the decision, whereas for the other types, S prefers the opposite decision. Thus, no equilibrium exists in which R's decision is conditional on S's message.

Selfish

Suppose that S sends the same message for those types of mergers where its payoff is positive and a different message for those types where, in the case of clearance, its payoff is negative (no. 6 in Table 4.2). Therefore, S would reveal those types for which it would prefer to have clearance or prohibition, respectively. There is an equilibrium where the authority implements the competitor's recommendation. For the rest of the paper, we refer to this equilibrium as the *selfish equilibrium*. This happens if the authority has priors in such way that it is optimal to decide according to the competitor's truthfully revealed preferences. There is indeed such a constellation of priors. Moreover, as we will explain in more detail later, the decision in this equilibrium is better for both sides than the default decision. In addition, there is, again, an equilibrium where R ignores S's message. This applies when priors are such that knowing whether or not the merger is profit-increasing or -decreasing does not affect the authority's optimal decision.

Welfare-Revealing

Suppose that S sends the same message for those merger types where welfare is positive (types 2 and 3) and a different message for those types where, in the case

of clearance, welfare is negative (no. 7 in Table 4.2). Therefore, S would reveal those types for which the *authority* would prefer to have clearance or prohibition. It is evident that R's optimal decisions would be to clear the welfare-improving types and to block the welfare-reducing types. However, this cannot constitute an equilibrium since the competitor would always have an incentive to deviate to improve its payoffs.

Common Interest

Suppose that S sends the same message for those merger types where both S and R's interests are aligned (types 2 and 4) (no. 8 in Table 4.2), whereas the other message is sent to indicate that S and R's interests are not aligned for the present merger and thus point to types 1 and 3. There is no equilibrium where R decides conditional on S's message. Consider, e.g., the message associated with types 1 and 3 for which S and R prefer the same decision. Even though their interests are aligned, there is a single decision for two merger types. Whichever decision the authority takes, there is a merger type (either 1 or 3) for which S prefers the opposite decision and therefore S has an incentive to deceive the authority. The only remaining equilibrium candidate is one where R ignores S's message. This is an equilibrium whenever, based on priors, R's optimal decision is the same for both groups of merger types.

4.3.5 Mixed-Strategy Equilibria

As we formally show in Section C.2, the game has a continuum of mixed-strategy equilibria. In these equilibria, R ignores S's messages and implements the default decision. Therefore, intuitively, S is indifferent between all pure and mixed strategies. These equilibria are the 'natural extension' of the pure strategy equilibria derived before, where R decides independent of S's message.

4.4 Policy Recommendation and Discussion

Having derived all equilibria, we can distinguish two different kinds of equilibria by the implemented decision. Either the authority ignores any message sent by the competitor and takes its default decision based on its prior beliefs or it follows exactly the competitor's recommendations (selfish equilibrium). An equilibrium of the first kind always exists whereas the second kind of equilibrium requires a certain constellation of the priors.

In order to prepare a policy recommendation, we first address the issue of multiple equilibria. As the uninformative equilibrium always exists, it is clear that we indeed have to deal with multiple equilibria for a given constellation of priors. Nevertheless, we argue that, by plausibility, there is a clear solution to our game. We prepare the argument by formally stating the payoff-superiority of the selfish equilibrium.

Proposition 1. *Suppose the selfish equilibrium exists, i.e.,* (4.3) *holds. In the selfish equilibrium, the authority's expected welfare and the competitor's expected profit are larger than under any other equilibrium.*

Proposition 1 implies that both players *prefer* the selfish equilibrium to any other (pure- or mixed-strategy) equilibrium. At the same time, all other equilibria are payoff-equivalent (for all parties) to just implementing the default decision *without playing the game*. Therefore, it is plausible to consider the selfish equilibrium as the only relevant equilibrium (conditional on its existence), whereas – whenever the selfish equilibrium does not exist – the authority can ignore the competitor (and thus the question which equilibrium is being played) and straightforwardly implement the default. The decision when to listen to the competitor and when to implement the default regardless of the competitor's information is simple, as it is completely based on the authority's prior information.

Let us now look in detail at the implications of the selfish equilibrium where S recommends its preferred decisions and R implements it. By Lemma 3, the

formal condition for this equilibrium is

$$p(t_1) \leq p(t_2), \quad p(t_3) < p(t_4). \tag{4.3}$$

This means that, conditional on the true merger type being either 1 or 2 (i.e., profit-increasing for the competitor), clearing the merger is more likely to increase rather than decrease welfare ($p(t_1) \leq p(t_2)$), and, conditional on the merger being profit-decreasing (for the competitor), clearing the merger is more likely to decrease than increase welfare ($p(t_3) < p(t_4)$). This constellation of prior information is compatible with both d_P or d_C being the default decision.

Why does the authority (i.e., welfare) profit from the selfish equilibrium? Clearly, it reveals valuable information to the authority: The competitor, through the message, truthfully reveals a group of two merger types (either the profit-increasing or the profit-decreasing types) in which the actual merger falls. Combining this truthful information with the authority's own prior information should intuitively improve the quality of the authority's decision. The *price* the authority pays for this information is to implement the competitor's preferred decision. Nevertheless, the existence condition of the selfish equilibrium, (4.3), ensures that the authority follows the competitor's recommendation only if that increases expected welfare.

To shed more light on this, we now formally evaluate the *accuracy* of the authority's decision in the selfish equilibrium as compared to the default decision. In the former, the authority relies on prior as well as the competitor's revealed information, whereas the latter is entirely based on prior information. We define:

The accuracy of the authority's decision is the probability that the decision is (ex post) welfare-maximising conditional on the information available to the authority.

Decision accuracy is therefore a value between zero and one.[33] For example, the default decision is d_P if the merger is more likely to be of either type 1 or 4, rather than 2 or 3. Therefore, the accuracy of the default decision is the probability that d_P is ex post welfare-maximising. In other words, it is the probability that the merger type is either 1 or 4, based on prior information. This probability is $(p(t_1) + p(t_4))/(p(t_1) + p(t_2) + p(t_3) + p(t_4)) = p(t_1) + p(t_4) > 1/2$. As another example, consider the selfish equilibrium and suppose the competitor revealed that the merger type is profit-increasing, i.e., either type 1 or 2. The authority will then follow the recommendation and implement d_C. This decision is ex post correct only if the merger is of type 2. The probability of this is $p(t_2)/(p(t_1) + p(t_2)) \geq 1/2$, by (4.3).

Proposition 2 summarises this discussion formally. It contains the observation that the decision accuracy improves even if the selfish equilibrium implements the same decision as the default. Intuitively this is because the competitor's *additional* information 'confirms' the default decision, increasing the probability that the decision is correct.

Proposition 2. *Consider the selfish equilibrium and the default decision which is entirely based on prior information. In the selfish equilibrium, the accuracy of the authority's decision is higher than under the default decision. This holds regardless of whether the decision implemented in the selfish equilibrium is different from the default decision or not.*

From these results we can derive a clear policy recommendation:

- In accordance with the procedural rules or practices, the authority is free to hear the competitor's opinion in all merger cases, however, it should almost never listen.
- The only case where it should not only hear but listen is when the authority's and the competitor's interests are aligned in the following way:[34]

[33] It would be one if the authority knew the merger type and accordingly implemented the optimal decision.

[34] Or, equivalently, when conditions (4.3) hold.

The authority's prior information must be such that welfare is more likely to increase rather than decrease, conditional on clearing a profit-increasing merger, and welfare must be more likely to decrease than increase, if a profit-decreasing merger were cleared.

- Therefore, intuitively, the authority should first thoroughly analyse and verify its prior information which reveals if it should listen to the competitor's opinion or ignore it. Given the right prior constellation, the authority should listen to the rival and straightforwardly implement its recommendation.

4.5 Conclusion

We have set up a model capturing the strategic interaction between competitor and authority in merger proceedings. As the competitor has superior information as well as a potential incentive to deceive the authority, it is important to understand how the authority should deal with the competitor's information.

Our main result is that the authority should generally ignore the competitor's recommendation, with one exception: If the interests of both parties are statistically aligned in a certain way, the authority should straightforwardly implement the competitor's recommendation. We have shown that this will improve the accuracy of the authority's decision, regardless of whether it would have taken the same or a different decision in ignorance of the competitor's report. Therefore, implementing the competitor's choice in these cases is a price worth paying.

Moreover, we have shown that the situation in which the authority should follow the competitor's recommendation is easily derived from the authority's own information: Merger type 2 must be expected to be more likely than type 1 and at the same time, type 4 must be more likely than type 3. In other words, welfare must be expected to increase if a profit-increasing merger is cleared, and welfare must be expected to decrease if a profit-decreasing merger were cleared.[35]

[35] The profit-decreasing mergers are prohibited in the selfish equilibrium, implying the status quo welfare.

Our analysis implies that the authority should strengthen its efforts to improve its prior information. This will save resources otherwise used for gathering information from competitors or holding lengthy Phase 2 proceedings.

5 Concluding Remarks

The essays in this dissertation investigate into the effectiveness of merger control in the European Union. Chapters 2 and 3 analyse the deterrent effect of merger policy decisions on future merger activity. Both chapters find that Phase 1 Remedies have a distinct effect on deterrence; Chapter 2 finds that Phase 1 Remedies work best in the low-competition industries which goes in line with the results in Chapter 3 where Phase 1 Remedies seem to deter firms from filing anticompetitive mergers. A possible explanation is that, although one could assume that Phase 1 proceedings entail less costs than Phase 2 proceedings and therefore Phase 1 Remedies might be encouraging rather than deterring, merging firms might agree to Phase 1 Remedies at relatively big concessions. In Chapter 3, I further find that individual Phase 2 instruments such as prohibitions, withdrawals, and remedies also involve relatively strong deterrence on the filing of anticompetitive mergers, whereas on an industry level the effect of Phase 2 instruments, with respect to the total number of filed notifications, seems to be generally weaker. Both analyses show that the aggregate effect of Phase 2 instruments, that is, the mere fact that Phase 2 proceedings were initiated, was not notable; rather, selected Phase 2 decisions had strong or less strong deterrent effects. Chapter 4 shows that the present rule of competitor involvement is suboptimal in the sense that it leaves room for abuse, leading to less efficient results. Based on the current rule, the merger authority could hear the competitor, but it should almost never listen, unless certain conditions of its prior information are fulfilled.

From a policy perspective, it will be desirable to strengthen the deterrent effect of opening Phase 2 proceedings *per se* (rather than its individual instruments)

and to improve the scanning process in Phase 1. Phase 2 decisions tie up resources over several months and should be concentrated on the most controversial mergers only, while ideally, the deterrent effects of Phase 1 instruments should suffice to influence future notifications. Prohibitions in Phase 2 can be avoided by encouraging to the merging firms already in Phase 1 to withdraw their notification. Thus, the authority should devote its efforts to improve its capability in Phase 1 scanning so as, among other goals, to conclude those merger cases already in Phase 1 which are highly likely to be prohibited in Phase 2 and to reduce the number of Phase 2 cases to a necessary minimum. Improved Phase 1 scanning further implies that the procurement of information on a specific merger must become more effective and depend to a smaller extent on the information provided by competitors.

Appendix A

In this appendix, we show the results for an alternative definition of our industry control variables, where we use the U.S. census bureau table of conversion and apply an m to 1 matching procedure to link the SIC and NACE industries for our industry control variables. In our main sample we linked only one NACE industry with one SIC industry. Here we place several SIC industries (and their firms), for which we have accountancy and stock market data, multiple times in the same NACE market as defined by the Commission when dealing with mergers. This matching procedure is more comprehensive since any potential overlap between industries is now taken care of, but it comes at the cost of double counting parts of some industries.

As can be seen from Table A.1 below, results are qualitatively the same. In particular, only Phase 1 Remedies show robust deterrence effects. Control variables and model adequateness are also qualitatively the same.

Table A.1: Robustness Check – Main Analysis – Industries' Double Counting

	OLS	Fixed Effects	System GMM	OLS	Fixed Effects	System GMM
	(1)	(2)	(3)	(4)	(5)	(6)
Merger Proposals$_{t-1}$	0.428***	0.150***	0.458***	0.423***	0.148***	0.427**
	(0.040)	(0.05548)	(0.163)	(0.039)	(0.054)	(0.211)
Merger Proposals$_{t-2}$	0.304***	0.03327	0.1000	0.304***	0.030	0.087
	(0.043)	(0.05106)	(0.0711)	(0.043)	(0.050)	(0.115)
Actions$_{t-1}$	−0.072	−0.04004	−0.302			
	(0.047)	(0.0463)	(0.213)			
P1 Remedies$_{t-1}$				−0.119**	−0.126**	−0.904*
				(0.056)	(0.050)	(0.536)
P1 Withdrawals$_{t-1}$				0.019	0.007	−0.609
				(0.087)	(0.078)	(0.496)
P2 Remedies$_{t-1}$				0.008	0.082	0.562
				(0.102)	(0.088)	(0.777)
P2 Preventions$_{t-1}$				−0.084	−0.030	−0.281
				(0.161)	(0.124)	(0.883)
HHI$_{t-1}$	−1.125***	0.827	−2.243	−1.132***	0.823	−2.453
	(0.377)	(0.586)	(3.735)	(0.373)	(0.582)	(3.804)
Beta$_{t-1}$ (×100)	−0.400	−0.00492	−0.00491	−0.331	−0.432	0.49
	(1.00)	(10.0129)	(0.01.08)	(0.949)	(1.280)	(1.350)
Salesgrowth$_{t-1}$	0.028	−0.0150	0.0534	0.0281	−0.0147	0.016
	(0.082)	(0.108)	(0.114)	(0.0828)	(0.108)	(0.128)
Tobinsq$_{t-1}$ (×100)	−0.004	−0.0654*	−0.0667	0.001	−0.060**	−0.027
	(0.034)	(0.0313)	(0.0573)	(0.033)	(0.029)	(0.061)
Sharereturn$_{t-1}$	0.272***	0.233***	0.243***	0.261***	0.219***	0.228**
	(0.083)	(0.073)	(0.0887)	(0.082)	(0.0698)	(0.115)
Constant	0.557***	1.446***	0.673*	0.567***	1.466***	0.766**
	(0.114)	(0.168)	(0.380)	(0.115)	(0.166)	(0.364)
Observations	666	666	666	666	666	666
R^2	0.608	0.460		0.609	0.463	
# of instruments			62			62
Sargan test			0.815			0.901
Arellano-Bond test			0.880			0.869

Notes: In columns (1) and (2), we report the estimate from a OLS regression. In columns (3) and (4), we report the results from a panel fixed-effects regression. In columns (5) and (6), we report the results from the system GMM estimation to account for the dynamic nature of our model. The dependent variable is the log of merger proposals. All merger policy action variables are expressed in logs. In all regressions, we include year fixed-effects. In columns (1) to (4), heteroskedasticity robust standard errors clustered at the industry level are reported in parentheses. In columns (5) and (6), heteroskedasticity robust standard errors are reported in parentheses. Significance at the 1%, 5%, and 10% significance levels is represented by ***, **, * respectively. For the fixed-effects estimates in columns (3) and (4) we report the R^2 within. We report the p-values for the Sargan test of overidentification restrictions and for the Arellano-Bond test of zero autocorrelation in first-differenced errors.

Appendix B

Table B.1: Logit by Years

	M_i, I_i	M_i, I_i, A_i	M_i, I_i, P_i (2 lags)	M_i, I_i, P_i (1 lag)	M_i, P_i (2 lags)
anticomprel					
y	−0.197 *	−0.101	0.0821	−0.127	0.102
	(0.103)	(0.145)	(0.255)	(0.112)	(0.255)
y^2	0.0114 ***	0.00722	−0.000552	0.00816	−0.000533
	(0.00402)	(0.00636)	(0.0160)	(0.00638)	(0.0165)
Experience Acq$_{it}$	0.0158 *	0.0160 *	0.0193 **	0.0183 **	0.0200 **
	(0.00900)	(0.00888)	(0.00962)	(0.00891)	(0.00919)
Experience Tar$_{it}$	0.0566	0.0593	0.0534	0.0519	0.0485
	(0.0361)	(0.0362)	(0.0364)	(0.0355)	(0.0392)
PastYIndustryPrev$_{it}$	−0.664 *	−0.634 *	−0.587	−0.587	−0.522
	(0.379)	(0.377)	(0.383)	(0.377)	(0.354)
1yHHI$_{it}$	−0.778	−0.723	0.325	−1.206	
	(2.567)	(2.569)	(2.425)	(0.863)	
1yBeta$_{it}$	0.0191	0.0179	0.0112	0.0165	
	(0.0310)	(0.0319)	(0.0297)	(0.0265)	
1ySalesgrowth$_{it}$	−0.716	−0.755	−0.840	−0.168	
	(0.771)	(0.760)	(0.765)	(0.721)	
1yMarkettoBook$_{it}$	−0.0139 ***	−0.0144 ***	−0.00871	−0.0141 **	
	(0.00529)	(0.00516)	(0.00536)	(0.00560)	
1ySharereturn$_{it}$	0.331 *	0.334 *	0.387 **	0.221 *	
	(0.173)	(0.180)	(0.185)	(0.132)	
1yLogTobinsq$_{it}$	0.0593	0.0536	−0.0583	0.182	
	(0.230)	(0.228)	(0.259)	(0.174)	
2yHHI$_{it}$	−0.812	−1.004	−1.601		
	(2.699)	(2.692)	(2.635)		
2yBeta$_{it}$	0.00888	0.00925	0.0221		
	(0.0218)	(0.0232)	(0.0235)		
2ySalesgrowth$_{it}$	−0.290	−0.394	−0.156		
	(0.777)	(0.737)	(0.700)		
2yMarkettoBook$_{it}$	−0.00441	−0.00539	−0.00435		
	(0.00366)	(0.00406)	(0.00346)		
2ySharereturn$_{it}$	0.0351	0.0678	0.00832		
	(0.107)	(0.111)	(0.109)		
2yLogTobinsq$_{it}$	0.206	0.260	0.276		
	(0.236)	(0.229)	(0.246)		

Table B.1 (continued)

	M_i, I_i	M_i, I_i, A_i	M_i, I_i, P_i (2 lags)	M_i, I_i, P_i (1 lag)	M_i, P_i (2 lags)
Actions/$y_{i,t-1}$		−0.0134			
		(0.00872)			
Actions/$y_{i,t-2}$		0.000120			
		(0.0105)			
Notifications/$y_{i,t-1}$			0.0121 ***	0.00968***	0.0133 ***
			(0.00376)	(0.00202)	(0.00339)
Ph1 Remedies/$y_{i,t-1}$			−0.0111	−0.0474 *	−0.0197
			(0.0364)	(0.0242)	(0.0305)
Ph2 Remedies/$y_{i,t-1}$			−0.247 **	−0.111 **	−0.242 **
			(0.107)	(0.0529)	(0.104)
Ph1 Withdrawals/$y_{i,t-1}$			−0.0185	−0.0133	−0.000442
			(0.0494)	(0.0442)	(0.0406)
Preventions/$y_{i,t-1}$			−0.0730	−0.0533	−0.0733
			(0.0619)	(0.0632)	(0.0580)
Simplifieds/$y_{i,t-1}$			−0.0144 ***	−0.00825**	−0.0137 ***
			(0.00482)	(0.00393)	(0.00500)
Notifications/$y_{i,t-2}$			−0.00391		−0.00396
			(0.00540)		(0.00504)
Ph1 Remedies/$y_{i,t-2}$			0.0559		0.0393
			(0.0563)		(0.0551)
Ph2 Remedies/$y_{i,t-2}$			0.0122		0.00261
			(0.0744)		(0.0732)
Ph1 Withdrawals/$y_{i,t-2}$			0.185 *		0.168 **
			(0.0989)		(0.0827)
Preventions/$y_{i,t-2}$			−0.197 **		−0.172 **
			(0.0804)		(0.0851)
Simplifieds/$y_{i,t-2}$			0.00565		0.00369
			(0.00973)		(0.00971)
Constant	−2.186 **	−2.310 **	−4.014 ***	−2.795 ***	−4.472 ***
	(0.942)	(0.952)	(1.267)	(0.925)	(1.167)
Observations	1773	1773	1773	1773	1773

Notes: Marginal effects; standard errors in parentheses: (VCE)robust, y cluster; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2: Logit by Quarters

	M_i, I_i	M_i, I_i, A_i	M_i, I_i, P_i (2 lags)	M_i, I_i, P_i (1 lag)	M_i, P_i (2 lags)
anticomprel					
q	−0.0487 *	−0.0504 *	−0.0430 *	−0.0414 *	−0.0367
	(0.0256)	(0.0271)	(0.0240)	(0.0232)	(0.0266)
q^2	0.000669***	0.000686**	0.000650***	0.000676***	0.000583**
	(0.000236)	(0.000287)	(0.000234)	(0.000195)	(0.000244)
Experience Acq_{it}	0.0167 *	0.0166 *	0.0143	0.0156 *	0.0152 *
	(0.00884)	(0.00871)	(0.00900)	(0.00839)	(0.00841)
Experience Tar_{it}	0.0573	0.0572	0.0626	0.0570	0.0577
	(0.0362)	(0.0363)	(0.0395)	(0.0381)	(0.0413)
$\text{PastYIndustryPrev}_{it}$	−0.669 *	−0.678 *	−0.678 *	−0.675 *	−0.616 *
	(0.381)	(0.382)	(0.384)	(0.379)	(0.359)
1yHHI_{it}	−0.839	−0.902	−1.112	−1.400	
	(2.596)	(2.614)	(2.526)	(0.882)	
1yBeta_{it}	0.0193	0.0185	0.0187	0.0233	
	(0.0313)	(0.0304)	(0.0304)	(0.0274)	
$\text{1ySalesgrowth}_{it}$	−0.727	−0.747	−0.761	−0.392	
	(0.780)	(0.789)	(0.844)	(0.725)	
$\text{1yMarkettoBook}_{it}$	−0.0136 **	−0.0130 **	−0.0117 **	−0.0160 ***	
	(0.00528)	(0.00562)	(0.00544)	(0.00617)	
1yShareretur_{it}	0.331 *	0.331 *	0.356 *	0.245 *	
	(0.180)	(0.181)	(0.185)	(0.130)	
1yLogTobinsq_{it}	0.0523	0.0370	−0.0154	0.176	
	(0.235)	(0.248)	(0.245)	(0.190)	
2yHHI_{it}	−0.776	−0.652	−0.404		
	(2.714)	(2.743)	(2.672)		
2yBeta_{it}	0.00754	0.00776	0.00724		
	(0.0219)	(0.0215)	(0.0229)		
$\text{2ySalesgrowth}_{it}$	−0.266	−0.293	−0.331		
	(0.771)	(0.823)	(0.836)		
$\text{2yMarkettoBook}_{it}$	−0.00436	−0.00430	−0.00447		
	(0.00377)	(0.00374)	(0.00367)		
2yShareretur_{it}	0.0404	0.0417	0.0241		
	(0.106)	(0.107)	(0.0925)		
2yLogTobinsq_{it}	0.206	0.219	0.256		
	(0.242)	(0.240)	(0.241)		

Table B.2 (continued)

	M_i, I_i	M_i, I_i, A_i	M_i, I_i, P_i (2 lags)	M_i, I_i, P_i (1 lag)	M_i, P_i (2 lags)
Actions/$q_{i,t-1}$		0.0232			
		(0.0225)			
Actions/$q_{i,t-2}$		−0.0177			
		(0.0223)			
Notifications/$q_{i,t-1}$			0.00616	0.00457	0.00786
			(0.00644)	(0.00507)	(0.00702)
Ph1 Remedies/$q_{i,t-1}$			−0.0316	−0.0239	−0.0349
			(0.0655)	(0.0486)	(0.0595)
Ph2 Remedies/$q_{i,t-1}$			0.0355	−0.0173	0.0473
			(0.0896)	(0.0768)	(0.0872)
Ph1 Withdrawals/$q_{i,t-1}$			0.113 **	0.109 **	0.130 *
			(0.0506)	(0.0532)	(0.0667)
Preventions/$q_{i,t-1}$			0.0540	−0.0110	0.0418
			(0.0547)	(0.0673)	(0.0542)
Simplifieds/$q_{i,t-1}$			−0.0176 **	−0.00848	−0.0164 **
			(0.00692)	(0.00540)	(0.00685)
Notifications/$q_{i,t-2}$			0.00442		0.00566
			(0.00641)		(0.00579)
Ph1 Remedies/$q_{i,t-2}$			0.000410		−0.0102
			(0.0302)		(0.0332)
Ph2 Remedies/$q_{i,t-2}$			−0.0321		−0.0205
			(0.0773)		(0.0760)
Ph1 Withdrawals/$q_{i,t-2}$			−0.0674		−0.0619
			(0.0573)		(0.0665)
Preventions/$q_{i,t-2}$			−0.188 **		−0.170 *
			(0.0912)		(0.102)
Simplifieds/$q_{i,t-2}$			0.00492		0.00279
			(0.00545)		(0.00562)
Constant	−2.105 **	−2.113 **	−2.562 **	−2.551 **	−3.083 ***
	(0.989)	(0.978)	(1.021)	(1.025)	(0.948)
Observations	1764	1764	1764	1764	1764

Appendix C

C.1 Pure-Strategy Equilibria of the Signaling Game

We formally derive all pure-strategy equilibria of our signaling game. We start with the babbling equilbrium which is known to exist in a game of the present form.

Lemma 1. *The game has (two) equilibria in which either T_A or T_B is empty, i.e., S's equilibrium strategy is uninformative. In these equilibria, R ignores S's message and implements the default decision. Formally, the set of these equilibria is characterised by*

$$
\begin{aligned}
&m^*(t_1) = m^*(t_2) = m^*(t_3) = m^*(t_4) = m_x,\ m_x \in M,\\
&d^*(m_A) = d^*(m_B) = d^{default},\\
&\mu(t_i|m_x) = p(t_i),\ t_i \in T,\\
&\mu(t_i|m_y)\ \textit{such that}\\
&\qquad \mu(t_2|m_y) + \mu(t_3|m_y) \geq \mu(t_1|m_y) + \mu(t_4|m_y)\ \textit{if}\ p(t_2) + p(t_3) \geq p(t_1) + p(t_4),\\
&\qquad \mu(t_2|m_y) + \mu(t_3|m_y) < \mu(t_1|m_y) + \mu(t_4|m_y)\ \textit{if}\ p(t_2) + p(t_3) < p(t_1) + p(t_4).
\end{aligned}
$$

These equilibria always exist.

Note: The uninformative equilibria of Lemma 1 require that R always implements the default decision after observing the *off-equilibrium* message. Otherwise S has an incentive to deviate in the cases where the default does not coincide with S's preferred decision. Therefore, the prior beliefs are a supporting belief

system off the equilibrium path (as are any beliefs that always implement the default decision).

Proof of Lemma 1. Clearly, as S always sends the same message m_x (for every type), R's beliefs on the equilibrium path are the prior beliefs. This implies that the default decision is implemented. The default decision is based on expected welfare only. Thus, it might be d_P or d_C. Depending on the true type, S's preferred choice might coincide with the default or not. If not, then S would have an incentive to deviate to the off-equilibrium message m_y if that message ever changes R's (default) decision in the cases where S wants to deviate. Therefore, R's off-equilibrium beliefs must be such that R implements the default whenever the off-equilibrium message m_y is observed. More precisely:

1. Suppose the type realisation is $t_i \in \{t_1, t_2\}$. Then S prefers d_C. If $d^{\text{default}} = d_C$, there is no incentive to deviate. If, however, $d^{\text{default}} = d_P$, then S has an incentive to deviate to the off-equilibrium message m_y if that leads to d_C. Therefore, if $p(t_2) + p(t_3) < p(t_1) + p(t_4)$ (when $d^{\text{default}} = d_P$), then the supporting beliefs must satisfy

$$\sum_{t_i \in T} \mu(t_i|m_y) W_i < 0,$$

   i.e., lead to the implementation of $d^{\text{default}} = d_P$. By $(W_1, W_2, W_3, W_4) = (-1, 1, 1, -1)$, this is equivalent to

$$\mu(t_2|m_y) + \mu(t_3|m_y) < \mu(t_1|m_y) + \mu(t_4|m_y).$$

   It can be seen that this corresponds to the relation of priors that implements $d^{\text{default}} = d_P$.

2. Suppose the type realisation is $t_i \in \{t_3, t_4\}$. Then S prefers d_P. If $d^{\text{default}} = d_P$, there is no incentive to deviate. If, however, $d^{\text{default}} = d_C$, then S has an incentive to deviate to the off-equilibrium message m_y if that leads to d_P. Therefore, if $p(t_2) + p(t_3) \geq p(t_1) + p(t_4)$ (when $d^{\text{default}} = d_C$), then the supporting beliefs must satisfy

$$\sum_{t_i \in T} \mu(t_i|m_y) W_i \geq 0,$$

i.e., lead to the implementation of $d^{\text{default}} = d_C$. By $(W_1, W_2, W_3, W_4) = (-1, 1, 1, -1)$, this is equivalent to

$$\mu(t_2|m_y) + \mu(t_3|m_y) \geq \mu(t_1|m_y) + \mu(t_4|m_y).$$

It can be seen that this corresponds to the relation of priors that implements $d^{\text{default}} = d_C$.

□

Lemma 2. *The game has equilibria in which either T_A or T_B is a singleton set, i.e., S's equilibrium strategy reveals one of the four merger types. In these equilibria, R ignores S's message and implements the default decision. Formally, the set of these equilibria is characterised by (where $t_i, t_j, t_k, t_l \in T$ are different types and $m_x, m_y \in M$ are different messages)*

$$\begin{aligned}
&m^*(t_i) = m^*(t_j) = m^*(t_k) = m_x,\ m^*(t_l) = m_y,\\
&d^*(m_A) = d^*(m_B) = d^{default} = d_P \text{ if } \sum_{t_s \in T_x} p(t_s) W_s < 0,\ W_l < 0,\\
&d^*(m_A) = d^*(m_B) = d^{default} = d_C \text{ if } \sum_{t_s \in T_x} p(t_s) W_s \geq 0,\ W_l > 0,\\
&\mu(t_s|m_x) = \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)},\ \mu(t_s|m_y) = 0,\ t_s \in T_x = \{t_i, t_j, t_k\},\\
&\mu(t_l|m_y) = 1,\ \mu(t_l|m_x) = 0.
\end{aligned} \tag{C.1}$$

If either $(\sum_{t_s \in T_x} p(t_s) W_s < 0,\ W_l > 0)$ or $(\sum_{t_s \in T_x} p(t_s) W_s \leq 0,\ W_l > 0)$, there is no such equilibrium.

Proof of Lemma 2. Consider S's candidate strategy which can be represented by $T_x = \{t_i, t_j, t_k\}$ and $T_y = \{t_l\}$ where $x \neq y$. Both messages are therefore played on the equilibrium path. As message m_y is only sent for type t_l, we have $\mu(t_l|m_y) = 1$, and the best response is

$$d^*(m_y) = \begin{cases} d_P & \text{if } W_l < 0, \\ d_C & \text{if } W_l > 0. \end{cases} \tag{C.2}$$

The remaining message m_x is sent for all other types, which gives the updated beliefs stated in (C.1). R's best response is found as follows. Decision d_P implies

$U^R = 0$, whereas d_C has an expected payoff of

$$\sum_{t_s \in T_x} \mu(t_s|m_x) U^R(t_s, d_C) = \sum_{t_s \in T_x} \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)} W_s.$$

Therefore, d_C is optimal if

$$\sum_{t_s \in T_x} \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)} W_s \geq 0 \iff \sum_{t_s \in T_x} p(t_s) W_s \geq 0.$$

It follows that

$$d^*(m_x) = \begin{cases} d_P & \text{if } \sum_{t_s \in T_x} p(t_s) W_s < 0, \\ d_C & \text{if } \sum_{t_s \in T_x} p(t_s) W_s \geq 0. \end{cases} \tag{C.3}$$

Combining (C.2) and (C.3), we have to distinguish four constellations of prior probabilities:

1. $\sum_{t_s \in T_x} p(t_s) W_s < 0$ and $W_l < 0$:
   (The above conditions imply $\sum_{t_i \in T} p(t_i) W_i < 0$, which gives $d^{\text{default}} = d_P$.)
   Here, $d^*(m_y) = d^*(m_x) = d_P = d^{\text{default}}$. We have an equilibrium because R ignores S's message and S, therefore, cannot profitably deviate.

2. $\sum_{t_s \in T_x} p(t_s) W_s < 0$ and $W_l > 0$:
   Here, $d^*(m_y) = d_C$ and $d^*(m_x) = d_P$. S sends m_x for three types and has a payoff of 0 in these cases. There is no equilibrium here, because for one of those three types, S's payoff can be improved from 0 to 1 by reporting m_y instead, which leads to decision d_C.

3. $\sum_{t_s \in T_x} p(t_s) W_s \geq 0$ and $W_l < 0$:
   Here, $d^*(m_y) = d_P$ and $d^*(m_x) = d_C$. S sends m_x for three types and must have a negative payoff for at least one of those types. There is no equilibrium here, because S can avoid a negative payoff by reporting m_y instead, which leads to decision d_P with a payoff of 0.

4. $\sum_{t_s \in T_x} p(t_s) W_s \geq 0$ and $W_l > 0$:
   (The above conditions imply $\sum_{t_i \in T} p(t_i) W_i \geq 0$, which gives $d^{\text{default}} = d_C$.)
   Here, $d^*(m_y) = d^*(m_x) = d_C = d^{\text{default}}$. We have an equilibrium because R ignores S's message and S, therefore, cannot profitably deviate.

□

Lemma 3. *The game has equilibria in which T_A and T_B each have two elements, i.e., in each of these equilibria, pairs of types are associated with the*

same message. Formally, the set of these equilibria is characterised by (where $t_i, t_j, t_k, t_l \in T$ *are different types and* $m_x, m_y \in M$ *are different messages)*

$$
\begin{aligned}
&m^*(t_i) = m^*(t_j) = m_x,\ m^*(t_k) = m^*(t_l) = m_y,\\
&d^*(m_A) = d^*(m_B) = d^{default} = d_P \ \textit{if}\ \left(\sum_{t_s \in T_x} p(t_s)W_s < 0, \sum_{t_u \in T_y} p(t_u)W_u < 0\right),\\
&d^*(m_A) = d^*(m_B) = d^{default} = d_C \ \textit{if}\ \left(\sum_{t_s \in T_x} p(t_s)W_s \geq 0, \sum_{t_u \in T_y} p(t_u)W_u \geq 0\right),\\
&d^*(m_x) = d_P,\ d^*(m_y) = d_C\\
&\qquad\qquad \textit{if}\ \left(T_x = \{t_3, t_4\}, T_y = \{t_1, t_2\}, p(t_3) < p(t_4), p(t_1) \leq p(t_2)\right),\\
&\mu(t_s|m_x) = \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)},\ \mu(t_s|m_y) = 0,\ t_s \in T_x = \{t_i, t_j\},\\
&\mu(t_u|m_y) = \frac{p(t_u)}{\sum_{t_r \in T_y} p(t_r)},\ \mu(t_u|m_x) = 0,\ t_u \in T_y = \{t_k, t_l\}.
\end{aligned}
\tag{C.4}
$$

There is no such equilibrium if

$$
\left(\sum_{t_s \in T_x} p(t_s)W_s < 0, \sum_{t_u \in T_y} p(t_u)W_u \geq 0, T_x \neq \{t_3, t_4\}\right).
$$

Proof of Lemma 3. Given $T_x = \{t_i, t_j\}$ and $T_y = \{t_k, t_l\}$, both feasible messages $m_j \in M$ are played on the equilibrium path, each message by exactly two types. The corresponding updated beliefs conditional on message m_x, resp. m_y, therefore have the form stated in (C.4). Consider S's decision conditional on observing message $m_x \in M$. Decision d_P implies $U^R = 0$, whereas d_C has an expected payoff of

$$
\sum_{t_s \in T_x} \mu(t_s|m_x) U^R(t_s, d_C) = \sum_{t_s \in T_x} \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)} W_s.
$$

Therefore, d_C is optimal if

$$
\sum_{t_s \in T_x} \frac{p(t_s)}{\sum_{t_r \in T_x} p(t_r)} W_s \geq 0 \iff \sum_{t_s \in T_x} p(t_s)W_s \geq 0.
$$

Summarising, the optimal decision is

$$d^*(m_x) = \begin{cases} d_P & \text{if } \sum_{t_s \in T_x} p(t_s) W_s < 0, \\ d_C & \text{if } \sum_{t_s \in T_x} p(t_s) W_s \geq 0. \end{cases} \tag{C.5}$$

By symmetry, the optimal decision conditional on observing message $m_y \neq m_x$ is

$$d^*(m_y) = \begin{cases} d_P & \text{if } \sum_{t_u \in T_y} p(t_u) W_u < 0, \\ d_C & \text{if } \sum_{t_u \in T_y} p(t_u) W_u \geq 0. \end{cases} \tag{C.6}$$

Combining (C.5) and (C.6), we have to distinguish four constellations of prior probabilities:

1. $\sum_{t_s \in T_x} p(t_s) W_s < 0$ and $\sum_{t_u \in T_y} p(t_u) W_u < 0$:
   (This constellation implies $\sum_{t_i \in T} p(t_i) W_i < 0$ and, therefore, $d^{\text{default}} = d_P$.)
   Here, $d^*(m_y) = d^*(m_x) = d_P = d^{\text{default}}$. We have an equilibrium because R ignores S's message and S, therefore, cannot profitably deviate.

2. $\sum_{t_s \in T_x} p(t_s) W_s \geq 0$ and $\sum_{t_u \in T_y} p(t_u) W_u \geq 0$:
   (This constellation implies $\sum_{t_i \in T} p(t_i) W_i \geq 0$ and, therefore, $d^{\text{default}} = d_C$.)
   Here, $d^*(m_y) = d^*(m_x) = d_C = d^{\text{default}}$. We have an equilibrium because R ignores S's message and S, therefore, cannot profitably deviate.

3. $\sum_{t_s \in T_x} p(t_s) W_s < 0$ and $\sum_{t_u \in T_y} p(t_u) W_u \geq 0$:
   Here, $d^*(m_x) = d_P$ and $d^*(m_y) = d_C$. Therefore, S is able to *choose* R's decision in its favor by sending the appropriate message. This implies that there is no equilibrium here unless R's decisions are equal to S's preferred decisions for every type. This is equivalent to requiring that $T_x = \{t_3, t_4\}$ (i.e., blocking of types 3 and 4) and $T_y = \{t_1, t_2\}$ (i.e., clearing of types 1 and 2), where, as before, m_x and m_y are arbitrary but different feasible messages. Given that $T_x = \{t_3, t_4\}$ and $T_y = \{t_1, t_2\}$, the condition ($\sum_{t_s \in T_x} p(t_s) W_s < 0$ and $\sum_{t_u \in T_y} p(t_u) W_u \geq 0$) simplifies to

   $$\begin{aligned} & p(t_3) W_3 + p(t_4) W_4 < 0 \text{ and } p(t_1) W_1 + p(t_2) W_2 \geq 0 \\ \iff & p(t_3) < p(t_4) \text{ and } p(t_1) \leq p(t_2). \end{aligned}$$

4. $\sum_{t_s \in T_x} p(t_s) W_s \geq 0$ and $\sum_{t_u \in T_y} p(t_u) W_u < 0$:
   As m_x and m_y are arbitrary (but different and feasible) messages, the analysis of this case is already covered in the analysis of case 3, above.

□

Proof of Proposition 1. By Lemma 3, the selfish equilibrium exists whenever (4.3) holds. By Lemmas 1–3 and C.2, all pure- and mixed-strategy equilibria except the selfish equilibrium implement the default decision. Therefore, it suffices to show that the selfish equilibrium is payoff-superior for both players to the corresponding default decision.

First, suppose d_P is the default decision. Then taking the default implies $U^R = 0$, whereas the selfish equilibrium implements d_P if the merger type is either type 3 or type 4, with $U^R = 0$. If, however, the merger is of type 1, we get $U^R = -1$ and for type 2 we get $U^R = 1$ where, by (4.3), the latter is more likely. In expectation the selfish equilibrium implements $E[U^R] = -p(t_1) + p(t_2) \geq 0$, which is better than the default $U^R = 0$.

Second, suppose d_C is the default decision. Taking the default implies $E[U^R] = -p(t_1) + p(t_2) + p(t_3) - p(t_4) \geq 0$. The equilibrium implements d_P for types 3 and 4, and it implements d_C for types 1 (with $U^R = -1$) and 2 (with $U^R = 1$) where, again, welfare is conditionally more likely to be positive. In expectation, the equilibrium implements $E[U^R] = -p(t_1) + p(t_2) > -p(t_1) + p(t_2) + p(t_3) - p(t_4)$, because $p(t_3) < p(t_4)$ by (4.3).

Combining these results, we conclude that the *selfish* equilibrium implements higher expected welfare than the default, regardless of what the default decision is.

The selfish equilibrium implements S's preferred decision for every actual merger type. Therefore, S's profit is maximised for every merger type. This implies that in expectation profit is larger than under the default decision which is made in order to maximise welfare, regardless of S's profit. □

Proof of Proposition 2. The proof proceeds by looking at all possible combinations of information and decisions. In each case we first analyze the selfish equilibrium (where the decision is based on prior as well as S's revealed information) and then compare with the default decision (which is based on prior information only).

We need to distinguish four cases: There are two possible sets of truthful information revealed by S in the selfish equilibria, i.e., the profit-increasing types $\{t_1, t_2\}$ and the profit-reducing types $\{t_3, t_4\}$. For each, the default decision can be either d_P or d_C. Denote the true merger type with t_i.

1. Suppose S reveals $t_i \in \{t_1, t_2\}$ and the default is $d^{\text{default}} = d_C$. The selfish equilibrium implements $d_C = d^{\text{default}}$. As the true type has been revealed to be either 1 or 2, the decision d_C is ex post correct if the type is 2, and wrong if it is type 1. The probability of the former is $p(t_2)/(p(t_1)+p(t_2))$, which is at least $1/2$ (and strictly larger if $p(t_2) > p(t_1)$), by (4.3). As the default decision is assumed to be $d^{\text{default}} = d_C$, we must have $p(t_2)+p(t_3) \geq p(t_1)+p(t_4)$, by (4.1). Based on that (prior) information, d^{default} is correct if the merger is type 2 or 3, which has a probability of $p(t_2) + p(t_3)/(p(t_1) + p(t_2) + p(t_3) + p(t_4) = p(t_2) + p(t_3) \geq 1/2$. By the above, the decision in the selfish equilibrium is more accurate if

$$\frac{p(t_2)}{p(t_1)+p(t_2)} \geq p(t_2) + p(t_3).$$

Multiply by $(p(t_1) + p(t_2))/p(t_2)$ and simplify to get

$$1 \geq p(t_1) + p(t_2) + p(t_3) + \frac{p(t_1)p(t_3)}{p(t_2)}. \tag{C.7}$$

As $p(t_1)+p(t_2)+p(t_3)+p(t_4) = 1$, (C.7) holds iff the last term on the right-hand side is not larger than $p(t_4)$,

$$\frac{p(t_1)p(t_3)}{p(t_2)} \leq p(t_4) \iff p(t_1)p(t_3) \leq p(t_2)p(t_4).$$

The latter is true by (4.3) (multiply the smaller and larger sides in the two conditions of (4.3), respectively).

2. Suppose S reveals $t_i \in \{t_3, t_4\}$ and the default is $d^{\text{default}} = d_P$. The selfish equilibrium implements $d_P = d^{\text{default}}$. As the true type has been revealed to be either 3 or 4, the decision d_P is ex post correct if the type is 4, and wrong if it is type 3. The probability of the former is $p(t_4)/(p(t_3) + p(t_4))$, which is larger than $1/2$, by (4.3). As the default decision is assumed to be $d^{\text{default}} = d_P$, we must have $p(t_2) + p(t_3) < p(t_1) + p(t_4)$, by (4.1). Based on that (prior) information, d^{default} is correct if the merger is type 1 or 4, which has a probability of $p(t_1) + p(t_4)/(p(t_1) + p(t_2) + p(t_3) + p(t_4) = p(t_1) + p(t_4) > 1/2$. By the above, the decision in the selfish equilibrium is more accurate if

$$\frac{p(t_4)}{p(t_3)+p(t_4)} \geq p(t_1) + p(t_4).$$

Multiply by $(p(t_3) + p(t_4))/p(t_4)$ and simplify to get

$$1 \geq p(t_1) + \frac{p(t_1)p(t_3)}{p(t_4)} + p(t_3) + p(t_4). \tag{C.8}$$

As $p(t_1)+p(t_2)+p(t_3)+p(t_4) = 1$, (C.8) holds iff the second term on the right-hand side is not larger than $p(t_2)$,

$$\frac{p(t_1)p(t_3)}{p(t_4)} \leq p(t_2) \iff p(t_1)p(t_3) \leq p(t_2)p(t_4).$$

The latter is true by (4.3) (multiply the smaller and larger sides in the two conditions of (4.3), respectively).

3. Suppose S reveals $t_i \in \{t_1, t_2\}$ and the default is $d^{\text{default}} = d_P$. The selfish equilibrium implements $d_C \neq d^{\text{default}}$. The accuracy of the equilibrium decision is $p(t_2)/(p(t_1) + p(t_2)) \geq 1/2$, whereas, based on the available information, d^{default} is correct only with probability $p(t_1)/(p(t_1) + p(t_2)) \leq 1/2$. Therefore, based on the information revealed in the selfish equilibrium, the default decision (based on priors only) is wrong.

4. Suppose S reveals $t_i \in \{t_3, t_4\}$ and the default is $d^{\text{default}} = d_C$. The selfish equilibrium implements $d_P \neq d^{\text{default}}$. The accuracy of the equilibrium decision is $p(t_4)/(p(t_3) + p(t_4)) > 1/2$, whereas, based on the available information, d^{default} is correct only with probability $p(t_3)/(p(t_3) + p(t_4)) < 1/2$. Therefore, based on the information revealed in the selfish equilibrium, the default decision (based on priors only) is wrong. □

C.2 Mixed-Strategy Equilibria of the Signaling Game

In this section, we formally identify all perfect Bayesian equilibria in mixed strategies of the signaling game between the competitor (S) and the authority (R). In order to simplify notation, we denote prior probabilities by

$$p_i := p(t_i).$$

As in the previous section, we denote two arbitrary but different messages with m_x and m_y.

As we consider mixed strategies now, we introduce additional notation. We denote S's strategies by

$$\tilde{p}_i = \Pr\{m_x | t_i\} \in [0,1],\ i \in \{1,2,3,4\}.$$

Therefore, $\tilde{p}_1$ is the probability that S sends the message m_x if the merger type is t_1. A complete strategy of S is therefore given by the vector

$$\tilde{p}_S := (\tilde{p}_1, \tilde{p}_2, \tilde{p}_3, \tilde{p}_4).$$

Similarly, denote

$$\tilde{p}_x = \Pr\{d_C | m_x\} \in [0,1],\ x \in \{A,B\}.$$

Therefore, $\tilde{p}_x$ is the probability that R *clears* the merger (d_C) after observing message m_x. A complete strategy of R is given by the vector

$$\tilde{p}_R := (\tilde{p}_A, \tilde{p}_B).$$

Moreover, we introduce an assumption that rules out special non-generic (non-general) configurations of the prior probabilities. In particular, this implies a unique default decision, d^{default}.

Assumption.

$$p_2 + p_3 \neq p_1 + p_4, \quad p_1 \neq p_2, \quad p_3 \neq p_4. \tag{C.9}$$

There are exactly two strategies of S where R's beliefs do not entirely follow from Bayes' rule. These are $\tilde{p}_S = (1,1,1,1)$, and $\tilde{p}_S = (0,0,0,0)$. Under these *pure* babbling strategies, S sends only one of the two messages. We now argue that in these cases R will never respond with a *mixed* strategy: As S's strategy does not reveal any information, R's best response is to decide based on priors. By (C.9), the default decision is unique, implying a pure strategy.

Therefore, it remains to analyse candidate strategies of S in which both messages are sent with strictly positive probabilities, implying that all of R's updated beliefs follow from Bayes's rule. These beliefs are given by

$$\begin{aligned}\mu(t_i|m_x) &= \frac{\tilde{p}_i p_i}{\sum_{j=1}^{4} \tilde{p}_j p_j} \in [0,1],\ i \in \{1,2,3,4\},\\ \mu(t_i|m_y) &= \frac{(1-\tilde{p}_i) p_i}{\sum_{j=1}^{4} (1-\tilde{p}_j) p_j} \in [0,1],\ i \in \{1,2,3,4\}.\end{aligned} \tag{C.10}$$

Note that the denominators in (C.10) are strictly positive as we rule out *babbling* strategies of S, and priors are assumed to be strictly positive.

Based on these updated beliefs, we now consider R's optimal decision. First, consider message m_x. Decision d_P implies $U^R = 0$, while decision d_C implies an expected payoff of

$$\sum_{i=1}^{4} \mu(t_i|m_x) U^R(t_i|d_C) = \sum_{i=1}^{4} \left(\frac{\tilde{p}_i p_i W_i}{\sum_{j=1}^{4} \tilde{p}_j p_j} \right).$$

Decision d_C is optimal whenever the above is nonnegative, i.e.,

$$\sum_{i=1}^{4} (\tilde{p}_i p_i W_i) \geq 0 \iff \tilde{p}_2 p_2 + \tilde{p}_3 p_3 \geq \tilde{p}_1 p_1 + \tilde{p}_4 p_4. \tag{C.11}$$

Second, consider message m_y. Decision d_P implies $U^R = 0$, while decision d_C implies an expected payoff of

$$\sum_{i=1}^{4} \mu(t_i|m_y) U^R(t_i|d_C) = \sum_{i=1}^{4} \left(\frac{(1-\tilde{p}_i) p_i W_i}{\sum_{j=1}^{4} (1-\tilde{p}_j) p_j} \right).$$

Decision d_C is optimal whenever the above is nonnegative, i.e.,

$$\sum_{i=1}^{4} ((1-\tilde{p}_i) p_i W_i) \geq 0 \iff \tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 \leq \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \tag{C.12}$$

Note that by (C.9), conditions (C.11) and (C.12) cannot simultaneously hold with equality.

Having characterised the conditions for R's best response, (C.11) and (C.12), we now partition R's candidate strategies as follows

(A) R plays a pure strategy with message-dependent decisions,
(i.e., $\tilde{p}_x, \tilde{p}_y \in \{0,1\}$, $\tilde{p}_x \neq \tilde{p}_y$).

(B) R plays a pure strategy with message-independent decision,
(i.e., $\tilde{p}_x, \tilde{p}_y \in \{0,1\}$, $\tilde{p}_x = \tilde{p}_y$).

(C) R plays mixed strategies following both messages,
(i.e., $\tilde{p}_x, \tilde{p}_y \in (0,1)$).

(D) R plays a mixed strategy following one message, and a pure strategy following the other message,
(i.e., $\tilde{p}_x \in (0,1)$, $\tilde{p}_y \in \{0,1\}$).

We now analyze **(A)** to **(D)** in detail.

(A) In any candidate equilibrium of this kind, R's optimal decision is d_C after message m_x and d_P after message m_y. The resulting S's payoff from sending message m_x, depending on merger type, is $\Pi_1 = \Pi_2 = 1$ and $\Pi_3 = \Pi_4 = -1$. The other message, m_y, implements d_P with payoffs equal to zero. Therefore, S's best response is unique and pure: $\tilde{p}_S = (1,1,0,0)$. Therefore, there is no mixed-strategy equilibrium here.

(B) In any candidate equilibrium of this kind, R's optimal decision is either d_C after any message, or always d_P. Recalling (C.11) and (C.12), we distinguish two cases, by the decision that is implemented. In case a), d_C is implemented after any message, and in case b), d_P is implemented after any message.

a)

$$\begin{aligned} &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 \geq \tilde{p}_1 p_1 + \tilde{p}_4 p_4, \text{ and} \\ &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 \leq \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \end{aligned} \tag{C.13}$$

Whenever S's strategy is such that these conditions hold, it is optimal for to R to implement d_C regardless of the message. This coincides with the default decision, as the above conditions imply $p_2 + p_3 > p_1 + p_4$ (recall that by (C.9), the two conditions of (C.13) cannot simultaneously hold with equality). As R's decision is message-independent, S's best response is any pure or mixed strategy. We have equilibria whenever these strategies satisfy (C.13). Therefore, we have a continuum of equilibria, where S plays a mixed strategy, while R implements the default decision d_C.

b)

$$\begin{aligned} &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 \leq \tilde{p}_1 p_1 + \tilde{p}_4 p_4, \text{ and} \\ &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 \geq \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \end{aligned} \tag{C.14}$$

The argument here is similar to case a), except that here d_P is implemented and the default decision is d_P as well, as (C.14) implies $p_2 + p_3 < p_1 + p_4$. Therefore, we have a continuum of equilibria, where S plays a mixed strategy, while R implements the default decision d_P.

(C) Here, R must be indifferent between both decisions for each message. By (C.11) and (C.12), this implies

$$\begin{aligned} &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 = \tilde{p}_1 p_1 + \tilde{p}_4 p_4, \text{ and} \\ &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 = \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \end{aligned}$$

This implies $p_2 + p_3 = p_1 + p_4$, which violates (C.9). Therefore, there is no equilibrium in which R plays a mixed strategy after both messages.

(D) We distinguish two cases. In case a), R implements d_C after m_x and plays a mixed strategy after m_y. In case b), R implements d_P after m_x and plays a mixed strategy after m_y.

a) Recalling (C.11) and (C.12), we require indifference after message m_y (i.e., equality in (C.12)) which, by (C.9), implies a strict inequality in (C.11):

$$\begin{aligned} &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 > \tilde{p}_1 p_1 + \tilde{p}_4 p_4, \text{ and} \\ &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 = \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \end{aligned} \tag{C.15}$$

As d_C is implemented after m_x, S's payoff from sending m_x is, depending on the merger type, $\Pi_1 = \Pi_2 = 1$ and $\Pi_3 = \Pi_4 = -1$. In contrast, sending message m_y results in mixed play by R, which gives S an expected payoff for merger type i of

$$\tilde{p}_y \Pi_i + (1 - \tilde{p}_y) \cdot 0 = \begin{cases} \tilde{p}_y & \text{if } i \in \{1, 2\}, \\ -\tilde{p}_y & \text{if } i \in \{3, 4\}. \end{cases}$$

By $\tilde{p}_y \in (0, 1)$, S's *unique* best response is to send message m_x for types 1 and 2, and send message m_y for types 3 and 4. Therefore, S's unique best response is the pure strategy $\tilde{p}_S = (1, 1, 0, 0)$. This, however, implies that the second line of (C.15) simplifies to $p_4 = p_3$, which violates (C.9). Therefore, there is no equilibrium here.

b) Recalling (C.11) and (C.12), we require indifference after message m_y (i.e., equality in (C.12)) which, by (C.9), implies a strict inequality in (C.11):

$$\begin{aligned} &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 < \tilde{p}_1 p_1 + \tilde{p}_4 p_4, \text{ and} \\ &\tilde{p}_2 p_2 + \tilde{p}_3 p_3 + p_1 + p_4 = \tilde{p}_1 p_1 + \tilde{p}_4 p_4 + p_2 + p_3. \end{aligned} \tag{C.16}$$

As d_P is implemented after m_x, S's payoff from sending m_x is zero. In contrast, sending message m_y results in mixed play by R, which gives S an expected payoff for merger type i of

$$\tilde{p}_y \Pi_i + (1 - \tilde{p}_y) \cdot 0 = \begin{cases} \tilde{p}_y & \text{if } i \in \{1, 2\}, \\ -\tilde{p}_y & \text{if } i \in \{3, 4\}. \end{cases}$$

By $\tilde{p}_y \in (0,1)$, S's *unique* best response is to send message m_y for types 1 and 2, and send message m_x for types 3 and 4. Therefore, S's unique best response is the pure strategy $\tilde{p}_S = (0,0,1,1)$. This, however, implies that the second line of (C.15) simplifies to $p_1 = p_2$, which violates (C.9). Therefore, there is no equilibrium here.

C.3 Data

Table C.1: Cases with Competitor Participation in Phase 2 EU

Type of Decision	Case no.	Year Notification	Rivals Heard
Art. 8(2) with conditions & obligations	M.42	1990	0
Art. 8(2) with conditions & obligations	M.43	1990	0
Art. 8(2) with conditions & obligations	M.126	1991	1
Art. 8(2) with conditions & obligations	M.12	1991	1
Art. 8(3)	M.53	1991	0
Art. 8(2)	M.68	1991	0
Art. 8(2)	M.222	1992	0
Art. 8(2) with conditions & obligations	M.214	1992	0
Art. 8(2) with conditions & obligations	M.190	1992	0
Art. 8(2) with conditions & obligations	M.291	1992	0
Art. 8(2)	M.358	1993	0
Art. 8(2)	M.315	1993	0
Art. 8(2) with conditions & obligations	M.308	1993	0
Art. 8(2) with conditions & obligations	M.468	1994	0
Art. 8(3)	M.469	1994	0
Art. 8(2)	M.269	1994	0
Art. 8(2)	M.477	1994	1
Art. 8(2)	M.484	1994	0
Art. 8(2) with conditions & obligations	M.430	1994	0
Art. 8(2) with conditions & obligations	M.582	1995	0
Art. 8(2) with conditions & obligations	M.623	1995	0
Art. 8(2) with conditions & obligations	M.553	1995	0
Art. 8(2) with conditions & obligations	M.580	1995	0
Art. 8(3)	M.490	1995	0

Table C.1 (continued)

Type of Decision	Case no.	Year Notification	Rivals Heard
Art. 8(2) with conditions & obligations	M.603	1995	0
Art. 8(3)	M.619	1995	0
Art. 8(2) with conditions & obligations	M.856	1996	0
Art. 8(3), Art. 8(4)	M.784	1996	0
Art. 8(2) with conditions & obligations	M.754	1996	0
Art. 8(2) with conditions & obligations	M.737	1996	0
Art. 8(3)	M.774	1996	0
Art. 8(2)	M.794	1996	1
Art. 8(2)	M.970	1997	0
Art. 8(3), Art. 8(4)	M.890	1997	1
Art. 8(2) with conditions & obligations	M.1069	1997	1
Art. 8(2)	M.1016	1997	1
Art. 8(2) with conditions & obligations	M.950	1997	1
Art. 8(2) with conditions & obligations	M.938	1997	1
Art. 8(3)	M.993	1997	0
Art. 8(2) with conditions & obligations	M.986	1997	0
Art. 8(2) with conditions & obligations	M.942	1997	0
Art. 8(2) with conditions & obligations	M.833	1997	0
Art. 8(2) with conditions & obligations	M.877	1997	0
Art. 8(2) with conditions & obligations	M.913	1997	0
Art. 8(3)	M.1027	1997	0
Art. 8(2) with conditions & obligations	M.1313	1998	1
Art. 8(2) with conditions & obligations	M.1221	1998	1
Art. 8(2) with conditions & obligations	M.1225	1998	1
Art. 8(2) with conditions & obligations	M.1157	1998	1
Art. 8(2) with conditions & obligations	M.1673	1999	1
Art. 8(2) with conditions & obligations	M.1636	1999	1
Art. 8(2) with conditions & obligations	M.1663	1999	0
Art. 8(2) with conditions & obligations	M.1601	1999	1
Art. 8(2) with conditions & obligations	M.1693	1999	1
Art. 8(2) with conditions & obligations	M.1630	1999	1
Art. 8(2) with conditions & obligations	M.1383	1999	1
Art. 8(2) with conditions & obligations	M.1641	1999	0
Art. 8(3)	M.1524	1999	1
Art. 8(2) with conditions & obligations	M.1532	1999	0

Table C.1 (continued)

Type of Decision	Case no.	Year Notification	Rivals Heard
Art. 8(2) with conditions & obligations	M.1628	1999	1
Art. 8(2) with conditions & obligations	M.1671	1999	1
Art. 8(2) with conditions & obligations	M.1578	1999	1
Art. 8(2) with conditions & obligations	M.1439	1999	1
Art. 8(3)	M.1672	1999	1
Art. 8(2) with conditions & obligations	M.1915	2000	0
Art. 8(2) with conditions & obligations	M.1845	2000	0
Art. 8(3)	M.1741	2000	1
Art. 8(2) with conditions & obligations	M.1813	2000	1
Art. 8(2)	M.1940	2000	1
Art. 8(2) with conditions & obligations	M.1853	2000	1
Art. 8(2) with conditions & obligations	M.2060	2000	1
Art. 8(2)	M.2499	2000	1
Art. 8(2) with conditions & obligations	M.2033	2000	1
Art. 8(2)	M.1879	2000	1
Art. 8(2)	M.2498	2000	1
Art. 8(2) with conditions & obligations	M.1806	2000	1
Art. 8(3)	M.2097	2000	0
Art. 8(2)	M.1882	2000	1
Art. 8(2) with conditions & obligations	M.2139	2000	1
Art. 8(4)	M.2416	2001	0
Art. 8(2)	M.2333	2001	1
Art. 8(2) with conditions & obligations	M.2533	2001	1
Art. 8(2) with conditions & obligations	M.2434	2001	0
Art. 8(2) with conditions & obligations	M.2530	2001	1
Art. 8(2) with conditions & obligations	M.2547	2001	1
Art. 8(2)	M.2621	2001	0
Art. 8(2)	M.2495	2001	0
Art. 8(3)	M.2220	2001	1
Art. 8(2) with conditions & obligations	M.2568	2001	1
Art. 8(4)	M.2283	2001	0
Art. 8(2) with conditions & obligations	M.2420	2001	0
Art. 8(2) with conditions & obligations	M.2389	2001	1
Art. 8(3)	M.2187	2001	1
Art. 8(2)	M.2314	2001	1

Table C.1 (continued)

Type of Decision	Case no.	Year Notification	Rivals Heard
Art. 8(2)	M.2201	2001	1
Art. 8(2) with conditions & obligations	M.2947	2002	1
Art. 8(2) with conditions & obligations	M.2903	2002	0
Art. 8(2)	M.2706	2002	1
Art. 8(2) with conditions & obligations	M.2876	2002	1
Art. 8(2) with conditions & obligations	M.2698	2002	1
Art. 8(2) with conditions & obligations	M.2650	2002	1
Art. 8(2) with conditions & obligations	M.2861	2002	1
Art. 8(2) with conditions & obligations	M.2822	2002	1
Art. 8(2)	M.3056	2003	0
Art. 8(2)	M.3216	2003	0
Art. 8(2) with conditions & obligations	M.2978	2003	0
Art. 8(2) with conditions & obligations	M.3083	2003	1
Art. 8(2) with conditions & obligations	M.2972	2003	0
Art. 8(2) with conditions & obligations	M.3099	2003	1
Art. 8(2) with conditions & obligations	M.3431	2004	1
Art. 8(2) with conditions & obligations	M.3436	2004	1
Art. 8(3)	M.3440	2004	1
Art. 8(2) with conditions & obligations	M.3916	2005	1
Art. 8(2) with conditions & obligations	M.3868	2005	1
Art. 8(2) with conditions & obligations	M.3796	2005	1
Art. 8(2) with conditions & obligations	M.3653	2005	1
Art. 8(2) with conditions & obligations	M.3687	2005	1
Art. 8(2) with conditions & obligations	M.3696	2005	1
Art. 8(2) with conditions & obligations	M.4187	2006	1
Art. 8(2) with conditions & obligations	M.4000	2006	1
Art. 8(2) with conditions & obligations	M.4404	2006	1
Art. 8(2) with conditions & obligations	M.4180	2006	1
Art. 8(3)	M.4439	2006	1
Art. 8(2) with conditions & obligations	M.4381	2006	1
Art. 8(2) with conditions & obligations	M.4525	2007	1
Art. 8(2) with conditions & obligations	M.4504	2007	1
Art. 8(2)	M.3333	2007	1
Art. 8(2) with conditions & obligations	M.4726	2007	1
Art. 8(2) with conditions & obligations	M.4513	2007	1

Table C.1 (continued)

Type of Decision	Case no.	Year Notification	Rivals Heard
Art. 8(2) with conditions & obligations	M.5153	2008	1
Art. 8(2) with conditions & obligations	M.4980	2008	1
Art. 8(2) with conditions & obligations	M.4919	2008	1
Art. 8(2) with conditions & obligations	M.5046	2008	1
Art. 8(2) with conditions & obligations	M.5335	2008	1
Art. 8(2) with conditions & obligations	M.5440	2009	1
Art. 8(3)	M.5830	2010	1
Art. 8(2) with conditions & obligations	M.5658	2010	1
Art. 8(2) with conditions & obligations	M.5675	2010	1
Art. 8(2) with conditions & obligations	M.6266	2011	1
Art. 8(2) with conditions & obligations	M.6203	2011	1
Art. 8(3)	M.6166	2011	1
Art. 8(2) with conditions & obligations	M.6286	2011	1
Art. 8(2) with conditions & obligations	M.6497	2012	1
Art. 8(2) with conditions & obligations	M.6576	2012	0
Art. 8(2) with conditions & obligations	M.6471	2012	0
Art. 8(2) with conditions & obligations	M.6690	2012	1
Art. 8(3)	M.6663	2012	1
Art. 8(2) with conditions & obligations	M.6410	2012	1
Art. 8(2) with conditions & obligations	M.6458	2012	1
Art. 8(3)	M.6570	2012	0

Table C.2: Competitor Participation as a Share of Phase 2 Cases EU (Figure 4.1)

Year Notification	Sum Participation	Sum Phase 2	Sum Participation/ Sum Phase 2
1990	0	2	0
1991	2	4	0.5
1992	0	4	0
1993	0	3	0
1994	1	6	0.167
1995	0	7	0
1996	1	6	0.167
1997	5	13	0.385
1998	4	4	1
1999	12	15	0.8
2000	12	15	0.8
2001	10	16	0.625
2002	7	8	0.875
2003	2	6	0.333
2004	3	3	1
2005	6	6	1
2006	6	6	1
2007	5	5	1
2008	5	5	1
2009	1	1	1
2010	3	3	1
2011	4	4	1
2012	5	8	0.625

Table C.3: Competitor Objections as a Share of Phase 2 Cases with Competitor Involvement EU (Figure 4.2)

Year Notification	Sum Participation	Sum Objections	Sum Objections/ Sum Participation
1997	5	1	0.2
1998	4	1	0.25
1999	12	3	0.25
2000	12	2	0.167
2001	10	1	0.1
2002	7	4	0.571
2003	2	1	0.5
2004	3	3	1
2005	6	6	1
2006	6	5	0.833
2007	5	5	1
2008	5	5	1
2009	1	1	1
2010	3	3	1
2011	4	3	0.75
2012	5	5	1

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Selbständigkeitserklärung

Hiermit erkläre ich, dass ich bei der Abfassung der Dissertation außer von den in der Danksagung genannten Personen keine weitere Hilfe von anderen Personen erhalten habe. Bei der Erstellung der Dissertation habe ich neben verschiedenen Textverarbeitungsprogrammen und bereits im Text zitierten Programmen die Software-Pakete STATA und Microsoft Excel verwendet. Darüber hinaus habe ich außer der angeführten Literatur und den in der Dissertation angegebenen Hilfsmitteln keine weiteren Hilfsmittel verwendet. Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Berlin, den 8.8.2014

Miyu Lee