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*Merger profitability and control – an analytical and empirical ex-post analysis on the increasing  
merger activity*

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# Introduction

Merger and acquisition activities experienced substantial growth up until 2007 (Grimpe, 2007), and have accelerated following the financial crisis again, leading to the strongest worldwide merger activity ever since in 2014 (McDermid, 2014). At the same time, competition authorities have advanced in implementing economics-based approaches for their merger assessments.

This dissertation investigates the effectiveness of both, merger and acquisition activities themselves in terms of merger profitability as well as merger control procedures as regards assessing merger proposals on an EU and US level, from an analytical as well as an empirical perspective.

On the one hand, the analytical horizontal merger literature has not been able to explain the upswing in merger activity as it proclaims that mergers are unprofitable in Cournot competition and mergers would largely have to be forbidden by competition authorities in industries competing à la Bertrand as consumer surplus decreases post-merger.

On the other hand, the empirical literature on merger assessments has not yet investigated the effectiveness of recent merger control procedure reforms, including the introduction of a more economics-based view in merger assessments in Europe. This economics-based view is aimed at providing a more *effective* approach within merger control regimes as well as a more *consistent* approach across merger control regimes.

This dissertation tries to contribute to explaining the gap between the analytical literature and empirical evidence. At the same time, the dissertation aims at investigating whether the 2004 merger reform in Europe has led to a more economics-based merger assessment process in practice and whether it thereby converges to the US merger control regime.

From an analytical perspective, I relax some restrictive assumptions applied in the horizontal merger literature in order to better align reality with the analytical literature: I incorporate uncertainty, risk aversion and information sharing mechanisms into the analytical merger models in order to assess the effects these mechanisms have on private merger profitability, the outsiders' profitability as well as consumers. Specifically, upon the merger decision, the

merging firms (“insiders”) do not have perfect information about their efficiency gains, which are induced by the merger. Consequently, uncertainty about their as well as the outsiders’ pricing or production decision enters into the model. The insiders can also decide to share any information they have on their efficiency gains with the competition authority and outsiders. Finally, while risk neutral behaviour has been assumed in the literature so far, the recent financial crisis (leading to liquidity constraints and costly financial distress), risk-averse manager behaviour, and non-diversified shareholder structures may suggest that firms’ pricing and production decisions may be affected by risk aversion, which I incorporate into the models.

From an empirical perspective, in 2004, the European Commission adopted new Merger Regulation as well as its first Merger Guidelines with the objectives to align merger review processes across the globe and to provide an effective one-stop merger review solution to an enlarged European Union of then 25 member states. I analyse the Phase II merger control decisions taken by the European Commission based on the merger assessment criteria set forth in the Merger Guidelines. The objective is to research whether the 2004 reform has led to a more consistent approach of using economics-based assessment criteria across merger assessments, whether these approaches are aligned and harmonized internationally and whether they have led to more effective merger control procedures.

# Horizontal Mergers, Information Sharing, Uncertainty, and Risk Aversion in Cournot competition

Claas Hendrik Fügemann\*

The traditional horizontal merger literature has asserted that merger incentives are highly limited under Cournot competition, thereby contradicting empirical evidence. In order to give possible explanations for the increase in merger activities in the last 20 years, I relax some restrictive assumptions applied in this literature by including uncertainty, risk aversion and information sharing mechanisms into the horizontal merger literature. I find that merger profitability increases with efficiency gains and with the level of risk and risk aversion; furthermore, in contrast to previous literature, insiders have incentives not to reveal private information about efficiency gains, when the outsiders are risk averse. From a regulatory point of view, consumer surplus is increasing with uncertainty and risk aversion.

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## 1. Introduction

Merger and acquisition activities experienced substantial growth until 2007. Grimpe (2007), for example, states that the worldwide transaction value in M&A deals amounted to 7.7bn € in the second and third quarter of 2007, an increase of 100 percent within two quarters. This empirical evidence of merger incentives could though not be explained by the early analytical models of the horizontal merger literature. These models assert that horizontal mergers are rarely profitable and may therefore underestimate the incentives to merge in light of the empirical merger efforts undertaken. In recent times, the analytical merger literature has made efforts to explain the growth of merger activities.

Firstly, one strand of literature has focused on the *cost structure* of the merged entity. The cost structure changes post-merger as the merged entity can produce more efficiently than previously. The resulting effects on the incentives to merge have been analyzed in the horizontal merger literature (e.g. Farrell & Shapiro, 1990). However, this change in the cost structure (i.e. the efficiency gains) might still be uncertain at the time of production and only the merged entity might be aware of the realized efficiency gains.

Secondly, a further strand of the merger literature has started to investigate the effects of *private information pooling among the insiders* on the incentives to merge (e.g. Zhou, 2008; Banal-Estañol, 2007). However, many obstacles about uncertain parameters possibly evolving from the merger itself still have to be analyzed in order to assess the incentives to *share private information between insiders and outsiders*, rather than to pool information among insiders.

Thirdly, the effect of risk aversion on the incentives to merge has only been investigated numerically thoroughly (Kao & Hughes, 1993), while recent research efforts focused on the effect of risk only on merger incentives

I relax some restrictive assumptions applied in the horizontal merger literature by including uncertainty, risk aversion and information sharing mechanisms in order to give possible explanations for the increase in merger activities. In particular, I assume a merger to take place in a Cournot oligopoly of risk-averse firms with differentiated products, where the merging firms are able to realize stochastic efficiency gains. The paper focuses on analysing the impact of uncertainty, risk aversion, and information sharing on the merger incentives as well as on consumer surplus.

I analyze the optimal decision rules for the insiders and find that absent risk aversion and under complete information, insiders reduce output post-merger as shown in the traditional literature; this effect however diminishes as efficiency gains increase, resulting in higher merger profitability. When insiders and outsiders are uncertain about the future efficiency gains, insiders increase output and profit as risk aversion increases, similar to findings by Banal-Estañol & Ottaviani (2006); this effect is even enhanced by a decrease in marginal costs and an increase in the industry size, contrary to findings by Salant, Switzer & Reynolds (1983), and is further

influenced by the substitutability of the products. Furthermore, unlike in the previous literature by e.g. Raith (1996), which asserts that it is always profitable for firms to share private cost information in Cournot competition, I find that insiders have the incentive not to share their full or noisy private information; this effect is increasing in the outsiders' level of risk aversion: As the outsiders' risk aversion increases, outsiders react less tough and insiders can expand output and increase private merger profitability at the outsiders' expense. Also, I find in this setting that merger incentives decrease when more firms merge ("merger scale") as insiders can then take advantage of fewer outsiders' accommodating behaviour. From a welfare point of view, consumer surplus is maximised, when aggregate output is maximised. Aggregate output, in turn, increases with uncertainty and risk aversion.

This paper consists of 5 sections. The following sub-sections review the relevant horizontal merger, risk aversion / uncertainty, and information sharing literature. Section 2 develops a oligopoly model, which is based on a horizontal merger scenario and takes information sharing and risk aversion mechanisms in a five step game into account. Section 3 then applies the model to a symmetric oligopoly setting, while section 4 comments on an asymmetric oligopoly setting. Section 5 derives the results for the impact of a horizontal merger under risk aversion and information sharing mechanisms for consumers. Section 6 summarizes the results for the outlined five-step game. Section 7 concludes the paper.

### **1.1. Horizontal Mergers**

In a horizontal merger setting, *unilateral effects* are the effects resulting from the internalization of competition between the merging firms by exerting market power when operating in the same market. *Coordinated effects*, by contrast, result from firms engaging in tacit collusion, as a result of which their behaviour may approximate that of a single dominant firm (e.g. Ivaldi, Jullien, Rey, Seabright & Tirole, 2003). The colluding firms may be able to maintain higher prices by tacitly agreeing that any deviation from the collusive path would trigger some retaliation. This paper focuses on an analysis of changes in the unilateral effects stemming from uncertainty, risk aversion and information sharing mechanisms in horizontal mergers.

First, post-merger the merged entity as well as the outsiders pursue their profit-maximising self-interest by alternating their output decision in Cournot competition, leading to the notion of "unilateral" effects. The merging firms decrease their output, thereby increasing price, because part of the sales which they would have lost pre-merger, now is taken up by the merging entity. Second, as well-known under Cournot competition (e.g. Dixit, 1986), the rivals or outsiders react on the output decrease of the merging firms by raising their output as customers might switch from the (merged) firm ("insiders") to the outsiders due to the higher prices set by the insiders. As a result, the merger profitability for the insiders depends on the extent and interdependence of these two effects, the possibility of the insiders to raise price and the outsiders'

(in-)ability to take advantage thereof.

Salant, Switzer & Reynolds (1983) have shown that merger profitability in Cournot markets crucially depends on the industry size, i.e. the number of firms in the market, and the number of insiders, i.e. firms which merge. They show that, first, the more firms there are in the industry pre-merger, the lower is the chance that the merger is privately profitable for the merging firms (i.e. incentives to merge exist for the insiders). Second, they show that merger profitability increases with the number of insiders. This is, fewer outsider firms can react tough (i.e. free-ride) on the price increase of the merging firms. As a conclusion of both effects, they find that 80% of the industry participants must merge for a merger to be privately profitable.

This result has long been challenged in the horizontal merger literature. Perry & Porter (1985) find that the 80% benchmark decreases to 50% if increasing rather than constant marginal costs are considered as the merged firm's cost function will change due to the merger: The capital endowment of the merged entity increases due to the merger and as marginal costs decrease with capital endowment, the marginal cost curve of the merged entity is less steep than in the pre-merger setting. As rivals' capital endowment does not change post-merger, their incentives to increase production are limited, since marginal costs increase with output.

A further point of interest has been the influence of the linearity assumption of the demand function on merger profitability. Cheung (1992), and partly Levin (1990), generalize the linear demand assumption of Salant, Switzer & Reynolds (1983) and show that for all demand functions satisfying  $2p'(x) + p''(x)X < 0$ , i.e. allowing for strictly convex demand by assuming that industry revenue is concave in industry output, horizontal mergers increase the market power of all firms, while not necessarily leading to a profitable state for the merged firm. In particular, the merged firm can exploit its market power profitably only if its market share exceeds 50%, thereby also lowering the 80% benchmark of Salant, Switzer & Reynolds (1983). Faulí-Oller (1997) also finds that merger profitability depends on the shape of the demand function, specifically the degree of the demand function's concavity. The greater the concavity of the demand function, the lower the merger profitability as the market share is higher the lower the degree of concavity.<sup>1</sup>

The effect of product differentiation on merger profitability has been examined by Leahy (2002), who finds that horizontal mergers are profitable if product differentiation is high enough. If the insiders increase their price post-merger, the customers' willingness to switch from the insiders to the outsiders is limited due to the existing product differentiation. Similar to the effect of increasing marginal costs, outsiders cannot take advantage of the insiders' output reduction.

Further points of interest in the literature have been market size and cost asymmetry. Cost asymmetry can have two forms: Either, cost asymmetry already prevails prior to the merger

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<sup>1</sup>Hennessy (2000) even shows that for certain demand functions horizontal mergers are privately profitable for the merging firms, independent of the industry size and the number of merging firms.

or cost asymmetry is imposed or enhanced by the merger through merger-specific efficiency gains.<sup>2</sup> Faulí-Oller (2002) shows that under the assumption of linear demand, mergers are only profitable, if the efficiency gains imposed by the merger are large enough: Following the merger, insiders do not decrease their output as much as they would have without efficiency gains, leading to a lower price increase, and outsiders cannot take advantage of the merging firm's output reduction decision by increasing output. This effect may incentivise merging firms to overstate their efficiency gains as shown by Sawaki (2015): Merging firms may not share their true expected efficiency gains with the outsiders in order for outsiders to increase their output less (or, even decrease their output). Furthermore, Faulí-Oller (2002) finds that if market size decreases, the market price decreases and the cost differential becomes relatively greater: Under Cournot competition, differences in firm size are explained by differences in price margins, e.g. induced by merger-specific efficiency gains. As the market size decreases, the equilibrium price decreases and the size differences increase for given costs. As laid out before, profitability increases as the cost differential increases and therefore, as the market size decreases.

Li (2012) assumes that firms have different cost structures prior to the merger, where an efficient firm competes against an inefficient firm in a duopoly, while products are differentiated. In this setup, the inefficient firm has incentives to merge as it can take advantage of the efficient firm's lower costs post-merger. Similarly to the effect of efficiency gains, the merged firm's costs are lower than the inefficient firm's costs prior to the merger. Post-merger, the inefficient firm does not reduce output as much as it would have, if it had merged with a firm of the same cost structure and outsiders' output increase is limited. Conversely, the efficient firm's incentives to merge with an inefficient are very limited due to the opposite effect. The author shows that the merger is profitable for the efficient firm if the cost differential is very low (i.e. the post-merger cost increase for the efficient firm is low) and the products are fairly homogeneous (i.e. the market for the merged entity's product is large given the lack of product differentiation).<sup>3</sup> Gelves (2014) extended this analysis to oligopoly competition and finds that mergers are more profitable with product differentiation as outsiders benefit less from any output reduction by the insiders: Customers are less willing to switch to the outsiders' products. Unlike Li (2012) and similarly to Faulí-Oller (2002), Gelves (2014) finds that the merger is profitable as the cost differential *increases*. This result stems from the extension to an oligopoly setting and the presence of outsiders and as in Faulí-Oller (2002)'s analysis for homogeneous products in oligopoly: In Li (2012)'s duopoly setting, the market is shared between the efficient and the inefficient firm,

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<sup>2</sup>Despite the different reasons for the cost asymmetry, the analysis for merger profitability is similar as the decisive factor is that the merging firms' post-merger cost structure differs from their pre-merger cost structure.

<sup>3</sup>The authors also show that welfare is reduced post merger, when the merger is profitable for both insider firms as total output is reduced and prices increase, while the consumer surplus reduction exceeds any increase in the firms' profits.

while the outsiders have lower incentives to compete tough post-merger and increase production given the cost differential in an oligopoly framework. Furthermore, product differentiation also reduces the merging firm's output reduction post-merger as customers are less willing to switch and hence, mergers become more profitable as both, product differentiation and cost asymmetry, increase. This result of reduced output reduction is also in contrast to Faulí-Oller (2002), who considered homogeneous products: Product differentiation induces the merging firms to keep producing both merging firms' products, thereby limiting post-merger output reduction. Furthermore, as products become more differentiated, the outsiders' free riding behaviour is mitigated and merger profitability is enhanced.

Irrespective of the actual market size, Dong, Guo, Qian & Wang (2016) find that fewer firms need to partake in the merger, if capacity constraints are imposed. In this case, outsiders cannot expand their output post-merger and thereby cannot take benefit of the insiders' output reduction, which in turn leads to a lower output reduction by the insiders.

Under Stackelberg competition, the free riding problem of the outsiders (i.e. output expansion by the outsiders upon the insiders' output contraction) may be mitigated, if the insiders generate efficiency gains: As the insiders first expand output due to high efficiency gains, outsiders expand less or even decrease production (Cunha & Vasconcelos, 2015). As for Cournot competition, sufficiently high efficiency gains may increase merger profitability as efficiency gains decrease the outsiders' incentives to expand output.<sup>4</sup>

From an empirical perspective, Dutordoir, Roosenboom & Vasconcelos (2014) analysed, whether merger profitability, defined as higher post-merger stock returns, increases with efficiency gains. Analysing 1719 mergers between 1995 and 2008 in the US, they confirm that stock returns were higher for mergers, for which efficiency gains were expected and communicated, and thereby lead to higher merger profitability. Any effects such information disclosure may have on any merger clearance decision are analysed in the subsequent parts of this paper from a theoretical perspective.

## **1.2. Uncertainty and Risk Aversion**

A standard assumption in oligopoly theory is that firms are risk-neutral. However, there are several reasons why firms may act as if they were risk-averse or actually are risk-averse. Firms may act as if they are risk-averse in cases of non-diversified owners (i.e. firms' payoff should take into account the level of risk aversion of the undiversified shareholders), liquidity constraints (i.e. firms may refrain from risky investments and may want to avoid liquidity squeezes when liquidity is scarce), costly financial distress (i.e. if financial turmoil is costly, firms may wish to avoid such turmoil by foregoing risky actions), non-linear tax systems (i.e. the higher the

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<sup>4</sup>Cunha & Vasconcelos (2015) also show that the merger paradox of benefiting from staying outside the merger is larger under Cournot competition than under Stackelberg competition.

tax rates, the greater is the amount of risk a firm is willing to take; see e.g. Domar & Musgrave, 1944; Feldstein, 1969; Waterson, 1985); furthermore, firms may act risk-averse due to the delegation of control to risk-averse managers or managers with an incentive structure linked to the profits of the organization: the degree of risk aversion amongst decision-makers, who maximise their lifetime incomes, is likely to be higher as they avoid risky behaviour and prefer steady income growth (Monsen & Downs, 1965). As a further reason for the assumption of risk aversion, the recent financial crisis has given plenty of evidence of potential differences in firms' degree of risk aversion, explicitly financial institutions.

Altering the assumption of risk-neutrality has several implications for product market competition. To analyse these implications, risk aversion has to be separated into its two single components, *risk* or *uncertainty*, expressed as  $\sigma$ , and the degree of *aversion*, expressed in the form of a risk aversion coefficient  $R$  (Diamond & Stiglitz, 1974). This implies, only once uncertainty in the form of a stochastic process has been introduced, the firm's attitude towards risk becomes important.

### **Risk / Uncertainty**

While uncertainty can persist with respect to numerous business decisions (e.g. R&D success, price uncertainty), two general cases of uncertainty, demand uncertainty and cost or efficiency gains uncertainty, are in the focus of this analysis. In the first case, demand uncertainty, (all) market participants are uncertain about the (common) demand intercept, while in the second case, cost uncertainty, the uncertainty is focused on the private cost or efficiency parameter of (each individual) firm. While the firms' best response strategy itself, i.e. good performance in low-profit-states, does not change irrespective of the prevailing type of uncertainty, the actions in order to *pursue* the best response strategy become more difficult to analyse when the underlying information structure and the rivals' best response to new information in an oligopoly framework are considered as shown in the next section.

Important to note is the interdependence of demand and cost uncertainty: If one firm is uncertain about its costs and, therefore about its output and profit, its rivals are uncertain about their residual demand as they are uncertain about the output of the cost-uncertain firm, which can be analysed analytically in quadratic preference models (Kühn & Vives, 1995).

The impact of the *degree of uncertainty* on the firms' utility has drawn special attention in previous literature. Rothschild & Stiglitz (1970, Theorem 2) illustrate that for mean-preserving increases in risk (i.e. the mean of the random variable is kept constant), the expected utility decreases (increases) if the utility function is strictly concave (convex), where concave utility functions are associated with the exposure to risk aversion. However, Rothschild and Stiglitz showed that this definition yields only a partial ordering over the set of cumulative distributions in two ways. First, only cumulative distributions of the same mean can be ordered. Second, not

all distributions with the same mean can be ordered, e.g. distributions with the same mean but different cumulative distribution functions. Thus, a necessary, but not sufficient condition for one distribution to be riskier than another is that their means are equal.

Diamond & Stiglitz (1974) obtain a stronger result by specifically modeling riskier distributions of the utility with mean utility preserving increases in risk. This implies, they extend Rothschild & Stiglitz (1970)'s definition of increasing risk considering a distribution  $G(x)$  as being at least as risky as another distribution  $F(x)$  if  $G(x)$  can be obtained from  $F(x)$  by a sequence of steps, each of which shifting weight from the center to its tails while keeping the expectation of the utility function constant. Put differently, if one increasing utility function is more concave (i.e. more risk averse) than another, then any change in the distribution of random income which constitutes a mean utility preserving increase in risk for the second utility function will lower the expectation of the first (Ito & Machina, 1983). As a response to greater (mean utility preserving) risk, firms adjust the control variable so as to make the utility function exhibit less risk aversion.

Applying these findings to demand uncertainty, both types of uncertainty increases, mean preserving and mean utility preserving, lead to output reductions of the competitive firm as illustrated by the respective authors and Sandmo (1971) for the case of mean preserving risk increases.

Hamada (2012) applied the analysis of mean preserving risk distributions to horizontal mergers. The merged firm's possibility to adjust its output once uncertainty e.g. about efficiency gains is resolved post-merger enables the firm to align its production with an optimal industry output level. The gain from this adjustment exceeds the loss incurred from the output reduction induced by the merger under Cournot competition. As a consequence, the existence of high mean-preserving risk itself may be sufficient for mergers to be profitable.<sup>5</sup> However, the outsiders may benefit more than the merging firms: The fewer outsiders remain post-merger (i.e. the larger the merger scale), the more the remaining outsiders benefit from free riding (Cunha, Sarmiento & Vasconcelos, 2014). Given the larger expected industry output, expected consumer surplus increases.

Pape & Zhao (2014) analyse mean preserving risk increases under Stackelberg competition in horizontal mergers. Similarly to Hamada (2012) for Cournot competition, they find that increases in uncertainty increase merger profitability: Mergers, which lead to the creation of a new leader for at least one of the merging firms, are always profitable due to the first-mover advantage under Stackelberg competition. Mergers, in which the merged firm keeps the position both firms had prior to the merger (follower or leader), are only profitable, if the uncertainty is high. Given that the Stackelberg first-mover advantage is not decisive for merger profitability

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<sup>5</sup>Analytically, the expected output of the firm increases as an output increase in case of high efficiency gains exceeds the output reduction in case of low or no efficiency gains as the profit function of the firm is convex with regards to costs. Expected output increases implies expected profit increases under Cournot.

when the market position of the merged firm does not change, the reasoning for the increase in merger profitability from increases in uncertainty follows Hamada (2012): The merging firms can optimally adjust their output once uncertainty is resolved and higher uncertainty leads to higher expected profits as under Cournot competition.

A further strand of research has focused on the dependence of the degree of risk aversion on wealth or initial capital endowment (Arrow, 1965; Pratt, 1964). Risk aversion can be independent (i.e. constant), increasing or decreasing in the level of wealth or capital endowment.<sup>6</sup>

### **Degree of risk aversion**

As noted above, while uncertainty is a necessary condition for effects on profit to materialize, the degree of risk aversion specifies the impact on firm profit. A pioneering analysis by Baron (1970) shows that in perfectly competitive markets increased price risk aversion lowers the quantity produced. In a monopoly framework, Baron (1971) and Leland (1972) derived similar results. If risk aversion is prevalent, prices are higher and output lower than if firms were indifferent to risk. The higher prices and lower outputs are caused by the risk premium which increases as firms become more risk-averse as discussed below. The key intuition behind the effects of risk aversion is that firms give relatively greater weight to realisations with low profits. The risk-averse firm acts as though its marginal costs are higher or the demand is lower than the expected values (e.g. Hirshleifer & Riley, 1992; Laffont, 1989) as outlined below.

These general findings are confirmed by Jin & Kobayashi (2016), who evaluate the magnitudes of risk aversion, when firms are uncertain about their rivals' costs, demand, as well as the degree of risk aversion. As any increase (decrease) in risk aversion can be modeled as an increase (decrease) in a firm's costs under Cournot competition, an increase (decrease) in a firm's risk aversion leads to a lower (higher) production and a decrease (increase) in profits. Higher risk aversion thereby reduces competition, leading to lower consumer surplus due to the resulting price increase as well as total welfare.<sup>7</sup>

Asplund (2002) has shown that in Cournot competition more risk-averse firms set lower quantities, irrespective of the type of uncertainty (i.e. cost uncertainty or demand uncertainty<sup>8</sup>). This follows from the firms' intuition to perform well, when uncertainty realization might decrease profits: Firms reduce output from the level that maximises profit in order to reduce the variance of its risk. The firm is willing to sacrifice an amount of expected profits, the *risk premium*, in

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<sup>6</sup>I focus on constant absolute risk aversion, which implies that the higher the curvature of the utility function, the higher the risk aversion, whereas relative risk aversion weights the measure of risk aversion by the level of wealth (Arrow, 1965; Pratt, 1964).

<sup>7</sup>This undesired consequence of higher risk aversion can be mitigated through a tax reduction: As higher risk aversion affects a firm similarly as higher costs, reducing costs through a tax reduction increases the competitive behaviour of firms facing risk aversion.

<sup>8</sup>Focusing on uncertain demand, Caraballo, Mármol, Monroy & Buitrago (2015) show that equilibria, which lead to the same price, exist for risk-averse firms competing in quantities.

order to eliminate the risk and obtain the expected profit with certainty.

Pratt (1964) showed that for all utility functions, assuming small risks, the risk premium can be modeled as half time the risk aversion coefficient times the variance of the risk involved, i.e.  $1/2R \cdot \sigma^2$ .<sup>9</sup>

Banal-Estañol & Ottaviani (2006) introduced the analysis of risk aversion in a horizontal merger setting. However, unlike my analysis, they focus on the best division of ownership (i.e. takeover versus equal division of ownership) in cases of risk-averse firm mergers. Related to my analysis, they find that risk aversion stipulates a higher probability for the insiders to increase production post-merger due to the higher risk bearing potential of the (larger) merged firm in contrast to the pre-merger set of (smaller) firms. This higher probability of a post-merger production increase leads to an increase in merger profitability.

From an empirical perspective, Bremer, Hoshi, Inoue & Suzuki (2017) compared the merger activities of risk-averse firms<sup>10</sup> to less risk-averse firms by analysing 4796 mergers between 2000 and 2009 from 17 countries. They find that the former engage less in merger activities. Also, risk-averse firms pay a higher control premium, thereby lowering their merger profitability. Frijns, Gilbert, Lehnert & Tourani-Rad (2013) come to similar findings on the merger activity, but additionally conclude that higher expected efficiency gains are necessary for mergers to take place in a risk-averse environment.

### 1.3. Information Sharing

The information sharing literature has focused on the question whether the sharing of private information is profit-enhancing for the revealing party (i.e. whether incentives to share private information about a random variable exist). Focusing on the revelation incentives in Cournot competition, the information sharing literature generally distinguishes between uncertainty about a common variable (i.e. uncertainty affecting all participants, e.g. demand) and a private variable (i.e. uncertainty affecting only one firm or each firm individually, e.g. cost). Furthermore, the literature distinguishes between the case, in which a signal about the realization of one firm's uncertainty (i.e. the random variable) does and the case, in which the signal does not infer information about other firms' realization of their random variable (Raith, 1996).<sup>11</sup>

In an industry of  $i, j \dots n$  competing firms, the sharing of information has three effects. First, from the standpoint of firm  $i$ , with information sharing the firm is better informed due to the new information it receives from its competitors,  $j \dots n$ , and can react optimally on the new

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<sup>9</sup>For a discussion on the risk aversion coefficient, please be referred to e.g. Pratt (1964).

<sup>10</sup>The authors distinguish between firms from nations with a high uncertainty avoidance index as defined by Hofstede, Hofstede & Minkov (2010) and firms from nations with a low uncertainty avoidance index.

<sup>11</sup>Raith (1996) reclassifies the notion of private variables in that he differentiates between models, in which the shocks are independent, i.e. information about one shock does not information about another shock, and models, in which the information revealer is perfectly informed about the uncertain parameter.

information. Second, the competitors react on the new information they receive from firm  $i$ . Third, the reaction of the competitors on the new information obtained from firm  $i$  might alter the best response of firm  $i$ . In an industry of  $i, j \dots n$  competing firms, the sharing of information has three effects. First, from the standpoint of firm  $i$ , with information sharing the firm is better informed due to the new information it receives from its competitors,  $j \dots n$ , and can react optimally on the new information. Second, the competitors react on the new information they receive from firm  $i$ . Third, the reaction of the competitors on the new information obtained from firm  $i$  might alter the best response of firm  $i$ .

It has long been debated which effect incentivises the firm to reveal its private information (e.g. Raith, 1996; Vives, 2002; Gal-Or, 1986, 1985). While the first effect is always positive (new information is always good), this channel is shut off when considering unilateral information revelation, i.e. only one firm reveals information to its competitors and does not obtain new information from its competitors. The effects of the second and third channel crucially depend on the type of uncertainty under consideration.

Amir, Jin & Troege (2010) generalised the information setup by assuming that information is firm-specific when extending Gal-Or (1986) and Raith (1996) to an asymmetric oligopoly. In their setup, the information / decision variables as well as the signals are uncorrelated, i.e. the information revealed by one firm informs the other firms only about the revealing firm's demand and cost structure. All information learned comes from the revealed information, rather than from any correlation of the signals or information (Raith, 1996). The other firms cannot infer any information about their own demand or cost structure from such revelation strategy. Amir, Jin & Troege (2010) find robust results for the cases described below.

### **Cost information**

In the case of uncertainty about a private variable, the correlation of decision strategies is reduced and firms have incentives to reveal their private information: If one firm observes e.g. a lower cost signal, it expands output, while the other firm, if informed, reduces output. The reverse holds true for the observation of a high cost signal. Gal-Or (1986) and Shapiro (1986) show that the firm's profit increase from the sharing of a low cost signal always exceeds the negative profit decreasing effect from the revelation of a high cost signal: According to Shapiro (1986), the probability that firms over- or underproduce due to missing information decreases the firms' expected profit. The firm receives lower unit profits when it produces more output (i.e. overproduction leads to lower prices) and higher unit profits when it produces less output (i.e. underproduction leads to higher prices).<sup>12</sup> As a conclusion, firms would reveal information they have about the realization of their private random variable as it provides each firm the

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<sup>12</sup>Given the higher exposure in high output states, the expected price per unit is reduced when output is variable. This variability of output is reduced upon information revelation as firms' mistakes are eliminated.

opportunity to adjust its production based on the true cost information and thereby eliminate allocative inefficiencies.

The dominance of the cost revelation strategy in order for each firm to adjust its production to the actual costs, which leads to the elimination of allocative inefficiencies, has been confirmed in later literature.

Amir, Jin & Troege (2010) confirm the finding that revealing private (firm-specific) cost information is a dominant strategy also in oligopoly, arguing that revealing high (low) costs leads competitors to increase (decrease) the quantity of substitutes and decrease (increase) the quantity of complements. The firm, which shares the information, anticipates the competitors' behaviour and produces less in the high cost state, and more in the low cost state. This ex ante increase in output variation (i.e. a low cost firm increases production, while competitors decrease production, and a high cost firm decreases production, while competitors increase production) also increases the expected profit of the firm revealing the private information.

Ganuzza & Jansen (2013) assume that the private cost information can be acquired. As before, firms prefer output variation as it increases expected profit in quantity competition. The output variation is largest, if both firms have perfect information and can adjust their quantity based on the actual true cost. Without any information, firms would produce an average output level, without any possibility to adjust output to the true costs. As adjusting output optimally increases the firms' profits as also shown by e.g. Shapiro (1996), an incentive exists to invest in obtaining cost information.

### **Demand information**

In the case of a common (demand) variable (see Gal-Or, 1985, for homogeneous products and Vives, 1984, for differentiated products), the correlation of decision strategies is increased upon information revelation. For Cournot competition, when demand is high and information is shared, all firms (i.e. the revealing firm and its competitors) increase their output. The benefit or loss from concealing information is derived by multiplying the additional output produced from revealing information with the market price. Since prices are higher when demand is high, the gain accrued from not revealing information more than compensates for the loss when demand is low, hence the firm would choose to conceal its private information (Gal-Or, 1985). However, this result is reversed, if the products are sufficiently differentiated (Raith, 1996).<sup>13</sup> Myatt & Wallace (2015) relate the difference in public vs. private information to differing correlations of the signals. Specifically, they assume that private signals are less correlated across firms than public signals and find that placing more weight on privately observed signals

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<sup>13</sup>With high product differentiation, the gain from specifying output according to the new information about the realization of demand outweighs the opportunistic decisions by competitors due to the higher production differentiation and thereby the less intense competition. This effect resembles the effect of increasing marginal costs discussed by Kirby (1988) for information sharing and by Perry & Porter (1985) in a merger setting.

related to common demand shocks would be more beneficial. Public (correlated) signals induce firms to align their output levels: All firms produce more in the case of a positive demand shock and less in the case of a negative demand shock, which is harmful under Cournot competition as shown by Gal-Or (1985). However, like Raith (1996), the authors find that as the importance of output correlation decreases with product differentiation, the correlation of signals is less relevant in the presence of product differentiation.

The preference of sharing information when demand is firm-specific (i.e. *private* demand shocks) is confirmed by Amir, Jin & Troege (2010), who argue that a positive demand shock has similar effects as a negative cost shock, and vice versa.

Cho & Jun (2013) generalise the information sharing incentives by abstracting from demand and cost shocks and purely focusing on the correlation of the information when competing in substitutes. They confirm the above findings that sharing information about private cost and demand shocks is beneficial when the information is not correlated, while the opposite is true for common demand information: If the information is correlated, concealing information is optimal as the competitive reaction of the rivals outweighs any positive effect from e.g. more accurate information.

The above literature has analysed whether it is preferable to share cost and/or demand information. Subsequent literature started to analyse the relationship between the value of cost and demand as well as private and public information and the sharing incentives.

Okura (2014) combined the analysis of sharing private cost and demand information.<sup>14</sup> As shown in the other models above, an increase in demand uncertainty increases the information's value, i.e. firms benefit from sharing the information (and the same holds true for cost uncertainty as shown above). However, as cost uncertainty increases, demand information becomes less valuable: In these cases, resolving demand uncertainty will only eliminate one of the two prevailing uncertainties (demand and cost), hence the value of demand information decreases. Likewise, if demand uncertainty is high and cost uncertainty is low, demand information is very valuable as it eliminates a significant share of the existing uncertainty in the industry.

Bernhardt & Taub (2015) prove in a duopoly setting that privately observed information about private values, i.e. information affecting one of the firms, is always more valuable than publicly observed information about a private variable as the informed firm can act as a monopolist on the received information. If both firms knew the private information (e.g. cost of one firm), the rival could free-ride on this information. By contrast, a common variable (e.g. demand) affects both firms and they maximise profit by jointly producing more or less dependent on the sign of the demand shock. Hence, the value of publicly observed information about common values exceeds the value of privately observed information.

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<sup>14</sup>Asplund (2002) analysed markets with cost and demand uncertainty, but did not analyse the relationship between these uncertainties

Several authors have already started to analyse the impact of information revelation in horizontal merger settings. However, these contributions only focus on the information *pooling between the merging firms* upon a merger (i.e. the insiders are informed about the partners' private costs, while outsiders are not). Put differently, no information sharing mechanism between insiders and outsiders and no change in the firms' or industry's information structure is modeled by these authors. Rather the information availability after the merger incentivises mergers, independent of the information structure in place.

For the case of uncertainty about private costs, incentives to merge are increased in most cases<sup>15</sup> upon information pooling as Banal-Estañol (2007) argues for increasing marginal costs and Zhou (2008) argues for constant marginal costs. Drawing on the effects of information sharing above, their main argument is that when merging firms have more information about each other (i.e. the other insiders) post-merger, they are able to rationalize their production. In the case of increasing marginal costs the incentives are even higher than for constant marginal cost due to the factors discussed above, i.e. the outsiders' lower possibilities of adverse reaction (Perry & Porter, 1985). Sinha (2013) relates the incentives to share private cost information to the size of the market as well as the cost difference in a duopoly framework. He finds that larger efficiency gains also incentivise firms to share private cost information: As efficiency gains increase, a revealing firm can limit the negative quantity adjustment effect of the merger partner as high efficiency gains lead to lower output decreases by the merging firm as shown in section 1.1.

For the case of demand uncertainty (Gal-Or, 1988), the merged firms estimate demand more accurately by pooling their private signals, making the merger more profitable, which is in line with the effect of being better informed in the information sharing literature. To avoid competition, however, the merging firms respond to market signals less aggressively (i.e. the merging firms reduce production upon the observation of a favourable signal in order to 'accommodate the remaining firms' that merge; e.g. Gal-Or, 1988). If the outsiders are able to anticipate the merged firm's actions, the outsiders are induced to be more aggressive, lowering the incentives to merge. Gal-Or shows that the net effect can go either way and may finally expose the merging firm to an informational disadvantage, giving rise to her conclusion that in Cournot competition uncertainty can only provide an additional incentive to merge, if such incentives already exist in the absence of the uncertainty.

It is important to note that my paper differs substantially from these contributions as their analyses focus on the effect of *information pooling* between the insiders, while my analysis focuses on *information sharing* between the insiders and the outsiders.

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<sup>15</sup>Zhou (2008, Proposition 4) finds that the incentives to merge are increased only if the cost uncertainty is large enough in a two-firm-merger and merger profitability largely depends on the number of merging firms,  $k$ . When  $k$  is very large, few firms are left outside to take advantage of the reduced competition, so the merger is profitable. When  $k$  is very small, although the merger is unprofitable due to the reaction of non-merged firms, the loss to the merged firms is small because only a few production facilities are shut down.

Cumbul (2014) investigated the effect of sharing private demand information in a duopoly framework and compared the merger clearance probabilities under Cournot and Stackelberg competition. As shown before (e.g. Gal-Or, 1985, Vives, 1984, Amir, Jin & Troege, 2010), sharing private demand information is profit-maximising. Pre-merger, the concentration under Cournot competition is lower than under Stackelberg competition in Cumbul (2014)'s duopoly setting. As the post-merger concentration is identical under Cournot and Stackelberg competition, the *change* in the industry concentration is larger under Cournot competition, which receives larger scrutiny by the competition authorities. Furthermore, if the pre-merger welfare is higher under Cournot competition, less efficiency gains are needed for merger clearance under Stackelberg competition.

## 2. The Model

In order to model and assess the effects of risk aversion, uncertainty, and information sharing on the incentives to merge, I analyse four different cases, each differing as regards their information structure, as outlined below.

In the first case (section 3.2.1 and section 4.2.1), neither the merging firms ("insiders") nor the non-merging firms ("outsiders") are informed ex ante about the efficiency gains induced by the merger. In the second case, only the merging firms are perfectly informed and they keep the information concealed, while in the third case, the merging firms share their private information about their efficiency gains with the outsiders (section 3.2.2 and section 4.2.2). In the fourth case (section 3.2.3), the merging firms ex ante only receive a noisy signal about their efficiency gains, which they can further dilute when informing the outsiders (e.g. Gal-Or, 1985, 1986).

In each of these cases, the merging firms as well as the non-merging firms engage in a five step game: In the first step, in an industry of  $n$  risk-averse firms producing differentiated products,  $k$  firms exogenously decide to merge; subsequently they form the insiders, which generate stochastic efficiency gains,  $\tilde{\delta}$ , due to the merger.  $n - k$  firms form the outsiders post-merger. In the second step, insiders decide and commit on their information revelation strategy, i.e. whether to conceal, reveal or partially reveal the private information they receive in a third step. In a fourth step, the insiders conceal or (partially) reveal the private information they received in the third step according to the information revelation strategy they determined in step two. At last, in step five, the firms compete under Cournot competition.

This game structure assumes that the insiders commit to an information revelation strategy prior to obtaining private information about their efficiency gains. This assumption is based on the fact that in reality merging firms also have to decide on their information revelation strategy by sharing information with the competition authority (even prior to the merger!), when they only have expectations about the efficiency gains and before knowing them precisely, in order to obtain a merger clearance. Also, this assumption is well-established in the information sharing

literature as well as in the horizontal merger literature (e.g. Gal-Or, 1985, 1986).

Firms maximise their utility, following their utility function  $U(\pi) = -e^{-R\pi}$ . According to this utility function, firms are exposed to constant absolute risk aversion (CARA). Constant absolute risk aversion assumes that a firm's degree of risk aversion is constant with regards to wealth or initial capital endowment.  $R$  is the risk aversion coefficient, defined as  $R = -\frac{U''}{U'}$ . According to Pratt (1964), the effect of risk aversion can be measured in the form of a risk premium, modeled as half time the risk aversion coefficient times the risk involved, i.e. the variance of the random profit function:  $\frac{1}{2} \cdot R \cdot \text{Var}(f(\pi[\phi]))$ , where  $\phi$  denotes the random variable under consideration, i.e. uncertain efficiency gains for the insiders and an uncertain demand shock for the outsiders. Intuitively, firms are willing to sacrifice an amount of expected profits in order to eliminate the risk and obtain the expected profit with certainty. The variance of the random profit function with respect to the random variable under consideration (i.e. demand shock for outsiders, efficiency gains for insiders) can be computed in each case using a Taylor expansion series ("Delta Method") leading to  $\frac{1}{2} \cdot R \cdot \text{Var}(\pi[\phi]) \approx \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \cdot \text{Var}[\phi]$ . As a result, the firms' expected utility becomes,

$$EU(\pi) = -e^{-R\left(E(\pi) - \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \text{Var}[\phi]\right)} \quad (1)$$

where,

$$EU(\pi) = U(E(\pi) - \Delta\pi)$$

and where  $\Delta\pi$  denotes the risk premium (e.g. Baron, 1970).

To maximise expected utility, firms maximise the bracket term in the exponent in (1).

$$\max f(\pi[\phi]) - \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \cdot \text{Var}[\phi] \quad (2)$$

The firm's profit function,  $f(\pi)$ , can be derived from the consumer utility function,  $U(x)$ , and the implied inverse demand function,  $p(x)$ . Consumers follow a usual linear-quadratic utility function (e.g. Vives, 1985; Friedman, 1977),

$$U(x) = a \sum_{i=0}^n x_i - \frac{1}{2} \left( b \sum_i x_i^2 + 2d \sum_{j \neq i} x_i x_j \right) \quad (3)$$

where  $b, d > 0, b > d, b + (n - 1)d > 0$  to ensure that  $U(x)$  is strictly concave (Vives, 2001). This leads to the inverse demand function,

$$p(x) = a - bx_i - dX_{-i} \quad (4)$$

As a result, and assuming constant marginal costs  $c$ <sup>16</sup>, the firms' pre-merger profit function becomes,

$$\pi = (a - bx_i - dX_{-i}) \cdot x - c \cdot x^{17} \quad (5)$$

Post-merger, the insiders generate (random) efficiency gains  $\tilde{\delta}$ , which directly affect marginal costs,  $(1 - \tilde{\delta})c_t$ , where  $c_t$  denotes the insiders' level of marginal costs. Importantly, the uncertainty about the efficiency gains to be achieved by the merging firms and induced by the horizontal merger translates into a residual demand uncertainty for the outsiders, i.e. the outsiders are unaware of the production output of the insiders and accordingly about the residual demand they can claim. Accordingly, the outsiders are exposed to an endogenous random demand shock,  $\theta_i$ . For each type of stochastic shock, efficiency gains and demand, the distributional properties coincide as  $Var = \sigma^2$  and  $Cov(\phi_i, \phi_j) = \rho\sigma^2$  for  $i \neq j$ <sup>18</sup>. The shocks are positively, independently or negatively correlated depending on whether  $\rho \gtrless 0$  (e.g. Raith, 1996). Accordingly, the insiders' and outsiders' expected profit functions become post-merger,

$$E(\pi_t) = \sum_{t=1}^k \left( a - bx_t - bX_{-t} - (1 - \tilde{\delta})c_t \right) x_t \quad (6)$$

$$E(\pi_i) = \sum_{i=1}^{n-k} \left( a - \theta_i - bx_i - bX_{-i} - c_i \right) x_i \quad (7)$$

Each firm's reaction function given by differentiating (5) with respect to quantity pre-merger,

<sup>16</sup>The effects of marginal cost,  $c$ , and efficiency gains,  $\delta$ , are analysed separately in the further analysis. Accordingly, symmetric marginal costs do not infer any information about efficiency gains achieved by the insiders, but only about the level of marginal costs, excluding efficiency gains.

<sup>17</sup>In section 3, a symmetric oligopoly setting is considered, while section 4 assumes an asymmetric oligopoly structure, where firms' marginal cost levels differ.

<sup>18</sup>These distributional properties are assumed in section 3.2.1 and 3.2.2 and alternated for the use of partial information sharing structures analysed in section 3.2.3 and Appendix C to take account of the insiders' influence on the signal shared with the outsiders.

and (6) and (7) post-merger, slopes downward. While the effect of the uncertain insiders' efficiency gains on the outsiders is modeled as an endogenous demand shock  $\theta_i$  in (7), the outsiders' profit function is affected by the change in the insiders output,  $x_i$ , post-merger. As shown by Dixit (1986), each firm's marginal revenue is lowered by an increase in rivals' output.

$$p'(X) + x_i p''(X) < 0 \tag{8}$$

Furthermore, a weak stability condition is imposed as each firm's residual demand curve intersects its marginal cost curve from above.

As discussed above, differing underlying information structures are assumed to analyse the effects of uncertainty and risk aversion. Depending on the information the participants possess, the random term drops out in the respective profit function. Likewise, the risk premium drops out, because  $\sigma^2$ , the risk variance, becomes zero.

In the following sections, the insiders' merger incentives are analysed in detail, while different information structures are imposed. At first, the pre-merger case will be evaluated in section 3.1. This case serves as a benchmark against all merger cases analysed in the following sections. In section 3.2.1, both insiders and outsiders are unaware of the insiders' efficiency gains generated in the course of the merger. In section 3.2.2, the insiders know their efficiency gains and have to decide whether to fully share this information. At last, in section 3.2.3, the insiders can dilute the information they communicate to the outsiders. Section 4 analyses the case of an asymmetric oligopoly assuming different marginal cost levels among the firms.

### 3. Model analysis: Symmetric Oligopoly

In order to evaluate private merger incentives, the insiders' utility prior and post-merger has to be compared. The post-merger utility depends on the information structure in place, i.e. whether the insiders and / or the outsiders are informed about the insiders' efficiency gains, the size of the efficiency gains, as well as the levels of risk aversion the firms are exposed to. This section assumes that all firms have the same level of marginal costs, while section 4 relaxes this assumption.

#### 3.1. Pre-merger equilibria

Prior to the merger, neither the insiders nor the outsiders are exposed to stochastic efficiency gains or (residual) demand. To maximise (1), consequently, the general maximisation problem in (2) simplifies to a maximisation of the deterministic profit function (5) for all firms since no uncertainty, and thereby no stochastic variable, gives rise to a risk premium. Assuming a

symmetric level of marginal costs, i.e.  $c_t = c_i = c$ , the equilibrium output and profit become,

$$x = \frac{a - c}{2b + d(n - 1)} \quad (9)$$

$$\pi = b \left( \frac{a - c}{2b + d(n - 1)} \right)^2 \quad (10)$$

As no firm is exposed to uncertainty, risk aversion has no effect on the firms' utility maximisation problem in (2) and the maximisation of the firms' profit equally solves the firm's expected utility maximisation problem based on (1): Neither insiders nor outsiders include a risk premium in the maximisation of their expected utility.

To evaluate private merger profitability, the merging firms' utility post-merger, which is analysed for different information structures in the following sections, has to be compared to their pre-merger utility given by (10).

### 3.2. Insiders' merger incentives and merger profitability

In this section, it will be shown that the insiders' merger incentives, among others, crucially depend on two effects, the outsiders' "risk-averse behaviour effect" and the "efficiency gains effect". The first effect explains the outsiders' reaction to their exposure to uncertainty and risk-aversion. The second effect captures the extent of efficiency gains realized by the insiders upon the merger. While the efficiency gains effect has already been taken into account in merger assessments by competition authorities (the so-called "efficiency defence"), the parties' risk behaviour has not yet been included in merger assessments as an assessment criterion.

#### 3.2.1. Insiders and Outsiders are uncertain about the insiders' efficiency gains

In the case, where insiders and outsiders are unaware of the insiders' efficiency gains<sup>19</sup> and, accordingly, of the outsiders' residual demand, both parties compete under uncertainty.

Given this underlying information structure, insiders and outsiders maximise (2), i.e.  $E(\pi) - \frac{R}{2}Var(\pi)$ , in order to maximise their expected utility function (1),

$$\max \sum_{t=1}^k \left( a - bx_t - bX_{-t} - (1 - \delta)c_t \right) x_t - \frac{R}{2} \sigma^2 \left( \left( \sum_{t=1}^k x_t c_t \right)^2 + \rho \sum_{i,j \neq j} x_i c_i x_j c_j \right) \quad (11)$$

<sup>19</sup>Insiders have either not received a signal about the realization of their efficiency gains or the signal did not convey any information. As outlined in section 3.2.3, this would be the case when  $e_t = \infty$ .

$$\max \sum_{i=1}^{n-k} \left( a - bx_i - bX_{-i} - c_i \right) x_i - \frac{R}{2} \sigma^2 x_i^2 \quad (12)$$

The maximisation problem (2) yields for insiders and outsiders, respectively,

$$(b + d(k-1) + \frac{R}{2} \sigma^2 c_i^2 (1 + (k-1)\rho)) x_i^2 \quad (13)$$

$$(b + \frac{R}{2} \sigma^2) x_i^2 \quad (14)$$

From (13) it follows that the insiders' expected utility (1) increases with production output. This implies that merger incentives increase with the merging firms' output. As a consequence, insiders maximise their output in order to maximise their utility. Therefore, to investigate merger profitability when neither insiders nor outsiders are aware of the insiders' efficiency gains, insiders' output pre- and post-merger has to be compared.

As shown in Appendix A, the insiders' post-merger equilibrium output yields,

$$x_t = \frac{a(2b - d + R\sigma^2) - (1 - \delta)c_t(2b + d(n - k - 1) + R\sigma^2) + d(n - k)c_i}{(2b + d(n - k - 1) + R\sigma^2)(2b + 2d(k - 1) + R\sigma^2 c_i^2 (1 + (k - 1)\rho)) - d^2 k(n - k)} \quad (15)$$

Assuming a symmetric level of marginal costs, i.e.  $c_t = c_i = c$ , (15) becomes,

$$x_t = \frac{(a - (1 - \delta)c)(2b + d(n - k - 1) + R\sigma^2) - d(n - k)(a - c)}{(2b + d(n - k - 1) + R\sigma^2)(2b + 2d(k - 1) + R\sigma^2 c^2 (1 + (k - 1)\rho)) - d^2(n - k)k} \quad (15a)$$

Comparing the insiders' post-merger equilibrium output with the outsiders pre-merger equilibrium output (9), insiders reduce output post-merger, if they are not risk-averse as shown in Appendix A. This result confirms the findings of the existing traditional horizontal merger literature (e.g. Salant, Switzer & Reynolds, 1983). The insiders' output reduction, however, diminishes as efficiency gains increase, resulting in higher private merger profitability (see Faulí-Oller, 2002). This is the so-called "efficiency gains effect". As a consequence, insiders are incentivised to overstate their efficiency gains as found by Sawaki (2015).

When insiders and outsiders are uncertain about the future efficiency gains, i.e.  $\sigma^2 > 0$ , and are risk averse, insiders increase output and profit as risk aversion increases, similar to findings by Banal-Estañol & Ottaviani (2006); this effect is even enhanced by a decrease in marginal costs

and, in contrast to the findings by Salant, Switzer & Reynolds (1983), by an increase in the industry size: Compared to the risk-neutral case, outsiders react less opportunistically than in the pre-merger setting due to their risk aversion ("risk-averse behaviour effect"). This implies that the outsiders do not take advantage of the price increase by the merging firms, if insiders were to reduce output as in the case of Salant, Switzer & Reynolds (1983). If insiders increase output and as the industry size grows, the merging firms can expand output even further. At the same time, more outsiders accelerate their output contraction compared to their production strategy under risk neutrality. A further factor, which determines insiders' merger profitability, is the substitutability of the products. The merger profitability for homogeneous products is higher than for differentiated products, if risk aversion is high, demand is high, and the marginal cost level is low, i.e.  $d((2b + d(n - k - 1) + R\sigma^2)((a - c)(k - 1) - \delta c(n - 1)) - (a - c)) > 0$ . This implies, an increase in the insiders' output is most profitable if products are homogeneous as outsiders need to decrease output due to risk aversion as shown above.

Furthermore, as risk aversion increases, the insiders' expected utility increases as seen in (13) as long as the shocks are not too negatively correlated, which can be excluded given that the shocks stem from the same source, i.e. the insiders' efficiency gains.

### 3.2.2. Perfectly informed insiders

This section explores whether the merger incentives of perfectly informed insiders increase when they conceal or reveal the perfect private information which they receive about the realization of their stochastic efficiency gains. Explicitly, it is assumed that insiders receive a perfect signal about the realization of their efficiency gains after the merger. Subsequently, the merging firms conceal or reveal their private information prior to their and the outsiders' production decision.

The information revelation decision directly infers the uncertainty structure: If insiders do not share their private information, asymmetric uncertainty persists (i.e. insiders are informed, while outsiders are not informed as in section 3.2.1). If the insiders reveal their information, insiders and outsiders are not exposed to uncertainty and compete in a deterministic setting.

As before, insiders and outsiders maximise (2), i.e.  $E(\pi) - \frac{R}{2}Var(\pi)$ , in order to maximise their expected utility function (1). Insiders are perfectly informed about their efficiency gains and therefore maximise their expected profit without being exposed to a risk premium.

$$\max \sum_{t=1}^k \left( a - bx_t - bX_{-t} - (1 - \delta)c_t \right) x_t \quad (16)$$

If outsiders are not informed about the realization of the insiders' efficiency gains, their maximisation problem is identical to (12). Otherwise, their maximisation becomes,

$$\max \sum_{i=1}^{n-k} \left( a - bx_i - bX_{-i} - c_i \right) x_i \quad (17)$$

In the course of the analysis of this scenario, it will be shown that both the outsiders' "risk-averse behaviour effect" and the "efficiency gains effect" enhance the insiders' expected utility. The first effect stems from the outsiders' uncertainty and risk-aversion, while the second effect captures the extent of efficiency gains realized by the insiders upon the merger. As shown in Appendix 2.1, the insiders' equilibrium profit solves to  $\pi_t = (b + d(k - 1))x_t^2$ , which in the insiders' deterministic setting maximises their expected utility according to (16) and (2), when  $\Delta\pi = 0$ . As shown in Appendix 2.1, the insiders' equilibrium output yields,

$$x_t = \frac{a(2b - d + R\sigma^2) - (1 - \delta)c_t(2b + d(n - k - 1) + R\sigma^2) + d(n - k)c_i}{(2b + d(n - k - 1) + R\sigma^2)(2b + 2d(k - 1)) - d^2k(n - k)} \quad (18)$$

if outsiders are not informed about the insiders' efficiency gains and as shown in Appendix 2.2

$$x_t = \frac{a(2b - d) - (1 - \delta)c_t(2b + d(n - k - 1)) + d(n - k)c_i}{(2b + d(n - k - 1))(2b + 2d(k - 1)) - d^2k(n - k)} \quad (19)$$

if outsiders are informed.

As expected utility increases with production output (and thereby merger profitability and merger incentives) as shown in Appendix 2.3, comparing (18) and (19) sheds light on whether insiders should conceal or reveal their private information in order to maximise merger profitability and merger incentives.

As shown in Appendix 2.3 under the assumption of a symmetric level of marginal costs, the merging firms should largely conceal their private information. This optimal concealment strategy is in sharp contrast to the optimal information sharing strategy found by Gal-Or (1986) and Shapiro (1986). These authors argued that insiders have incentives to share private information if uncertainties exist about private values (e.g. costs) and increases in efficiency gains further incentivises the insiders to share such information (Sinha, 2013). My finding is triggered by and increasing in the degree of risk aversion,  $R$ , the level of uncertainty,  $\sigma^2$ , as also shown by Hamada (2012) as well as product differentiation,  $d$ . Similar to the reasoning, when insiders and outsiders are exposed to uncertainty (see section 3.2.1), outsiders produce less (i.e. act as if demand is lower) due to their risk-aversion ("risk-averse behaviour effect"). While under the setting of symmetric uncertainty in section 3.2.1 both, insiders and outsiders, were exposed to risk aversion, here insiders are not and have an influence on the outsiders' exposure to risk aversion through their information sharing strategy. Given the nature of strategic substitutes,

the outsiders' lower output (compared to the risk-neutral case) due their risk-averse behaviour enhances merger incentives: Insiders can take further advantage of the "risk-averse behaviour effect" of the outsiders by increasing output as shown in 3.2.1, leading to the optimal information sharing strategy of concealing private information.

In order to finally decide on whether the merger itself is (privately) profitable, the equilibrium output pre-merger and under the asymmetric information structure has to be compared as insiders have incentives to conceal their private information about the realization of their efficiency gains as shown above. As shown in Appendix 2.3, the merging firms' output (and, thereby their expected utility) is higher, if the merger takes place, and increases with the efficiency gains,  $\delta$ , since the merging firms increase output as costs decrease ("efficiency gains effect"), as well as the level of uncertainty and risk aversion (outsiders' "risk-averse behaviour effect"). However, as the merger scale, i.e. the number of insiders, increases, merger incentives decrease, since the insiders can take less advantage of the outsiders' "risk-averse behaviour effect". This is also in sharp contrast to the findings by Salant, Switzer & Reynolds (1983) and the traditional horizontal merger literature, who find that merger incentives increase with the number of insiders. The effect found in this paper is specifically caused by the insiders' lower possibilities to take advantage of the outsiders' "risk-averse behaviour effect" because as the merger scale increases, less outsiders remain in the industry.

### 3.2.3. Partially informed insiders

#### **Partial Information Sharing structure**

In this case, insiders receive a noisy signal about their efficiency gains before they make their production decision and reveal this signal partially, fully or not at all according to their optimal information revelation strategy. The following analysis follows Gal-Or (1985, 1986) in the derivation of partial information signals and sheds light on whether insiders should dilute the information they have when communicating with the outsiders (or a competition authority) and what the optimal level of dilution is.

It is assumed that  $\tilde{\delta}$  is a random variable that is normally distributed with mean  $\delta^{20}$  and variance  $\eta$ . Before choosing its output strategy, the merging firms observe a signal for their efficiency gains as follows:

$$z_t = \tilde{\delta} + e_t \tag{20}$$

where  $e_t \sim N(0, m)$  and where  $e_t$  and  $\tilde{\delta}$  are independently distributed.

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<sup>20</sup>Without loss of generality, the mean of  $\delta$  could also be normalized to zero.

When revealing information to the outsiders, the insiders themselves convey a noisy signal in the form of:

$$\hat{z}_t = z_t + f_t \tag{21}$$

where  $f_t \sim N(0, s_t)$ .

Prior to receiving their own signal, though, the insiders choose an information revelation strategy in accordance with the five stage game. In this case, they choose the amount of noise,  $s_t$ , to which any report they make e.g. to competition authorities is subject<sup>21</sup>. If  $s_t = 0$ , insiders perfectly reveal their private information, if  $s_t = \infty$  insiders generate infinite noise in their signal so that the informational content is worthless. If  $0 < s_t < \infty$ , insiders partially reveal their private information.

As discussed previously, the insiders' efficiency gain uncertainty translates into a (residual) demand uncertainty for the outsiders. Accordingly, the insiders' signal conveys information about the realization of the outsiders' residual demand illustrated in (7). The outsiders' uncertainty might differ among the outsiders, depending on the individual signal they receive. However, given that the uncertainty stems from the same source, i.e. the insiders' efficiency gains, it is assumed that this information about the realization of the insiders' efficiency gains received by one outsider may be positively correlated with the information received by another outsider. The parameter  $h$  determines this correlation. When  $h = 0$ , private signals are completely uncorrelated.<sup>22</sup> When  $h = \eta$ , the coefficient of correlation between the demand shocks observed by the outsiders is one.<sup>23</sup>

After insiders report their signal to the competition authority, the competition authority makes the information available to the outsiders. The reported information is subsequently used by each firm to select its output strategy. This information set for the insiders is denoted by  $t_t = (z_t, \hat{z}_t, s_t)$  and for the outsiders  $t_i = (\hat{z}_t, s_t)$ . Hence, each firm, insiders and outsiders, can condition its output strategy on its information set.

### **Determination of Insiders' Partial Information revelation strategy**

Following Gal-Or (1985, 1986), I consider only sub-game perfect equilibria. Hence it has to be guaranteed that the strategy choice made by each firm initially remains optimal at the time of its production decision. This problem can be solved through backward induction, starting with

<sup>21</sup>The assumption is that the insiders have to inform the competition authorities on achievable efficiency gains in order to receive merger clearance: Efficiency gains increase social welfare (Farrell & Shapiro, 1990) and thereby increase the probability of merger clearance.

<sup>22</sup>This condition coincides with Raith (1996)'s notion of independent values.

<sup>23</sup>Since the source of the uncertainty is the same for all demand shocks, i.e. the insiders' signal about the realization of its efficiency gains, this case is of particular interest.

the optimal production decision for a given level of garbling  $s_t$ .

Since both, insiders and outsiders, are still exposed to uncertainty at the time of setting their production strategy, insiders and outsiders follow (2), where the output strategy though depends on the private information set,  $t_t$  and  $t_i$ .

*Proposition:* For given  $s_t$ , the following equilibrium outputs are the unique Nash equilibrium under Cournot competition of the maximisation sub-game,

$$x_t = C_0 + C_1 z_t + C_2 \hat{z}_i$$

and

$$x_i = B_0 + B_1 \hat{z}_i$$

*Proof:* Provided in Appendix C

As shown in Appendix C, the equilibrium output of the merging firms becomes

$$\begin{aligned} C_0 &= \frac{a(2b - d + R\sigma^2) + d(n - k)c_i}{y_1 y_2 - d^2(n - k)k} \\ C_1 &= -\frac{d(n - k)((\eta + m)dkmc_t)}{y_1((\eta + m + (k - 1)h)(\eta + m + s_t)(y_1 y_2 - d^2(n - k)k))} \\ C_2 &= -\frac{m}{(\eta + m + (k - 1)h)y_1} c_t \end{aligned} \quad (22)$$

where,

$$y_1 = 2b + 2d(k - 1) + R\sigma^2 c_t^2 (1 - (k - 1)\rho)$$

$$y_2 = 2b + d(n - k - 1) + R\sigma^2$$

Since the insiders are still exposed to uncertainty as they may not receive a perfect signal for the realization of their efficiency gains, the maximisation problem is identical to the maximisation problem in section 3.2.1, (11). According to (13), insiders maximise output in order to maximise expected utility, which yields the equilibrium of the output decision sub-game.

To evaluate whether the insiders should fully, partially or not at all reveal their private information signal, it therefore has to be analysed under which conditions the insiders' equilibrium output is maximised for any given  $s_t$ . From (22) it is obvious that only,  $C_1$ , i.e. the insiders' reaction to their private signal, depends on the garbling term. Specifically, if  $C_1$  decreases, output (and thereby private merger profitability) increases.  $C_1$  is a strictly decreasing function of  $s_t$ . This implies, as  $s_t$  increases,  $C_1$  decreases. Hence, as  $s_t \rightarrow \infty$ , merger profitability increases and  $s_t = \infty$ , i.e. concealing the private signal is a dominant strategy for each merging firm at the Cournot equilibrium with uncertainty about private efficiency gains.

## 4. Model analysis: Asymmetric Oligopoly

This section analyses the insiders' merger incentives in an asymmetric oligopoly structure: The marginal cost level in the industry differs between the insiders and the outsiders pre-merger, i.e.  $c_t \neq c_i$ . Importantly, the difference in marginal costs is not caused by the stochastic efficiency gains generated through the merger, but rather differentiates the firms in the oligopoly independent of the merger.

The analysis of the asymmetric oligopoly setting focuses on perfect signals, equivalent to sections 3.2.1 and 3.2.2 as the analysis of partial information sharing structures in section 3.2.3 already allows for asymmetric levels of marginal costs.

### 4.1. Pre-merger equilibria

As in the symmetric oligopoly setting, neither the insiders nor the outsiders are exposed to stochastic efficiency gains or (residual) demand prior to the merger. To maximise (1), consequently, the general maximisation problem in (2) simplifies to a maximisation of the deterministic profit function (5) for all firms since no uncertainty, and thereby no stochastic variable, gives rise to a risk premium pre-merger. As analysed in the previous section, the single most important variable for the further analysis of the insiders' incentives to merge is the insiders' output, which pre-merger and under an asymmetric level of marginal costs, i.e.  $c_t \neq c_i$ , amounts to,

$$x_t = \frac{(a(2b-d) - c_t(2b+d(n-k-1)) + c_i d(n-k))}{(2b+d(k-1))(2b+d(n-k-1)) - d^2(n-k)k} \quad (23)$$

### 4.2. Insiders' merger incentives and merger profitability in the asymmetric oligopoly

#### 4.2.1. Insiders and Outsiders are uncertain about the insiders' efficiency gains

As in section 3.2.1 for the case of the symmetric oligopoly, in which insiders and outsiders are unaware of the insiders' efficiency gains and, accordingly, of the outsiders' residual demand, both parties compete under uncertainty.

Maximising (2), i.e.  $E(\pi) - \frac{R}{2}Var(\pi)$ , in order to maximise the expected utility function (1), yields (13), which reveals that insiders' expected utility increases with their production output, (15), as analysed in Appendix A.

(23) and (15) need to be compared in order to analyse whether insiders' output increases post-merger, making the merger privately profitable. The analysis particularly focuses on the new distinguishing factor in this asymmetric oligopoly structure, the difference in the marginal cost levels of the insiders and the outsiders.

Assuming an asymmetric level of marginal costs, i.e.  $c_t \neq c_i$ , and focusing the analysis of merger incentives on the difference in the levels of marginal costs, insiders' output, and thereby merger incentives, increase as outsiders' marginal cost level,  $c_i$ , decreases as seen in (23).

The reverse tends to be true for the insiders' marginal cost level,  $c_t$ : The higher the insiders' marginal cost level is, the higher the incentives to merge, if the risk aversion is not too high.

The findings in section 3.2.1 that merger incentives increase with industry size and efficiency gains are confirmed under an asymmetric level of marginal costs.

#### 4.2.2. Perfectly informed insiders

In line with the analysis of the symmetric oligopoly setting in section 3.2.2, it is explored whether the merger incentives of perfectly informed insiders increase when they conceal or when they reveal the perfect private information which they receive about the realization of their stochastic efficiency gains.

As before, insiders' merger incentives increase with their production as shown for the symmetric oligopoly. The insiders' equilibrium output [(18) if outsiders are uninformed or (19) if outsiders are informed] depends on their information revelation strategy, as shown in Appendices 2.1 and 2.2.

As shown in Appendix 2.3 under the assumption of an asymmetric level of marginal costs, the merging firms should largely conceal their private information, in line with the findings of the symmetric level of marginal costs.

In order to finally decide on whether the merger itself is (privately) profitable, the equilibrium outputs pre-merger and post-merger under the asymmetric information structure have to be compared as insiders have incentives not to share their private information about the realization of their efficiency gains as shown above. Comparing (18) and (23) reveals that, as in section 4.2.1, insiders' merger incentives increase as the outsiders' marginal cost level decreases and as the insiders' marginal cost level increases.

Again, the finding in section 3.2.2 that merger incentives increase as the merger scale decreases is confirmed under an asymmetric level of marginal costs.

## 5. Consumer Surplus

Consumer surplus, i.e. the net gain to consumers for a particular amount of a good, is a primary measure of the (anti-)competitive effects imposed on consumers resulting from a (horizontal) merger for the competition authorities. Consumer surplus is computed as the area under the demand curve between 0 and the amount of the good ( $X$ ), i.e. the equilibrium output of the firms, minus the monetary cost of acquiring that amount of the good ( $p \cdot X$ ). In terms of the integral of the inverse demand function  $p(x)$  it follows that

$$CS = \int_0^X p(x)dx - pX = \int_0^X (p(x) - p)dx \quad (24)$$

Using the inverse demand function,

$$CS = \frac{1}{2}(a - p(x))x_i = \frac{1}{2} \left( \sum_{i=1}^n bx_i^2 + \sum_{j=1, j \neq i}^n dx_ix_j \right) \quad (25)$$

This implies that consumer surplus increases with industry output as shown by Dixit (1986) in an duopoly setting and extended by Farrell & Shapiro (1990) to an oligopoly setting under Cournot competition with horizontal mergers.<sup>24</sup> Upon the output change of one party in the industry, the other parties' reaction is to change their output in the opposite direction. Importantly, the reaction of the other parties does not offset the change in the industry output induced by the initial change in output of the first party.

As shown above, mergers' private profitability increases when insiders increase their output post-merger. As output, and thereby merger profitability, increases with a higher probability under the assumptions of risk aversion and uncertainty as shown in sections 3 and 4<sup>25</sup> these mergers also induce a positive change in consumer surplus: The higher output of the merging firms leads to a higher industry output resulting in a higher consumer surplus. Therefore, not only the merger incentives have been underestimated by the previous traditional horizontal merger literature, but also the positive impact of risk aversion and uncertainty on consumer surplus has been neglected in the previous literature by foregoing a holistic analysis of the effects of risk aversion and uncertainty on the incentives to merge.

## 6. Results and Implications of the five stage game

The results for the five stage game outlined in section 2 can be summarized as follows. After the exogenous merger decision, the merging entities have to decide on their information revelation strategy about the information they receive subsequently. The insiders might receive one out of three types of signals containing either no, partial, or full information about the efficiency gains, which they achieve upon the merger. As shown, assuming risk-averse firms, the insiders' optimal revelation strategy is to conceal any information they have if the efficiency gains are

<sup>24</sup>Dixit (1986) and Farrell & Shapiro (1990) also assume that demand curves slope downward and that each firm's residual demand curve intersects its marginal cost curve from above.

<sup>25</sup>As also shown in these sections, efficiency gains also induce insiders to increase product or limit their post-merger production contraction. Given the positive effect on consumer surplus, merging entities also have an incentive to overstate their expected efficiency gains when communicating with e.g. the competition authorities in order to increase the probability of a merger clearance decision, in addition to increasing private merger profitability (Sawaki, 2015).

not too high. Thereby, they maximise their expected utility when competing under Cournot competition in the last stage of the game.

When insiders increase their output post-merger, (private) merger profitability increases. As shown in the previous literature, this is largely not the case when firms operate in the von Neumann-Morgenstern utility theorem with risk-neutral firms and under disrespect of efficiency gains. I have shown that the output reduction of risk-neutral merging firms diminishes as efficiency gains increase, resulting in higher merger profitability.

Introducing uncertainty and risk aversion into the framework changes merger incentives and optimal information sharing strategies considerably. If the private signal to the insiders does not convey any information about the realization of the stochastic efficiency gains or if the insiders do not receive a signal before competition takes place, insiders increase output and profit as risk aversion or efficiency gains increase. Insiders can expand output induced by the efficiency gains and insiders risk-bearing potential further due to the "risk-averse behaviour effect" of the outsiders, as these behave softer than under risk-neutrality analysed in the traditional horizontal merger literature. Thereby, merger profitability is higher in a setting of risk aversion. Whether horizontal mergers are privately profitable in a setting of complete uncertainty depends on the degree as well as the extent of the expected efficiency gains.

If the private signal to the insiders conveys full or partial information about the efficiency gains, the merging firms have incentives to conceal their private information. This finding is in sharp contrast to the findings by Gal-Or (1986) and Shapiro (1986), who find that insiders should share private information if uncertainties exist about private values (e.g. costs). The effect of concealing private information is triggered by and increasing in the degree of risk aversion,  $R$ , the extent of uncertainty,  $\sigma$ , as well product differentiation,  $d$ . Given the nature of strategic substitutes, the outsiders' lower output due to risk-averse behaviour enhances merger incentives as insiders can take advantage of the risk-averse behaviour of the outsiders, leading to the optimal information sharing strategy of concealing private information.

## 7. Conclusion

This paper has focused on elaborating the effects of private information and risk aversion in horizontal merger settings under Cournot competition in order to give possible explanations for the limited merger profitability asserted by the traditional horizontal merger literature (e.g. Salant, Switzer & Reynolds, 1983). I have shown in this paper that merger profitability, and thereby the incentives to merge, have been underestimated by the traditional horizontal merger literature by foregoing a holistic analysis of the effects of risk aversion and uncertainty on the incentives to merge. Furthermore, I find that the information sharing incentives about private variables are reversed if risk aversion is taken into account: Insiders have incentives to conceal their private information from the outsiders as well as the competition authority.

From a regulatory point of view, mergers explained by this framework have not been to the consumers' disadvantage. Rather contrary, horizontal mergers in an industry of firms, which are or act as if they are risk-averse, benefit consumers.

Finally, competition authorities should underline the importance of not only the insiders' efficiency gains, but also uncertainty and risk aversion in their guidelines and should put particular emphasis on the industries' information structure when assessing antitrust cases.

## A. Insiders and Outsiders are uncertain about the insiders' efficiency gains

If  $k$  insiders decide to merge, the insiders' and the outsiders' general maximisation problems in (2) become,

$$\max \sum_{t=1}^k \left( a - bx_t - bX_{-t} - (1 - \delta)c_t \right) x_t - \frac{R}{2} \sigma^2 \left( \left( \sum_{t=1}^k x_t \cdot c_t \right)^2 + \rho \sum_{i,j \neq i} x_i \cdot c_i \cdot x_j \cdot c_j \right) \quad (26)$$

$$\max \sum_{i=1}^{n-k} \left( a - bx_i - bX_{-i} - c_i \right) x_i - \frac{R}{2} \sigma^2 \cdot x_i^2 \quad (27)$$

The first-order condition for the insiders becomes

$$a - 2bx_t - 2(k-1)dx_t - d(n-k)x_i - (1 - \delta)c_t - R\sigma^2 \cdot x_i^2 (1 + (k-1)\rho) = 0 \quad (28)$$

Or,

$$a - d(n-k)x_i - (1 - \delta)c_t = (2b + 2d(k-1) + R\sigma^2 \cdot x_i^2 (1 + (k-1)\rho)) x_t \quad (29)$$

Inserting the outsiders' decision rule of  $x_i = \frac{a - dkx_t - c_i}{S + R\sigma^2}$ , where  $S = 2b + d(n-k-1)$  and positive, and setting  $P = (2b + 2d(k-1))$ , which is also positive, the term becomes,

$$a - d(n-k) \frac{a - dkx_t - c_i}{S + R\sigma^2} - (1 - \delta)c_t = (P + R\sigma^2 \cdot x_i^2 (1 + (k-1)\rho)) x_t \quad (30)$$

Multiplying by  $S + R\sigma^2$  and simplifying yields,

$$a(S + R\sigma^2) - (1 - \delta)c_t(S + R\sigma^2) - d(n-k)a + d(n-k)c_i = (S + R\sigma^2)(P + R\sigma^2 \cdot x_i^2 (1 + (k-1)\rho)) x_t - d^2(n-k)kx_t \quad (31)$$

Finally, solving for the insiders' equilibrium output  $x_t$  yields,

$$x_t = \frac{a(S + R\sigma^2 - d(n-k)) - (1 - \delta)c_t(S + R\sigma^2) + d(n-k)c_i}{(S + R\sigma^2)(P + R\sigma^2 \cdot x_i^2 (1 + (k-1)\rho)) - d^2(n-k)k} \quad (32)$$

where  $(S + R\sigma^2)$ ,  $P, P + R\sigma^2 \cdot x_i^2(1 + (k-1)\rho)$  and  $(S + R\sigma^2)(P + R\sigma^2 \cdot x_i^2(1 + (k-1)\rho)) - d^2(n-k)k$  are all positive as  $b, d > 0$ ,  $b > d$  and  $R\sigma^2 > 0$  in the case of risk aversion and uncertainty.

Substituting into the outsiders' first-order condition yields,

$$x_i = \frac{a - dk \left( \frac{a(S + R\sigma^2 - d(n-k)) - (1-\delta)c_t(S + R\sigma^2) + d(n-k)c_i}{(S + R\sigma^2)(P + R\sigma^2 \cdot x_i^2(1 + (k-1)\rho)) - d^2(n-k)k} \right) - c_i}{S + R\sigma^2} \quad (33)$$

Multiplying by  $S + R\sigma^2$  and solving similarly for the outsiders' equilibrium output yields,

$$x_i = \frac{(a - c_i)(P + R\sigma^2 \cdot x_i^2(1 + (k-1)\rho)) - (a - (1-\delta)c_t)dk}{(S + R\sigma^2)(P + R\sigma^2 \cdot x_i^2(1 + (k-1)\rho)) - d^2k(n-k)} \quad (34)$$

Substituting into the inverse demand functions and solving for the equilibrium profits  $\pi_t = (p(x_t) - (1-\delta)c_t)x_t$  and  $\pi_i = (p(x_i) - c_i)x_i$  yields,

$$\pi_t = (b + d(k-1) + R\sigma^2 c_t^2(1 + (k-1)\rho))x_t^2 \quad (35)$$

$$\pi_i = (b + R\sigma^2)x_i^2 \quad (36)$$

Assuming symmetric marginal costs, i.e.  $c_t = c_i = c$ , insiders increase output if,

$$\frac{(a - (1-\delta)c)(2b + d(n-k-1) + R\sigma^2) - d(n-k)(a-c)}{(2b + d(n-k-1) + R\sigma^2)(2b + 2d(k-1) + R\sigma^2 c^2(1 + (k-1)\rho)) - d^2(n-k)k} > \frac{a-c}{2b + d(n-1)} \quad (37)$$

This simplifies to,

$$(a-c) \left( (1 - c^2(1 + (k-1)\rho)) - \frac{2b - d + R\sigma^2}{2b + d(n-k-1) + R\sigma^2} \right) R\sigma^2 > (a-c)d(k-1) - \delta c(2b + d(n-1)) \quad (38)$$

Or,

$$(a - c) \left( (1 - c^2(1 + (k - 1)\rho)) - \frac{2b - d + R\sigma^2}{2b - d + R\sigma^2 + d(n - k)} \right) R\sigma^2 > (a - c)d(k - 1) - \delta c(2b + d(n - 1)) \quad (39)$$

The term  $\frac{2b-d+R\sigma^2}{2b-d+R\sigma^2+d(n-k)}$  is in the centre of the analysis. First, given that  $b > d$ , and  $b, d > 0$  the numerator and the denominator are positive, but the numerator is smaller than the denominator. Hence,  $0 < \frac{2b-d+R\sigma^2}{2b-d+R\sigma^2+d(n-k)} < 1$ . This implies, as  $n$ , the industry size, increases, the term approaches zero.

Furthermore, the left-hand side of the equation above depends on the degree of risk aversion and uncertainty,  $R\sigma^2$ . As the left-hand side increases, the insiders' production increases. As risk aversion and uncertainty increases, the left-hand side increases, as production is fully dependent on risk aversion and uncertainty as well as  $\frac{2b-d+R\sigma^2}{2b-d+R\sigma^2+d(n-k)}$  approaches one.

Finally, a decrease in the marginal cost level enhances insiders' merger profitability. In the equation above, the left-hand side, and thereby production unambiguously increases with a decrease in the marginal cost level, assuming shocks are positively correlated, i.e.  $\rho > 0$ .

## B. Perfectly informed informed insiders

### 2.1. Perfectly informed informed insiders do not reveal their information

If  $k$  insiders decide to merge and are perfectly informed about their efficiency gains, the insiders' and the outsiders' maximisation problems become,

$$\max \sum_{t=1}^k \left( a - bx_t - bX_{-t} - (1 - \delta)c_t \right) x_t \quad (40)$$

$$\max \sum_{i=1}^{n-k} \left( a - bx_i - bX_{-i} - c_i \right) x_i - \frac{R}{2} \sigma^2 \cdot x_i^2 \quad (41)$$

The first-order condition for the insiders becomes

$$a - 2bx_t - 2(k - 1)dx_t - d(n - k)x_i - (1 - \delta)c_t = 0 \quad (42)$$

Or,

$$a - d(n - k)x_i - (1 - \delta)c_t = (2b + 2d(k - 1))x_t \quad (43)$$

Inserting the outsiders decision rule of  $x_i = \frac{a - dkx_t - c_i}{S + R\sigma^2}$ , where  $S = 2b + d(n - k - 1)$  and positive, and setting  $P = (2b + 2d(k - 1))$ , which is also positive, the term becomes,

$$a - d(n - k)\frac{a - dkx_t - c_i}{S + R\sigma^2} - (1 - \delta)c_t = Px_t \quad (44)$$

Multiplying by  $S + R\sigma^2$  and simplifying yields,

$$a(S + R\sigma^2) - (1 - \delta)c_t(S + R\sigma^2) - d(n - k)a + d(n - k)c_i = (S + R\sigma^2)Px_t - d^2(n - k)kx_t \quad (45)$$

Finally, solving for the insiders' equilibrium output  $x_t$  yields,

$$x_t = \frac{a(S + R\sigma^2 - d(n - k)) - (1 - \delta)c_t(S + R\sigma^2) + d(n - k)c_i}{(S + R\sigma^2)P - d^2(n - k)k} \quad (46)$$

where  $(S + R\sigma^2)$ ,  $P$ , and  $(S + R\sigma^2)P - d^2(n - k)k$  are all positive as  $b, d > 0$ ,  $b > d$  and  $R\sigma^2 > 0$  in the case of risk aversion and uncertainty.

Substituting into the outsiders' first-order condition yields,

$$x_i = \frac{a - dk\left(\frac{a(S + R\sigma^2 - d(n - k)) - (1 - \delta)c_t(S + R\sigma^2) + d(n - k)c_i}{(S + R\sigma^2)P - d^2(n - k)k}\right) - c_i}{S + R\sigma^2} \quad (47)$$

Multiplying by  $S + R\sigma^2$  and solving similarly for the outsiders' equilibrium output yields,

$$x_i = \frac{(a - c_i)P - (a - (1 - \delta)c_t)dk}{(S + R\sigma^2)P - d^2k(n - k)} \quad (48)$$

Substituting into the inverse demand functions and solving for the equilibrium profits  $\pi_t = (p(x_t) - (1 - \delta)c_t)x_t$  and  $\pi_i = (p(x_i) - c_i)x_i$  yields,

$$\pi_t = (b + d(k - 1))x_t^2 \quad (49)$$

$$\pi_i = (b + R\sigma^2)x_i^2 \quad (50)$$

To finally maximise expected utility, the firms maximise  $E(\pi) - \frac{R}{2}Var(\pi)$  as shown above. The maximisation problem therefore yields for the insiders, where  $Var(\pi) = 0$ , and the outsiders,

$$(b + d(k - 1))x_t^2 \quad (51)$$

$$(b + \frac{R}{2}\sigma^2)x_i^2 \quad (52)$$

## 2.2. Insiders and Outsiders are perfectly informed about insiders' efficiency gains

If  $k$  insiders decide to merge and both, insiders and outsiders, are perfectly informed about the insiders' efficiency gains prior to their production decision, the insiders' and the outsiders' maximisation problems become,

$$\max \sum_{t=1}^k (a - bx_t - bX_{-t} - (1 - \delta)c_t)x_t \quad (53)$$

$$\max \sum_{i=1}^{n-k} (a - bx_i - bX_{-i} - c_i)x_i \quad (54)$$

The first-order condition for the insiders becomes

$$a - 2bx_t - 2(k - 1)dx_t - d(n - k)x_i - (1 - \delta)c_t = 0 \quad (55)$$

Or,

$$a - d(n - k)x_i - (1 - \delta)c_t = (2b + 2d(k - 1))x_t \quad (56)$$

Inserting the outsiders decision rule of  $x_i = \frac{a - dkx_t - c_i}{S}$ , where  $S = 2b + d(n - k - 1)$  and positive, and setting  $P = (2b + 2d(k - 1))$ , which is also positive, the term becomes,

$$a - d(n-k) \frac{a - dkx_t - c_i}{S} - (1 - \delta)c_t = Px_t \quad (57)$$

Multiplying by  $S$  and simplifying yields,

$$aS - (1 - \delta)c_t S - d(n-k)a + d(n-k)c_i = SPx_t - d^2(n-k)kx_t \quad (58)$$

Finally, solving for the insiders' equilibrium output  $x_t$  yields,

$$x_t = \frac{a(S - d(n-k)) - (1 - \delta)c_t S + d(n-k)c_i}{SP - d^2(n-k)k} \quad (59)$$

where  $S$ ,  $P$ , and  $SP - d^2(n-k)k$  are all positive as  $b, d > 0$  and  $b > d$ .

Substituting into the outsiders' first-order condition yields,

$$x_i = \frac{a - dk \left( \frac{a(S - d(n-k)) - (1 - \delta)c_t S + d(n-k)c_i}{SP - d^2(n-k)k} \right) - c_i}{S} \quad (60)$$

Multiplying by  $S$  and solving similarly for the outsiders' equilibrium output yields,

$$x_i = \frac{(a - c_i)P - (a - (1 - \delta)c_t)dk}{SP - d^2k(n-k)} \quad (61)$$

Substituting into the inverse demand functions (4) and solving for the equilibrium profits  $\pi_t = (p(x_t) - (1 - \delta)c_t)x_t$  and  $\pi_i = (p(x_i) - c_i)x_i$  yields,

$$\pi_t = (b + d(k - 1))x_t^2 \quad (62)$$

$$\pi_i = bx_i^2 \quad (63)$$

To finally maximise expected utility, the firms maximise  $E(\pi) - \frac{R}{2}Var(\pi)$  as shown above. Since  $Var(\pi) = 0$  for insiders and outsiders, the maximisation problem solves to,

$$(b + d(k - 1))x_i^2 \quad (64)$$

$$bx_i^2 \quad (65)$$

### 2.3. Should insiders share their private information?

This proof follows in two steps. In the first step, it is analysed, whether the expected utility of the merging firms is higher when the merging firms share their information they possess or not. Analytically, insiders will conceal their information, if (48) > (56) and reveal their private information about their efficiency gains otherwise.

In accordance with the arguments made that expected utility increases with production output, the insiders' utility is higher when they conceal their information, if the insiders' equilibrium output is higher, when they conceal information vs. when they reveal information, i.e. (46) > (59):

$$\begin{aligned} & \frac{(a - (1 - \delta)c_i)(2b + d(n - k - 1) + R\sigma^2) - d(n - k)(a - c_i)}{(2b + d(n - k - 1) + R\sigma^2)(2b + 2d(k - 1)) - d^2k(n - k)} \\ & > \frac{(a - (1 - \delta)c_i)(2b + d(n - k - 1)) - d(n - k)(a - c_i)}{(2b + d(n - k - 1))(2b + 2d(k - 1)) - d^2k(n - k)} \quad (66) \end{aligned}$$

Setting  $2b + d(n - k - 1) + R\sigma^2 = S + R\sigma^2$ ,  $2b + d(n - k - 1) = S$  and  $2b + 2d(k - 1) = P$ , all,  $P$ ,  $S + R\sigma^2$  and  $S$  are positive, given that  $b, d > 0, b > d$ . Also, given that  $R\sigma^2 > 0$  in case of risk aversion and uncertainty, the denominator on both sides of the equation is always positive. Therefore, (66) can be re-written as,

$$\begin{aligned} & \frac{(a - (1 - \delta)c_i)(S + R\sigma^2) - d(n - k)(a - c_i)}{P(S + R\sigma^2) - d^2k(n - k)} \\ & > \frac{(a - (1 - \delta)c_i)S - d(n - k)(a - c_i)}{PS - d^2k(n - k)} \quad (67) \end{aligned}$$

Multiplying with the positive denominators and cancelling out common terms leads to,

$$d(n - k)(a - c_i)PR\sigma^2 > (a - (1 - \delta)c_i)R\sigma^2 d^2k(n - k) \quad (68)$$

Substituting in the term for  $P$  and subtracting leads to,

$$d(n-k)((a-c_i)(2b+2d(k-1)) - (a-(1-\delta)c_t)dk)R\sigma^2 > 0 \quad (69)$$

Or,

$$d(n-k)((a(2b+2d(k-1)) - dk) - c_i((2b+2d(k-1))) + (1-\delta)c_t)dk)R\sigma^2 > 0 \quad (70)$$

Leading to,

$$d(n-k)((a(2b+2d(k-2)) - c_i((2b+2d(k-1))) + (1-\delta)c_t)dk)R\sigma^2 > 0 \quad (71)$$

Given that  $a > c$ ,  $d > 0$ ,  $n > k$  and in the presence of risk aversion and uncertainty, i.e.  $R\sigma^2 > 0$ , the expression is true.

Assuming symmetric marginal cost levels, i.e.  $c_t = c_i = c$ , this simplifies to,

$$d(n-k)R\sigma^2((a-c)(2b+d(k-2)) - dk\delta c) > 0 \quad (72)$$

Assuming asymmetric marginal cost levels, i.e.  $c_t \neq c_i$ , (71) simplifies to,

$$d(n-k)R\sigma^2((a-c_i)(2b+2d(k-1)) - dk(a-(1-\delta)c_t)) > 0 \quad (73)$$

$R\sigma^2$  in (72) and (73) relates to the outsiders' risk aversion. As  $d$  and the outsiders' risk aversion increase, the area in which the insiders should conceal their private information increases, since the bracket terms in (72) and (73) are mostly positive<sup>26</sup>. As a conclusion, insiders have incentives to conceal their private information about their efficiency gains.

In a second step, it is necessary to investigate the conditions under which the insiders' expected utility upon concealing information will lead to a privately profitable merger.

To conclude on this question, the equilibrium output when insiders are perfectly informed and conceal their information and the pre-merger setting have to be compared. The following proof is provided for the symmetric and the asymmetric oligopoly setting individually.

In the symmetric oligopoly setting, the merger is profitable, if the output produced when in-

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<sup>26</sup>The information revelation strategy would be alternated towards sharing private information, if the efficiency gains were very high or the insiders' marginal cost level was very low.

siders conceal the information about their private efficiency gains (46) is larger than the output produced pre-merger (9):

$$\frac{(a - (1 - \delta)c)(2b + d(n - k - 1) + R\sigma^2) - d(n - k)(a - c)}{(2b + d(n - k - 1) + R\sigma^2)(2b + 2d(k - 1)) - d^2k(n - k)} > \frac{a - c}{2b + d(n - 1)} \quad (74)$$

Setting again  $2b + d(n - k - 1) + R\sigma^2 = S + R\sigma^2$ , and  $2b + 2d(k - 1) = P$ ,  $P$  and  $S + R\sigma^2$  are positive, given that  $b, d > 0, b > d$ . Also, given that  $R\sigma^2 > 0$  in case of risk aversion and uncertainty, the denominator on the left side, as well as on the right side, is positive.

Multiplying with the positive denominators and rearranging yields for a symmetric cost level,

$$((a - c)(2b + d(n - 1) - P) + \delta(2b + d(n - 1)))(S + R\sigma^2) > d(n - k)((a - c)(2b + d(n - 1)) - dk) \quad (75)$$

Substituting back in  $P$  and  $S + R\sigma^2$  leads to,

$$((a - c)(2b + d(n - 1) - (2b + 2d(k - 1))) + \delta(2b + d(n - 1)))(2b + d(n - k - 1) + R\sigma^2) > d(n - k)((a - c)(2b + d(n - 1)) - dk) \quad (76)$$

After further rearranging,

$$((a - c)(d(n - 2k + 1) + \delta(2b + d(n - 1)))(2b + d(n - k - 1) + R\sigma^2) > (a - c)d(n - k)(2b + d(n - k - 1)) \quad (77)$$

Or,

$$((a - c)(d(n - k) - d(k - 1))(2b + d(n - k - 1) + R\sigma^2) + \delta(2b + d(n - 1)))(2b + d(n - k - 1) + R\sigma^2) > (a - c)d(n - k)(2b + d(n - k - 1)) \quad (78)$$

The implications from the above equation are as follows.

First, as efficiency gains  $\delta$  increase, merger profitability increases: The efficiency gains have a purely profit-enhancing effect as both,  $(2b + d(n - 1))$  and  $2b + d(n - k - 1) + R\sigma^2$  are positive

as  $b, d > 0, b > d$  and  $R\sigma^2 > 0$ .

Second, the merger is profitable, as long as the merger scale is not too large. If the merger scale, i.e. the number of insiders  $k$  increases, the term  $(d(n-k) - d(k-1))$  becomes negative.

This implies, under this setting, when insiders conceal their private information about the realization of their stochastic efficiency gains from the risk-averse outsiders, a merger is privately profitable, but this effect diminishes in the number of insiders. As the number of insiders increases, these can only take advantage of fewer outsiders' "risk-averse behaviour effect", who forgo profits according to (1). Specifically, if  $k \rightarrow n$ , merger incentives persist in the extreme as long as the efficiency gains  $\delta$ , which also increase merger profitability, are high enough, i.e.  $\delta(2b + d(n-1)) > (a-c)d(n-1)$ , and thereby counter-effect the lower merger profitability caused by the higher merger scale.

In the asymmetric oligopoly setting, the merger is profitable, if

$$\frac{(a - (1 - \delta)c_t)(S + R\sigma^2) - d(n-k)(a - c_i)}{(S + R\sigma^2)P - d^2k(n-k)} > \frac{a(2b - d) - c_tS + c_id(n-k)}{(2b + d(n-1))S - d^2(n-k)k} \quad (79)$$

It follows that insiders' output, and thereby expected utility, is larger post-merger if,

$$\begin{aligned} & R\sigma^2((a - (1 - \delta)c_t)((2b + d(k-1))(2b + d(n-k-1)) - d^2(n-k)k) \\ & - (2b + 2d(k-1))((a - c_t)(2b + d(n-k-1)) - (a - c_i)(d(n-k)))) \\ & > (2b + d(n-k-1))d(k-1)((a - c_t)(2b + d(n-k-1)) - (a - c_i)d(n-k)) \\ & \quad - \delta(2b + d(n-k-1))c_t((2b + d(n-k-1))(2b - d^2(n-k)k)) \quad (80) \end{aligned}$$

As  $(2b + d(k-1))(2b + d(n-k-1)) - d^2(n-k)k$  is positive, and  $2b + d(n-k-1) > d(n-k)$ , given that  $b > d$ , as well as  $a > c_t$  and  $a > c_i$ , the terms on the right-hand side, which depend on the level of the insiders' marginal cost level,  $c_t$ , are unambiguously negative, while the left-hand sides' positive terms  $2b + 2d(k-1)$  and  $2b + d(n-k-1)$  may lead to increases in insiders' production post-merger, depending on the level of risk aversion and uncertainty. For the outsiders' marginal cost level,  $c_i$ , the left-hand sides' terms are unambiguously negative,  $-R\sigma^2(2b + d(n-k-1))d(n-k)c_i < 0$ , while the opposite is true for the right-hand side terms, where  $c_id(2b + d(n-k-1))d(k-1)d(n-k) > 0$ .

Hence, as the analysis of the asymmetric oligopoly setting reveals, a higher marginal cost level of the insiders as well as a lower marginal cost level of the outsiders increases the insiders merger incentives, which is in line with the findings in section 4.2.1.

### C. Partially informed insiders

*Derivation of the posterior expected values*

The insiders receive the signal

$$z_t = \tilde{\delta}_t + e_t \quad (81)$$

$$\tilde{\delta}_t \sim N(\delta_t, \eta)$$

$$e_t \sim N(0, m)$$

and produce the signal

$$\hat{z}_t = z_t + f_t \quad (82)$$

$$z_t \sim N(\delta_t, \eta + m)$$

$$f_t \sim N(0, s_t)$$

The outsiders receive this signal about the insiders' efficiency gains, which equivalently conveys information about the realization of their residual demand. Specifically, if the outsiders receive information about the efficiency gains of the insiders, this signal of the insiders,  $\hat{z}_t$ , conveys diluted information about insiders' efficiency gains as well as outsiders' random demand.

Since the distribution of priors and private signals is normal and demand is linear, each firm follows a linear decision rule (Radner, 1962) of the form

$$\begin{aligned} x_t &= C_0 + C_1 \hat{z}_t + C_2 z_t \\ x_i &= B_0 + B_1 \hat{z}_i \end{aligned} \quad (83)$$

Since both, insiders and outsiders, are still uncertain about the insiders' efficiency gains and their residual demand respectively, the first-order conditions of the insiders and the outsiders, respectively, follow from (11) and (12),

$$E\left(a - 2b\left(C_0 + \sum_{t=1}^k C_1 \hat{z}_t + \sum_{t=1}^k C_2 z_t\right) - d \sum_{i=k+1}^n \left(B_0 + B_1 \hat{z}_i\right) - \sum_{t=1}^k \left(1 - \delta_t\right) c_t - R\sigma^2 c_t^2 \left(1 + (k-1)\rho\left(C_0 + \sum_{t=1}^k C_1 \hat{z}_t + \sum_{t=1}^k C_2 z_t\right)\right) = 0 \quad (84)$$

$$E\left(a - d\left(C_0 + \sum_{t=1}^k C_1 \hat{z}_t + \sum_{t=1}^k C_2 z_t\right) - 2b\left(B_0 + B_1 \hat{z}_i\right) - d \sum_{i=k+1/i \neq j}^n \left(B_0 + B_1 \hat{z}_i\right) - c_i - R\sigma^2 \left(B_0 + B_1 \hat{z}_i\right)\right) = 0 \quad (85)$$

Using the distributional properties of  $\hat{z}_t$ ,  $z_t$ , and  $\delta_t$ , the posterior expected values for the unobserved variables  $\delta_t$  for the insiders and  $z_t$  for the outsiders can be derived as follows:

$$1) E(\delta_t | z_1 \cdots z_k)$$

The signal the insiders receive can be decomposed into,

$$z_t = \delta_t + e_t \rightarrow \frac{\sum_{t=1}^k z_t}{k} = \frac{\sum_{t=1}^k \delta_t}{k} + \frac{\sum_{t=1}^k e_t}{k} \quad (86)$$

Using expected operators on the unknown variables yields,

$$E\left(\frac{\sum_{t=1}^k \delta_t}{k} | z_1 \cdots z_k\right) = \frac{\sum_{t=1}^k z_t}{k} - E\left(\frac{\sum_{t=1}^k e_t}{k} | z_1 \cdots z_k\right) \quad (87)$$

Accordingly, to find the posterior expected value of  $\delta_t$ , since  $z_t$  is observed by the insiders, only the expected value of  $e_t$  has to be computed using the respective variance-covariance matrix,

$$\begin{matrix}
e_t & z_1 & \dots & z & \dots & z_n \\
e_t & \left( \begin{matrix} m & 0 & \dots & m & \dots & 0 \\ z_1 & 0 & \eta + m & \dots & h & \dots & h \\ \vdots & \vdots & & \ddots & \vdots & & \vdots \\ z & m & h & \dots & \ddots & & \vdots \\ \vdots & \vdots & & & & \ddots & \vdots \\ z_n & 0 & h & \dots & \dots & & \eta + m \end{matrix} \right) & \begin{pmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{pmatrix}
\end{matrix}$$

Based upon DeGroot (1970),

$$E(e_t | z_1 \dots z_k) = S_{12} S_{22}^{-1} \begin{pmatrix} z_1 \\ \vdots \\ z_k \end{pmatrix}$$

Substituting in yields,

$$\begin{pmatrix} 0 & \dots & m & \dots & 0 \end{pmatrix} \begin{pmatrix} \eta + m & h & \dots & h \\ h & \eta + m & & \vdots \\ \vdots & & \ddots & \vdots \\ h & & & \eta + m \end{pmatrix} \begin{pmatrix} z_1 \\ \vdots \\ \vdots \\ z_k \end{pmatrix}$$

It follows that,

$$E\left(\frac{\sum_{t=1}^k e_t}{k}\right) = \frac{m \sum_{i=1}^k z_t}{(\eta + m + (k-1)h)k} \quad (88)$$

Substituting in (86) yields the posterior expected value for  $\delta_t$ ,

$$E\left(\delta_t | z_1 \dots z_k\right) = \frac{\sum_{i=1}^k z_t}{k} - \frac{m \sum_{i=1}^k z_t}{(\eta + m + (k-1)h)k} = \frac{\eta + (k-1)h}{\eta + m + (k-1)h} z_t \quad (89)$$

2)  $E(z_t | \hat{z}_i)$

Using the variance-covariance matrix,

$$\begin{pmatrix} \eta + m + s_t & \eta + m \\ \eta + m & \eta + m + s_t \end{pmatrix} \begin{pmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{pmatrix} \quad (90)$$

and DeGroot's rule,  $S_{12}S_{22}^{-1}\hat{z}_i$ , the expected posterior value for  $E(z_t | \hat{z}_i)$  becomes,

$$E(z_t | \hat{z}_i) = \frac{\eta + m}{\eta + m + s_t} \hat{z}_t \quad (91)$$

since  $\hat{z}_i = \hat{z}_t$ .

Substituting the posterior expected values into the first-order conditions (84) and (85) yields a system of five equations with five unknowns,

$$\begin{aligned} (1) \quad & a - (2b + 2d(k-1))C_0 - d(n-k)B_0 - R\sigma^2c_t^2(1 + (k-1)\rho)C_0 = 0 \\ (2) \quad & a - 2bB_0 - dkC_0 - d(n-k-1)B_0 - c_i - R\sigma^2B_0 = 0 \\ (3) \quad & (-2b - 2d(k-1))C_3 - \left(1 - \frac{\eta + (k-1)h}{\eta + m + (k-1)h}\right)c_t - R\sigma^2c_t^2(1 + (k-1)\rho)C_3 = 0 \\ (4) \quad & (-2b - 2d(k-1))C_2 - d(n-k)B_1 - R\sigma^2c_t^2(1 + (k-1)\rho)C_2 = 0 \\ (5) \quad & -dkC_2 - 2bB_1 - d(n-k-1)B_1 - dkC_3 \frac{\eta + m}{\eta + m + s_t} = 0 \end{aligned} \quad (92)$$

Solving for the five unknowns yields,

$$\begin{aligned} B_0 &= \frac{(a - c_i)y_1y_2 - dka}{y_1y_2 - d^2(n-k)k} \\ B_1 &= \frac{(\eta + m)dkmc_t}{(\eta + m + (k-1)h)(\eta + m + s_t)(y_1y_2 - d^2(n-k)k)} \\ C_0 &= \frac{a(2b - d + R\sigma^2) + d(n-k)c_i}{y_1y_2 - d^2(n-k)k} \\ C_1 &= -\frac{d(n-k)(\eta + m)dkmc_t}{y_1((\eta + m + (k-1)h)(\eta + m + s_t)(y_1y_2 - d^2(n-k)k))} \\ C_2 &= -\frac{m}{(\eta + m + (k-1)h)y_1}c_t \end{aligned} \quad (93)$$

where,

$$y_1 = 2b + 2d(k-1) + R\sigma^2c_t^2(1 - (k-1)\rho)$$

$$y_2 = 2b + d(n-k-1) + R\sigma^2$$

# Horizontal Mergers, Information Sharing, Uncertainty, and Risk Aversion in Bertrand competition

Claas Hendrik Fügemann\*

The traditional horizontal merger literature has asserted that mergers in Bertrand competition are always profitable for the merging firms. At the same time, the non-merging firms benefit even more than the merging firms, while consumers suffer from the merger. Though most real world mergers take place under Bertrand competition, not all mergers proved to be beneficial for the merging and the non-merging firms in the past, e.g. *Daimler Benz/Chrysler* and *AOL/Time Warner*. In order to give possible explanations for the limited profitability of mergers in the real world, I relax some restrictive assumptions applied in the traditional horizontal merger literature by including uncertainty, risk aversion and information sharing mechanisms into the horizontal merger literature. I find that merger profitability increases with efficiency gains and with the level of risk and risk aversion; furthermore, in contrast to the previous literature, insiders have incentives to reveal private information about efficiency gains, when the outsiders are risk-averse. From a regulatory point of view, consumers may not necessarily be harmed in a Bertrand merger setting depending on the degree of risk aversion and the size of the efficiency gains.

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## 1. Introduction

The standard Bertrand merger analysis has so far proclaimed that industry prices increase post-merger, that mergers are privately profitable for the insiders, and that mergers come at the disadvantage of consumers (e.g. Deneckere & Davidson, 1985). However, reality has shown that this is not necessarily the case as seen in the mergers of *Daimler Benz/Chrysler* and *AOL/Time Warner*. As a companion paper to Fügemann (2017), this paper has the purpose to introduce mechanisms into the Bertrand merger literature, which have not yet been captured thoroughly, in order to give possible explanations for the differences between the findings of the analytical literature and empirical evidence. While I maintain the basic assumptions of substitute products and strategic complements in this paper, I relax other critical assumptions by introducing risk-averse behaviour and uncertain efficiency gains and try to explain the effects these have on the insiders' merger incentives, industry prices as well as consumer welfare. Specifically, I assume that the insiders can generate efficiency gains due to the merger. However, as in the real world these efficiency gains may be uncertain at the time of the merger. Both, merging and non-merging firms, are assumed to be risk-averse.

This paper consists of 5 sections. The following section reviews the relevant horizontal merger, risk aversion and uncertainty, as well as information sharing literature with a focus on Bertrand competition. In section 3, I develop an oligopoly model, which considers a horizontal merger scenario and takes information sharing and risk aversion mechanisms in a five step game into account. Section 4 then applies the model to an oligopoly setting. Section 5 derives the results of a horizontal merger including risk aversion and information sharing mechanisms for consumer welfare. Section 6 summarizes the results and concludes the paper.

## 2. Literature Review

### 2.1. Horizontal Mergers

The horizontal merger literature started analysing private merger profitability (i.e. the incentives to merge) under Bertrand competition in the early 1980s. A distinction between homogeneous products and differentiated products has to be made when analysing the effects of mergers as the degree of price competition -and thereby post-merger price increases and merger profitability- depends on the nature of product differentiation.

For homogeneous products, as in the standard case of Bertrand competition, the equilibrium price equals marginal cost as in a perfectly competitive market: For any price exceeding marginal cost, a firm would have an incentive to undercut the rivals' price and capture the whole market (Vives, 2001).

For differentiated products, Deneckere & Davidson (1985) found that mergers are always profitable for the merging firms and the profitability depends on the cross-price elasticity of de-

mand.<sup>1</sup> As a first reaction after the merger, the insiders increase their price as they absorb formerly external competition through the merger: Prior to the merger, the merging firms set prices which were below the optimal, i.e. joint profit maximising, level. Post-merger, the insiders internalize this effect and increase prices. Upward-sloping reaction functions under Bertrand competition imply that the initial price increase of the merging firms is followed by a price increase of the outsiders, which though is smaller than the price increase of the insiders. As the outsiders' price increases are smaller than the insiders' price increases, the market share of the merging firms decreases and a reallocation of production from the merging firms to the competitors takes place.<sup>2</sup> As a result and as shown by Deneckere & Davidson (1985), mergers in Bertrand competition are always privately profitable, i.e. the insiders' post-merger profit is higher than their pre-merger profits. However, as the merger scale (i.e. the number of merging parties) increases, outsiders benefit more from the increased prices than the merging firms. While both, insiders and outsiders, benefit from a merger, consumers lose as evidenced by higher industry prices leading to a decrease in consumer surplus.<sup>3</sup>

The results of Deneckere & Davidson (1985) crucially depend on four conditions:

- (1) Reaction functions are upward-sloping (i.e. strategic complements)
- (2) For any coalition structure, the equilibrium is unique
- (3) Insiders raise price post-merger
- (4) The joint reaction function of the outsiders has a slope less than one (i.e. the insiders charge a higher price than the outsiders post-merger)

While maintaining the first two conditions, I investigate whether the relaxation of specific assumptions imposed by the traditional horizontal merger literature change the latter two conditions and thereby trigger some objection to the general merger profitability claim under Bertrand competition as shown below.

The general merger profitability claim under Bertrand competition has been confirmed by parts

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<sup>1</sup>Shapiro (1996) first introduced the notion of a "diversion ratio", which is the ratio of the increase in quantity sold for one product to the decrease in the quantity sold of another product, when the price of the first product is increased. The larger the diversion ratio (and the larger the pre-merger price-cost margins for the merging firms), the larger the price increases (Werden & Froeb, 2008).

<sup>2</sup>Similar to the Cournot model, such a reallocation of output would be desirable if the merging firms are relatively inefficient and have small market shares. As shown by Motta (2004), this effect decreases with the number of firms in the industry, i.e. the more concentrated the industry is, the higher the prices will be.

<sup>3</sup>Two reasons for post-merger price increases can be distinguished (Röller, Stennek & Verboven, 2006). First, a merger between two or more firms may increase the firms' unilateral market power. As explained above, before the merger the independent firms compete under Bertrand and maximise their own profit only through their quantity or price decisions. After the merger, the insiders maximise their joint profits, and thereby take into account the negative effect their low-pricing strategy has on each other and raise prices. Second, a merger may shift the nature of conduct from competitive to collusive behaviour, or facilitate collusion at a higher price level. As the number of firms decreases, it may become easier to sustain implicit cartel agreements, for example because it becomes easier to monitor cheating. When a shift in conduct takes place, the merger increases the joint market power of the firms in the industry.

of the later horizontal merger literature (Leahy, 2002; Froeb, Tschantz & Werden, 2005; Werden & Froeb, 1994)<sup>4</sup>. Other research relaxed certain stringent assumptions to identify conditions, under which mergers under Bertrand competition are not profitable. One strand of literature has focused on conditions for equilibria prices not to increase post-merger. Röller, Stennek & Verboven (2006) find that product homogeneity, possibility of entry, strong buyers, or a failing firm scenario (failing firm defence) may constrain the merging firms' ability to raise prices. The effect of different cost structure on post-merger prices, and hence merger profitability, is of most interest for this article.

### **Cost asymmetry in the horizontal merger literature under Bertrand competition**

Li (2012) analysed the case of cost asymmetric firms and whether cost asymmetry induces merger incentives. In a duopoly framework, which was later extended to an oligopoly setting by Gelves (2014), cost asymmetry implies that one firm is efficient (i.e. has low production costs), while the other firm is inefficient (i.e. has high production costs). She generally finds that the inefficient firm has incentives to merge, while the efficient firm's incentives are limited as the firm is otherwise able to underprice the inefficient firm and drive it out of the market (i.e. engage in limit pricing behaviour). The only conditions when the efficient firm may find it profitable to merge is, if the cost asymmetry is low (i.e. it cannot drive the inefficient firm out of the market with its limit pricing behaviour) and product heterogeneity is low (i.e. the market for the merged entity's product is large, which increases the monopoly profits post-merger).

Structurally similar is the case, where cost asymmetry only enters into framework in the course of the merger: Merger-induced efficiency gains may lead to falling prices. Upon the realisation of efficiency gains, incentives exist to decrease prices post-merger (Motta, 2004). The increase in the price-cost margins incentivises the insiders to produce more and to underprice the outsiders, thereby profitably gaining market share.<sup>5</sup>

Adding the assumption that efficiency gains may be uncertain, Choné & Linnemer (2008), assuming homogeneous goods, find that with efficiency gains, all sales are made by the firm with the lowest marginal costs, which is in line with the standard Bertrand competition model. They find that if the expected efficiency gains are zero but uncertain, efficiency losses may be passed through to consumers while efficiency gains may not. However, they also establish conditions under which the uncertainty of efficiency gains may increase total welfare.

Barros & Cabral (2001) find that merger profitability is overestimated when introducing uncer-

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<sup>4</sup>Werden & Froeb (1994) assume in their logit model that a unit price increase by one firm increases the market share of all competitors by the same percentage amount and find that all prices increase post-merger, also confirming Deneckere & Davidson (1985)'s result that the price increase depends on the pre-merger market shares of the individual products as well as that the insiders' prices increase the most.

<sup>5</sup>Röller, Stennek & Verboven (2006) though find that significant savings in marginal costs, below the lowest marginal cost of either partner involved in the merger, are required for prices to drop after the merger.

tain efficiency gains in the Bertrand oligopoly model as managers are willing to gamble on the uncertain efficiency gains.<sup>6</sup>

Fiocco & Guo (2015) introduce regulated firms into the oligopoly merger setting under Bertrand competition with uncertain efficiency gains. They show that if (inefficient) regulated firms merge, Bertrand competition among the (efficient) unregulated outsiders may limit the allocative inefficiency induced by the merger: The output reduction by the merged entity is met by fierce price competition in the unregulated market.

From an empirical perspective, Dutordoir, Roosenboom & Vasconcelos (2014) analysed, whether merger profitability, defined as higher post-merger stock returns, increases with efficiency gains. Analysing 1719 mergers between 1995 and 2008 in the US, they confirm that stock returns were higher for mergers, for which efficiency gains were expected and communicated, and thereby lead to higher merger profitability. Any effects such disclosure may have on any merger clearance decision are analysed in the subsequent parts of this paper from a theoretical perspective. As a conclusion, the condition of increasing prices for merger profitability in Bertrand markets (Deneckere & Davidson, 1985) may not hold anymore, when efficiency gains are realised or stochastic shocks occur in the course of the merger. Consequently, the effect of decreasing prices can then deter merger profitability.

### **Consumer and total welfare analysis in the horizontal merger literature under Bertrand competition**

From a consumer and total welfare point of view, price increases give rise to concerns for two reasons. First, a price increase implies a transfer of wealth from consumers to producers. Second, an increase in the price of a product above its marginal cost creates (or strengthens) an allocative inefficiency, also called the dead-weight loss.

As shown above, prices increase and insiders as well as outsiders are better off in the standard merger analysis under Bertrand competition. However, due to the price increase, consumers are worse off (i.e., consumer surplus falls). Consumers may only benefit from the merger, if industry prices fall following the merger, for example, due to extensive efficiency gains. Therefore, the price effect is decisive for the evaluation of the effect of the merger on consumer surplus.

For a total welfare defense, it is important whether the producer surplus rises enough to outweigh the decrease in consumer surplus and whether consequently the net welfare effect is positive.

As discussed above, efficiency gains may lead to decreasing equilibria prices post-merger, im-

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<sup>6</sup>Barros & Cabral (2001) show that the second derivative of the profit function with regards to random costs is positive, i.e. it may be beneficial for firms to try to achieve efficiency gains even though the expected value is negative. Managers evaluate the profit function at expected levels of efficiency gains, rather than expected profit.

plying a positive effect on consumer surplus (Motta, 2004). Besanko & Spulber (1993) provided a consumer welfare defence standard arguing that the mere announcement of a merger already conveys information about the efficiency gains to be captured in the merger as a merger becomes more profitable as efficiency gains grow. In addition, when more firms operate in the industry, the extent to which prices increase after the merger is reduced: Each firm internalises the externality on the price of the partner, but with a large number of outsiders the price-increasing effect of the merger becomes marginal, and a small efficiency gain can outweigh this effect.

Williamson (1968) initiated the total welfare analysis by comparing the dead-weight losses due to price increases post-merger with the internal efficiencies that are generated by all firms in the industry. Williamson concluded that average cost reductions do not need to be very high to compensate for dead-weight losses induced by price increases. As Röller, Stennek & Verboven (2006) show, the size of efficiency gains heavily depends on the degree of competition (i.e. the lower the price increase, the lower the efficiency gains needed to outweigh the dead-weight loss) and pre-merger market power (i.e. the gain due to internal cost savings is proportional to the industry output, the loss due to reduced output is proportional to the price-cost margin, e.g. Weiss, 1992).

The detailed effect of efficiency gains on output reallocation and, as a consequence, on total welfare has been investigated for homogeneous as well as differentiated products competing in Bertrand markets as summarized below.

Farrell & Shapiro (1990) investigated the welfare effects from horizontal mergers for homogeneous products. They find that total welfare may increase post-merger, if reallocation of output to the outsiders takes place: As in the standard Bertrand model, the outsiders' price is lower than the insiders' price, the market share of the merging firms decreases.

Reallocation of production from the merging firms to the competitors takes place as shown for Bertrand competition with differentiated products by Werden & Froeb (1994). Such reallocation would be welfare enhancing, if the insiders' market share is low and therefore the average industry price decreases. Werden & Froeb (1994) show that mergers may increase welfare in two cases depending on the reallocation of the output to the entity with lower costs (and thereby, lower price) post-merger<sup>7</sup>: Either the output of outsiders increases substantially post-merger as the outsiders are large or the insiders have lower costs post-merger than pre-merger (e.g. through the realisation of efficiency gains). Both effects would lead to reallocation of output in the cases of a high cross-elasticity of demand, i.e. a high substitutability of the products, and

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<sup>7</sup>Werden & Froeb (1994) argue that the industry average price may fall if reallocation of output to the lower priced products occurs post-merger even though every single price rises. Though consumer surplus rises as every price rises, producer surplus may outweigh this effect and lead to a positive net welfare effect. Kao & Menezes (2010), however, find that the increase in producer surplus does not outweigh the loss in consumer surplus: Upon the realisation of efficiency gains, the insiders have incentives to produce more and to underprice the insiders. Given this underpricing behaviour, the increase in producer surplus does not outweigh the loss in consumer surplus, leading to a negative effect on total welfare.

little substitution to an outside good.

Taking into account cost asymmetry, prices increase post-merger in Li (2012)'s duopoly framework, whenever the firms have the incentive to merge. From a total welfare point of view, the monopoly-induced price increases cannot be outweighed by the higher producer surplus in Li (2012)'s duopoly framework. Hence, total welfare decreases as a result of the merger.

## 2.2. Uncertainty and Risk Aversion

While uncertainty can persist with respect to numerous business decisions (e.g. R&D success, price uncertainty), two general cases of uncertainty, demand uncertainty and cost/efficiency gains uncertainty, are in the focus of this analysis.<sup>8</sup> In the first case, demand uncertainty, (all) market participants are uncertain about the (common) demand intercept, while in the second case, cost uncertainty, the uncertainty is focused on the private cost or efficiency parameter of an individual firm. Adding risk-averse behaviour<sup>9</sup>, the firms' best response strategy to uncertainty is always to perform well in low-profit-states, irrespective of the prevailing type of uncertainty (Asplund, 2002). However, the actions necessary to *pursue* the best response strategy become more difficult to analyse when taking into account differing underlying information structures and the rivals' best response to new information in an oligopoly framework.

Important to note is the interdependence of demand and cost uncertainty: If one firm is uncertain about its costs ex-ante and, therefore, about its pricing decision, its rivals are uncertain about their residual demand as they are uncertain about the price of the cost-uncertain firm (Kühn & Vives, 1995).

### Demand Uncertainty

In a general model, Sandmo (1971) and Baron (1970) analysed additive uncertainty (i.e., an additive uncertain parameter in the firm's utility function) for the case of competitive firms facing price uncertainty and found that a risk-averse competitive firm would produce less when facing uncertain demand.<sup>10</sup> The lower outputs are caused by the risk premium which increases as firms become more risk-averse as discussed below. Batra & Ullah (1974) and Hartman (1976) extended the analysis and find that the result only holds when all factor inputs are chosen at the same time before the observation of the realised price. These general findings have been extended in several aspects.

Most important for this paper, Baron (1971) extended the analysis to Bertrand competition.

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<sup>8</sup>In addition to cost and demand uncertainty, uncertainty can be modeled for other variables as well. As one example, Janssen & Rasmusen (2002) introduce uncertainty about the number of competing firms. As the probability of other firms being inactive increases, firms increase their prices and positive industry profits increase. Likewise, as the probability of competition or the number of firms increases, industry profits decrease.

<sup>9</sup>See Fügemann (2017) for a discussion of reasons, why firms may behave risk-averse.

<sup>10</sup>Leland (1972) confirmed these findings for a more general uncertainty assumption.

While Mills (1959, 1962) had already shown that the price of a risk-averse monopolistic firm is lower in order to reduce the expected loss from discarding unsold output, Baron (1971) specifically investigated the effect of demand uncertainty on a risk-averse firm competing under Bertrand competition. He finds that in case the common demand intercept is uncertain, the price a firm sets is a decreasing function of the absolute risk aversion index assuming a risk-averse firm with constant marginal costs. As the firm becomes more risk-averse, the price decreases, which increases expected output. Therefore, the higher the risk aversion, the higher the output of a risk-averse firm. From a decision theory point of view, an increase in risk aversion causes a reduction in the decision variable "price" in order to reduce risk, in contrast to the findings by Sandmo (1971) and Baron (1970).

Jin & Kobayashi (2016) extend the analysis to a quantitative evaluation of the impact of risk aversion in Bertrand competition. They confirm that the price a firm sets decreases in its risk aversion in order to limit its risk exposure: The effects of risk aversion resemble the effects, which a firm faces from changes in its cost structure. Lower risk aversion related to an uncertain demand parameter has the same effects on firm behaviour as higher costs and induces a firm to increase its prices and to produce less.<sup>11</sup>

### **Cost Uncertainty**

In contrast to the case of demand uncertainty, cost uncertainty focuses on the *private* cost parameter and rivals' reactions to the individual firm's cost uncertainty. In a Bertrand model with homogeneous products, efforts have been made to eliminate the Bertrand paradox by introducing uncertainty and risk aversion mechanisms, which may lead to positive expected profits. Spulber (1995) assumes asymmetric information about rivals' costs. In this case, competitors price above marginal costs, which results in positive expected profits and thereby leads to price competition and the entry of new firms. As a result, the positive expected profits diminish as the number of firms increases. Introducing cost uncertainty, Wambach (1999) shows that the Bertrand paradox can be eliminated even if the number of firms is high, i.e. after the possible entry of new firms. He finds that increases in uncertainty -and risk aversion- lead to price increases as firms are afraid of taking over the entire market if the possibility of incurring higher losses exists, even if expected profits would increase. Following Wambach (1999), Cheng (2002) extends this work to take account of the effect that the degree of cost uncertainty might be different for the firms in the industry and also finds that the industry prices will exceed marginal costs.

In a summarising paper, Asplund (2002) concludes that risk-averse firms would like to perform well in low profit states. For the case of cost uncertainty, the firms' best response to uncertainty

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<sup>11</sup>Jin & Kobayashi (2016) show that the resulting allocative inefficiency, i.e. the drop in consumer surplus and total welfare, can be mitigated by imposing a lower tax rate on the firm. The tax break lowers the firm's costs and thereby counterbalances the effect of the lower risk aversion.

is to set higher prices, leading to higher price-cost margins. For the case of demand uncertainty, the best response is to set lower prices, which confirms the findings of the previous literature (e.g. Baron, 1971). These findings follow from the firms' intuition to perform well, when uncertainty realisation might decrease profits (i.e. low-profit states): Firms increase (cost uncertainty) or decrease (demand uncertainty) their prices from the level that maximises profit in order to reduce the variance of their risk. The firm is willing to sacrifice an amount of expected profits, the *risk premium*, in order to eliminate the risk and obtain the expected profit with certainty.

Anderson, Freeborn & Hulbert (2012) distinguish the cases of substitutes and complements for Bertrand competition. In the former case, companies facing risk aversion tend to price lower than if they were not exposed to risk aversion. Thereby, they limit the risk to be underpriced by the rival. At the same time, they avoid a "low profit state" as in Asplund (2002). In the latter case, companies facing risk aversion behave collusively, i.e. they follow their rival's pricing pattern. The authors also find that risk averse players generally price lower than risk-lovers, again with the objective to avoid low profit states.

Banal-Estañol & Ottaviani (2006) introduced the analysis of risk aversion in a horizontal merger setting. However, unlike my analysis, they focus on the best division of ownership (i.e. takeover versus equal division of ownership) in cases of risk-averse firm mergers. They find that risk aversion leads to a higher probability for the insiders to increase prices post-merger for the case of cost uncertainty and demand uncertainty post-merger. Their results are driven by the (larger) merged firm's possibility to take on more risk in contrast to the pre-merger set of (smaller) firms. From an empirical perspective, Bremer, Hoshi, Inoue & Suzuki (2017) compared the merger activity of risk-averse firms<sup>12</sup> to less risk-averse firms by analysing 4796 mergers between 2000 and 2009 from 17 countries. They find that the former engage less in merger activities. Also, risk-averse firms pay a higher control premium, thereby lowering their merger profitability. Frijns, Gilbert, Lehnert & Tourani-Rad (2013) come to similar findings on the merger activity, but additionally conclude that higher expected efficiency gains are necessary for mergers to take place in an risk-averse environment.

### **2.3. Information Sharing**

The information sharing literature has focused on the question whether the sharing of private information is profit-enhancing for the revealing party (i.e. whether incentives to share private information about a random variable exist). The literature also distinguishes between uncertainty about a common variable (i.e. uncertainty affecting all participants, e.g. demand) and a private variable (i.e. uncertainty affecting only one firm or each firm individually, e.g. cost). Furthermore, the literature distinguishes between the case, in which the signal about the real-

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<sup>12</sup>The authors distinguish between firms from nations with a high uncertainty avoidance index as defined by Hofstede, Hofstede & Minkov (2010) and firms from nations with a low uncertainty avoidance index.

isation of one firm's uncertainty (i.e. the random variable) does or does not infer information about other firms' realisation of their random variable (Raith, 1996).<sup>13</sup>

In an industry of  $i, j \dots n$  competing firms, the sharing of information has three principal effects. First, from the standpoint of firm  $i$ , the firm is better informed due to the new information it receives from its competitors,  $j \dots n$ , and can react optimally on the new information. Second, the competitors react on the new information they receive from firm  $i$ . Third, the reaction of the competitors on the new information obtained from firm  $i$  might alter the best response of firm  $i$ . It has long been debated which effect incentivises the firm to reveal its private information (e.g. Raith, 1996; Vives, 2002; Gal-Or, 1986, 1985). While the first effect is always positive (new information is always good), this channel is shut off when considering unilateral information revelation, i.e. when only one firm reveals information to its competitors and does not obtain new information from its competitors. The effects of the second and third channel crucially depend on the type of uncertainty as well as the slope of the reaction functions under consideration. In this paper, I focus on Bertrand competition with strategic complements, i.e. upward sloping reaction functions, and summarize the previous findings in the information sharing literature below.

If the information is correlated, Cho & Jun (2013) show that concealing information is optimal as the additional information received (i.e. the first effect of information sharing as explained above) is outweighed by the negative competitive reaction of competitors in the case of substitutes (i.e. the second and third effects of information sharing explained above).

Amir, Jin & Troege (2010) generalised the information setup by assuming information to be firm-specific when extending Gal-Or (1986) and Raith (1996) to an asymmetric oligopoly. In their setup, the information / decision variables as well as the signals are uncorrelated, i.e. the information revealed by one firm only informs the other firms about the revealing firm's demand and cost structure. The other firms cannot infer any information about their own demand or cost structure from such revelation strategy. All information learned comes from the information revealed by one firm. Amir, Jin & Troege (2010) find robust results for the cases described below.

## **Demand Uncertainty**

Vives (1984) started the analysis of sharing private information under Bertrand competition assuming that the private information relates to an uncertain demand parameter. Due to the sharing of private information on an uncertain demand parameter, rivals are better informed about the demand realisation and the correlation in the decision variable is aligned (Gal-Or, 1985): For

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<sup>13</sup>Raith (1996) reclassifies the notion of private variables in that he differentiates between models, in which the shocks are independent, i.e. information about one shock does not information about another shock, and models, in which the information revealing firm is perfectly informed about the uncertain parameter.

example, if one firm observes high industry demand and communicates this information, all firms will set higher prices under Bertrand competition.

The first effect (better information) increases expected profits, whereas the profitability of the second effect (alignment of the correlation of the decision variable) depends on the slope of the reaction curves. For strategic complements considered in this paper, a price increase of one firm increases the marginal revenues of the competitors, as they have the incentive to increase their prices as well (Bulow, Geanakoplos & Klemperer, 1985). Consequently, information sharing is unambiguously profitable since both effects increase the profits of the firms.<sup>14</sup>

This effect is confirmed by Amir, Jin & Troege (2010), who similarly to Jin & Kobayashi (2016) argue that demand uncertainty in Bertrand competition induces the same firm behaviour as changes in the firm's cost structure: A positive demand shock has the same effects as a decrease in costs. The authors find that revealing private demand information is always a dominant strategy: In case of low (high) demand, competitors will price higher (lower) in the case of complements, and lower (higher) in the case of substitutes. The firm anticipates this reaction of the competitors and aligns its pricing behaviour dependent on the competitive situation to maximise its profit.

### **Cost Uncertainty**

Gal-Or (1986) first analysed the case of cost uncertainty in a duopoly framework and finds that firms have incentives to conceal their private information about their costs: If one firm has high costs and increases its price, rivals react by decreasing prices. While again the accuracy of (rival's) information is increased through sharing, a reduction in the correlation of the decision variable would be the outcome: Assuming a symmetric oligopoly setting (all firms have the same marginal cost level  $c$ ), firm  $i$  is unaware about this cost level. All other firms acquire information about  $c$ , and will set higher prices in high cost states, thereby reducing output, and lower prices in low cost states, thereby increasing output. Expected outputs remain unchanged, so that the optimal price set by the remaining firm  $i$  is unchanged. Firm  $i$  gains from the increased information of other firms in high cost states and loses in low cost states: In high cost states, other firms will increase their prices thus increasing residual demand for firm  $i$ . Firm  $i$  gains by selling more units at the same price as before. When costs are low, other firms gain market share by selling at lower prices, leading to lower residual demand and lower sales for firm  $i$ . Considering the net effect from this direct externality from other firms acquiring information, the uninformed firm  $i$  has lower expected profits on average (Kühn & Vives, 1995). Hornig & Stadler (2006) provided the analytical proof that concealing private cost information

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<sup>14</sup>For strategic substitutes, the second effect is negative. It outweighs the precision effect in the case of fairly homogeneous goods. With more differentiated goods, in contrast, the precision effect dominates since there is less intense competition, implying that the adverse effect of a higher correlation of strategies is smaller.

is always the dominant strategy in oligopolies competing under Bertrand competition, because price competition can be softened and expected profits increased.

Sakai (1986) extended the analysis to an asymmetric duopoly model, in which different demand and cost structures prevail. Specifically, each firm initially has some information about its own costs or demand. Due to e.g. different sources of uncertainty, however, they receive differing signals about their demand or costs. He finds that additional information may be harmful if the two products are strong substitutes or complements, but firms would reveal private information in intermediate cases.<sup>15</sup>

Amir, Jin & Troege (2010) confirm that concealing private cost information is a dominant strategy in their general asymmetric oligopoly framework, arguing that revealing high (low) costs leads competitors to increase (decrease) the prices of substitutes and decrease (increase) the prices of complements. The firm, which shares private cost information, prices higher than it would otherwise. The firm's decision variable is the price margin and concealing private cost information thereby increases the price margin, which is profit-maximising under Bertrand competition.<sup>16</sup>

Brito, Pereira & Varela (2016) analyse partial cost information sharing patterns in a Bertrand framework with asymmetric firms. If firms face an efficient rival, firms set a higher price under partial information revelation, and a lower price otherwise. Put differently, if the firms knew that the rival was efficient (i.e. if the rival fully revealed its information), they would reduce their price. This lower pricing behaviour of the less efficient firm as induced by the full information revelation of the efficient firm redistributes market share to the less efficient firm. Vice versa, if firms face an inefficient firm and obtain full information about its inefficiency, they increase their prices. Again, market share is redistributed to the less efficient firms.

Analysing the effects of information sharing on the profitability of horizontal merger from an empirical perspective, Dutordoir, Roosenboom & Vasconcelos (2014) find that revealing private information about efficiency gains increases merger profitability in terms of higher stock returns as explained above, in addition to inducing favorable merger clearance decisions by the competition authorities.

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<sup>15</sup>If the demand (or cost) shocks are negatively correlated and the products are substitutes, when a certain firm receives a signal that indicates that its own demand (or cost) will be high (or low), it is keen to share that signal with its rival since the signal suggests that the latter's demand (or cost) will be low (or high). This happens precisely, when the firm values such a reduction in its rival's output most highly, i.e. when its own demand (or cost) is low (or high). Conversely, if it receives a signal that its own demand (or cost) is low (or high), revealing this information is not harmful since its profits would have been small anyway and the reduction in profits would not be high.

<sup>16</sup>Profit is proportional to the squared price margin under Bertrand competition.

### 3. The Model

In order to model and assess the effects of risk aversion, uncertainty, and information sharing on the incentives to merge, I analyse four different cases, each differing as regards their information structure, as outlined below and analysed in section 4.

In the first case (section 4.2), neither the merging firms ("insiders") nor the non-merging firms ("outsiders") are informed *ex ante* about the insiders' efficiency gains induced by the merger. In the second case, only the merging firms are perfectly informed (section 4.3), while in the third case, the merging firms share their private information about their efficiency gains with the outsiders (also section 4.3). In the fourth case (section 4.4), the merging firms *ex ante* only receive a noisy signal about their efficiency gains, which they can further dilute when informing outsiders (e.g. Gal-Or, 1985, 1986).

In each of these cases, the merging firms as well as the non-merging firms engage in a five step game: In the first step, in an industry of  $n$  risk-averse firms producing differentiated products,  $k$  firms exogenously decide to merge; subsequently they form the insiders, which generate stochastic efficiency gains,  $\tilde{\delta}$ , as a result of the merger. The remaining  $n - k$  firms form the outsiders post-merger. In the second step, insiders commit to their information revelation strategy, i.e. whether to conceal, reveal or partially reveal the private information they will receive in a third step. In a fourth step, the insiders conceal or (partially) reveal the private information they received in the third step according to the information revelation strategy they determined in step two. At last, in step five, the firms compete under Bertrand competition.

This game structure assumes that the insiders commit to an information revelation strategy prior to obtaining private information about their efficiency gains. This assumption is based on the fact that in reality merging firms also have to decide on their information revelation strategy with the competition authority (even prior to the merger!), when they only have expectations about the efficiency gains and before knowing them precisely, in order to obtain merger clearance. Also, this assumption is well-established in the information sharing literature as well as in the horizontal merger literature (e.g. Gal-Or, 1985, 1986).

Firms maximise their utility subject to their utility function  $U(\pi) = -e^{-R\pi}$ . According to this utility function, firms are exposed to constant absolute risk aversion (CARA). Constant absolute risk aversion assumes that a firm's degree of risk aversion is constant with regards to wealth or initial capital endowment.  $R$  is the risk aversion coefficient, defined as  $R = -\frac{U''}{U'}$ . According to Pratt (1964), the effect of risk aversion can be measured in the form of a risk premium, modeled as half time the risk aversion coefficient times the risk involved, i.e. the variance of the random profit function:  $\frac{1}{2} \cdot R \cdot \text{Var}(f(\pi[\phi]))$ , where  $\phi$  denotes the random variable under consideration, i.e. uncertain efficiency gains for the insiders and an uncertain demand shock for the outsiders. Intuitively, firms are willing to sacrifice an amount of expected profits in order to eliminate the risk and obtain the expected profit with certainty. The variance of the random

profit function with respect to the random variable under consideration (i.e. demand shock for outsiders, efficiency gains for insiders) can be computed in each case using a Taylor expansion series ("Delta Method") leading to  $\frac{1}{2} \cdot R \cdot Var(\pi[\phi]) \approx \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \cdot Var[\phi]$ . As a result, the firms' expected utility becomes,

$$EU(\pi) = -e^{-R \left( E(\pi) - \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \cdot Var[\phi] \right)} \quad (1)$$

where,

$$EU(\pi) = U(E(\pi) - \Delta\pi)$$

and where  $\Delta\pi$  denotes the risk premium (e.g. Baron, 1970).

In order to maximise expected utility, firms maximise the bracket term in the exponent in (1).

$$\max f(\pi[\phi]) - \frac{1}{2} \cdot R \cdot (f'(\pi(E[\phi])))^2 \cdot Var[\phi] \quad (2)$$

The firm's profit function,  $f(\pi)$ , can be derived from the consumer utility function,  $U(x)$ , and the implied inverse demand function,  $p(x)$ . Consumers follow a usual linear-quadratic utility function (e.g. Vives, 1985; Friedman, 1977),

$$U(x) = a \sum_{i=0}^n x_i - \frac{1}{2} \left( b \sum_i x_i^2 + 2d \sum_{j \neq i} x_i x_j \right) \quad (3)$$

where  $b, d > 0, b > d, b + (n-1)d > 0$  to ensure that  $U(x)$  is strictly concave (Vives, 2001).

This leads to the inverse demand function,

$$p(x) = a - bx_i - dX_{-i} \quad (4)$$

and after rearranging,

$$x_i = \alpha - \beta p_x + \gamma p_{-i} \quad (5)$$

where  $\alpha = \frac{a}{b+(n-1)d}$ ,  $\beta = \frac{b+(n-2)d}{(b+(n-1)d)(b-d)}$ , and  $\gamma = \frac{d}{(b+(n-1)d)(b-d)}$  and therefore,  $\beta + \gamma > 0$  and  $\beta - (n-1)\gamma > 0$ .

As a result and assuming constant marginal costs  $c^{17}$ , the firms' pre-merger profit function becomes,

$$\pi = (p_i - c) \cdot (\alpha - \beta p_i + \gamma p_{-i}) \quad (6)$$

Post-merger, the insiders generate (random) efficiency gains  $\tilde{\delta}$ , which directly affect marginal costs,  $(1 - \tilde{\delta})c$ . Importantly, the uncertainty about the efficiency gains achieved by the merging firms and induced by the horizontal merger translates into a residual demand uncertainty for the outsiders, i.e. the outsiders are unaware of the price the insiders set and accordingly the demand the insiders claim as well as the residual demand the outsiders themselves can claim. Accordingly, the outsiders are exposed to an endogenous random demand shock,  $\theta_i$ . For each type of stochastic shock, efficiency gains and demand, the distributional properties coincide as  $Var = \sigma^2$  and  $Cov(\phi_i, \phi_j) = \rho\sigma^2$  for  $i \neq j$ <sup>18</sup>. The shocks are positively, independently or negatively correlated depending on whether  $\rho \gtrless 0$  see e.g. Raith, 1996. Post merger, the insiders' and outsiders' expected profit functions include the risk premium and become,

$$E(\pi_t) = \sum_{t=1}^k (\alpha - \beta p_t + \gamma p_{-t}) \cdot (p_t - (1 - \tilde{\delta})c) - \frac{R\sigma^2(1 + \rho(k-1))c^2(\alpha - \beta p_t + \gamma p_{-t})^2}{2} \quad (7)$$

$$E(\pi_i) = \sum_{i=1}^{n-k} (\alpha - \theta_i - \beta p_i + \gamma p_{-i}) \cdot (p_i - c) - \frac{R\sigma^2(p_i - c)^2}{2} \quad (8)$$

In case the insiders or the outsiders are informed about the insiders' efficiency gains, the random term drops out in the respective profit function. Likewise, the risk premium drops out, because  $\sigma^2$ , the risk variance, becomes zero. In the following sections, the insiders' merger incentives are analysed in detail, while different information structures are imposed. At first, the pre-merger case is evaluated. This case serves as a benchmark against all merger cases analysed in the following sections. In section 4.2, both, insiders and outsiders, are unaware of the insiders' efficiency gains generated in the course of the merger. In section 4.3, the insiders know their

<sup>17</sup>The effects of marginal cost,  $c$ , and efficiency gains,  $\delta$ , are analysed separately in the further analysis. Accordingly, symmetric marginal costs do not infer any information about efficiency gains achieved by the insiders as a result of the merger.

<sup>18</sup>These distributional properties are assumed in sections 4.1 through 4.3 and alternated and precised for partial information sharing in section 4.4 to take account of the insiders' influence on the signal shared with the outsiders.

efficiency gains and have to decide whether to fully share this information. At last, in section 4.4, the insiders can dilute the information they communicate to the outsiders.

## 4. Analysis of the Insiders' Merger Incentives

In order to evaluate private merger incentives, the insiders' utility pre- and post-merger has to be evaluated. The post-merger utility depends on the information structure in place, i.e. whether the insiders and/or the outsiders are informed about the insiders' efficiency gains, the size of the efficiency gains, as well as the level of risk aversion the firms are exposed to.

### 4.1. Pre-merger

Pre-merger, all firms have the same marginal costs, because the merging firms generate the efficiency gains only in the course of the merger. In this pre-merger case, all firms are aware of the industry marginal cost level, no firm is exposed to uncertainty and, consequently, risk aversion has no effect in the utility maximisation problem.

The firms' profit function becomes as in (6),

$$\pi = (p_i - c) \cdot (\alpha - \beta p_i + \gamma p_{-i}) \quad (9)$$

Solving the maximisation problem according to (2) in this deterministic setting, the firms' profit becomes,

$$\pi = \frac{(\beta\alpha - c(\beta - \gamma(n-1)))^2(\alpha - c\beta)}{(2\beta - \gamma(n-1))^2} \quad (10)$$

As no firm is exposed to uncertainty, risk aversion has no effect on the firms' utility maximisation problem in (2) and the maximisation of the firms' profit equally solves the firm's expected utility maximisation problem based on (1): Neither insiders nor outsiders include a risk premium in the maximisation of their expected utility.

To evaluate private merger profitability, the merging firms' result from the utility maximisation problem post-merger, which is analysed in the following sections, has to be compared to the pre-merger result given by (10).

### 4.2. Insiders and outsiders are unaware of the insiders' efficiency gains

In the merger case,  $k$  firms merge and form the "insiders". All other  $n - k$  firms are the "outsiders". In the following sections, different information structures will be imposed and the

insiders' utility will be evaluated in each case in order to assess the insiders' private merger profitability.

In the first case evaluated in this section, neither the insiders nor the outsiders are aware of the insiders' efficiency gains generated in the course of the merger. Therefore, insiders and outsiders are exposed to a stochastic parameter: The insiders face efficiency gains uncertainty,  $\tilde{\delta}$ , while the outsiders do not know their residual demand with certainty due to the demand shock,  $\tilde{\theta}$ . Given this underlying information structure, insiders and outsiders maximise (2), i.e.  $E(\pi) - \frac{R}{2}Var(\pi)$ , in order to maximise their expected utility function (1). Consequently, their expected profit functions become,

$$E(\pi_t) = \sum_{t=1}^k (\alpha - \beta p_t + \gamma p_{-t}) \cdot (p_t - (1 - \tilde{\delta})c) - \frac{R\sigma^2(1 + \rho(k-1))c^2(\alpha - \beta p_t + \gamma p_{-t})^2}{2} \quad (11)$$

$$E(\pi_i) = \sum_{i=1}^{n-k} (\alpha - \tilde{\theta} - \beta p_i + \gamma p_{-i}) \cdot (p_i - c) - \frac{R\sigma^2(p_i - c)^2}{2} \quad (12)$$

The equilibrium prices become,

$$p_t = \frac{(1 + c^2L)((\alpha + \gamma(n-k)c)N^- + \gamma(n-k)(a - c\beta))(1 + c^2L) + (1 - \delta)cN}{A} \quad (13)$$

$$p_i = \frac{(k\gamma((1 + c^2L)(\alpha + \gamma(n-k)c) + ((1 - \delta)c(\beta - \gamma(k-1)))) + cA}{A} + \frac{(\alpha - c\beta)(\beta - \gamma(k-1))(2 + c^2L)}{A} \quad (14)$$

where,  $L = (\beta - \gamma(k-1))(1 + (k-1)\rho)R\sigma^2$ ,  $N^- = (2\beta - \gamma(n-k-1) + R\sigma^2)$  and  $N = (\beta - \gamma(k-1))N^-$ , and  $A = N + (1 + c^2L)(N - \gamma(n-k)k\gamma)$

Following the maximisation problem in (2), the insiders' expected utility maximisation problem solves to,

$$\left(1 + \frac{1}{2}c^2L\right)(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N^- - ((1 - \delta)cN + \gamma(n-k)(\alpha - c\beta + k\gamma(1 - \delta)c))}{A} \right)^2 \quad (15)$$

In order to assess whether, as in the standard case of Deneckere & Davidson (1985), the merger is privately profitable for the insiders, (15) and (10) have to be compared. As illustrated in Appendix A, this is always the case as long as  $\alpha - \beta c > 0$ , i.e. as long as global demand is sufficiently high.

In the following paragraphs, the effects of risk aversion and efficiency gains on private merger profitability are analysed in detail.

Private merger incentives increase in the level of risk aversion, i.e. the higher the level of risk aversion the higher the private merger profitability. As shown in the previous literature (e.g. Wambach, 1999; Asplund, 2002; Anderson, Freeborn & Hulbert, 2012), risk-averse firms tend to increase prices, thereby softening competition. In a Bertrand merger setting, this behaviour intensifies the standard upward pricing pressure identified by Deneckere & Davidson (1985): Upon the merger, the merging entities have a larger share of the market and would be hurt if they engaged in fierce price competition.

Risk-averse firms facing cost uncertainty give up a portion of the potential demand for the return of higher price-cost margins. Risk-averse firms facing demand uncertainty, however, rather set lower prices (Baron, 1971): Risk-aversion related to uncertain demand induces the same effects as lower costs - the risk-averse firm exposed to demand uncertainty would like to limit its risk exposure and decreases its price (Jin & Kobayashi, 2016).

Efficiency gains have a countervailing effect for the insiders: Upon the realisation of efficiency gains, insiders have the incentives to set lower prices, while outsiders will engage in the same strategy given the nature of strategic complements (Motta, 2004; Röller, Stennek & Verboven, 2006).

Finally, however, as a result of these pricing behaviours caused by risk aversion and efficiency gains, merger profitability increases from both sides: Efficiency gains lead to lower costs and higher price-cost margins, while risk aversion faced by all industry participants leads to higher price-cost margins due to the upward pricing pressure. Consequently, the insiders' result from post-merger utility maximisation (15) is higher than the pre-merger maximisation result (10) as shown in Appendix A.

As in the standard literature of homogeneous products in Bertrand competition, the more homogeneous the products are, the lower the incentives to increase prices and the lower the merger profitability. As the products become more homogeneous, firms cannot raise prices as they lose market share to tough acting competitors. The more homogeneous the products are, the more the price approaches marginal costs.

A further component analysed in the literature is the effect of the size of the industry on merger profitability (Motta, 2004). I find that the larger the industry, the worse off the insiders are as the outsiders' equilibrium price will be below the insiders' equilibrium price. Here, the second mover advantage analysed by Gal-Or (1985) is visible: The outsiders' possibility to react on

a price increase by the insiders gives the outsiders the option to increase prices to a level just below the one of the insiders and benefit more from the merger than the insiders (Deneckere & Davidson, 1985). Therefore, as the industry (and, thereby, the number of tough acting outsiders) grows, the insiders have less incentives to increase the price.

### 4.3. Perfectly informed insiders

This section explores whether the merger incentives of perfectly informed insiders increase if they conceal or reveal the perfect private information which they receive about the realisation of their stochastic efficiency gains. Explicitly, it is assumed that the insiders receive a perfect signal about the realisation of their efficiency gains after the merger. Subsequently, the merging firms conceal or reveal their private information prior to their and the outsiders' pricing decision. The information revelation decision directly infers the uncertainty structure: If the insiders do not share their private information, asymmetric uncertainty persists (i.e. insiders are informed, while outsiders are not). If the insiders reveal their information, insiders and outsiders are not exposed to uncertainty anymore and compete in a deterministic setting. The insiders are perfectly informed about their efficiency gains and therefore maximise their expected profit without being exposed to a risk premium. As before, given this underlying information structure, insiders and outsiders maximise (2), i.e.  $E(\pi) - \frac{R}{2}Var(\pi)$ , in order to maximise their expected utility function (1). For the insiders, who receive a perfect private signal of their efficiency gains,

$$E(\pi_t) = \sum_{t=1}^k \left( \alpha - \beta p_t + \gamma p_{-t} \right) \cdot \left( p_t - (1 - \delta)c \right) \quad (16)$$

If the outsiders are not informed about the realisation of the insiders efficiency gains, their maximisation problem can be derived from (12). If outsiders are informed, their maximisation problem becomes,

$$E(\pi_i) = \sum_{i=1}^{n-k} \left( \alpha - \theta - \beta p_i + \gamma p_{-i} \right) \cdot \left( p_i - c \right) \quad (17)$$

In case the insiders do not inform the outsiders about their perfect private signal, i.e. about their efficiency gains, the equilibrium prices solve to,

$$p_t = \frac{((\alpha + \gamma(n-k)c)N_{conceal}^- + (1 - \delta)cN + \gamma(n-k)(\alpha - c\beta))}{B} \quad (18)$$

$$p_i = \frac{(2(\alpha - c\beta)(\beta - \gamma(k-1))) + cB + k\gamma(\alpha + \gamma(n-k)c + (1-\delta)c)(\beta - \gamma(k-1))}{B} \quad (19)$$

where  $N_{conceal}^- = 2\beta - \gamma(n-k-1) + R\sigma^2$ ,  $N = (\beta - \gamma(k-1))N_{conceal}^-$ ,  $B = 2N - \gamma(n-k)k\gamma$ .

If the insiders inform the outsiders, the equilibrium prices are the same as in (18) and (19) except for the effect of risk aversion, which drops out as neither insiders nor outsiders are exposed to a stochastic term, i.e. they compete in a deterministic setting. Therefore, the term  $N_{conceal}^- = 2\beta - \gamma(n-k-1) + R\sigma^2$  changes to  $N_{reveal}^- = 2\beta - \gamma(n-k-1)$  and the term  $N$  changes accordingly.

In order to determine the insiders' private merger profitability, the solution to the insiders' expected utility maximisation problem is solved in each case (i.e. revealing and concealing information) and the results are compared in order to assess whether the insiders should conceal or reveal their information.

As shown in Appendix B, the result from the insiders' expected utility maximisation problem becomes, if they conceal their information...

$$(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N_{conceal}^- + (1-\delta)cN + \gamma(n-k)(\alpha - c\beta + (1-\delta)ck\gamma)}{B} \right)^2 \quad (20)$$

...and if they reveal the information about the realisation of their private efficiency gains...

$$(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N_{reveal}^- + (1-\delta)cN + \gamma(n-k)(\alpha - c\beta + (1-\delta)ck\gamma)}{B} \right)^2 \quad (21)$$

Comparing these maximisation solutions of the insiders sheds light on the insiders' incentives to conceal or reveal their private information. As in the case of the equilibrium prices, the only difference between concealing and revealing the private efficiency gains information relates to the effect of the risk aversion in  $N_{conceal}^-$  vs.  $N_{reveal}^-$ , where, as before,  $N_{conceal}^- = 2\beta - \gamma(n-k-1) + R\sigma^2$  and  $N_{reveal}^- = 2\beta - \gamma(n-k-1)$ .

As shown in Appendix B, it is easy to see that the insiders have incentives to share their private information; in this case, the outsiders are not exposed to uncertainty anymore and risk aversion does not have an effect. While this result is in contrast to the dominant cost concealing strategy found by Amir, Jin & Troege (2010), the reason can be explained by the different effects risk aversion has on the insiders and the outsiders, an effect not considered by Amir, Jin & Troege (2010). While the cost or efficiency gains uncertainty faced by the insiders leads to an upward pricing pressure of the insiders, the demand uncertainty faced by the outsiders has the oppo-

site effect. Therefore, as the insiders are aware of their efficiency gains, they would like the outsiders to act less tough, i.e. to soften competition and increase their prices given the nature of strategic complements. Again, the sharing of private cost information by the insiders has the opposite effect on the outsiders' pricing behaviour than previously found in the literature (Brito, Pereira & Vareda, 2016) due to the effect of outsiders' exposure to risk aversion, which was not considered by the cited previous literature. The insiders can effectuate a higher pricing strategy by the outsiders by eliminating the effect of outsiders' risk aversion: Insiders need to fully reveal their private information about their efficiency gains. Subsequently, insiders and outsiders compete in a deterministic setting.

Following the insiders' optimal strategy of sharing private information, it needs to be evaluated whether the case in which both, insiders and outsiders, compete under full information is superior, i.e. more profitable for the insiders, to the pre-merger case. This analysis is very similar to the standard Bertrand case of Deneckere & Davidson (1985), only with the additional effect of efficiency gains:  $k$  firms merge in a deterministic setting, where insiders achieve efficiency gains upon the merger. As efficiency gains are profit increasing for the insiders (e.g. Motta, 2004; Röller, Stennek & Verboven, 2006), the insiders' profit and utility maximisation result post-merger (20) will exceed the profit and utility maximisation result of the pre-merger setting (10) as illustrated in Appendix C.

#### 4.4. Partially informed insiders

##### Partial Information Sharing structure

Insiders may receive a noisy signal about their efficiency gains before they make their pricing decision and reveal this signal partially, fully or not at all according to their information revelation strategy. The analysis follows Gal-Or (1985, 1986) in the derivation of partial information signals and sheds light on whether the insiders should dilute the information they have when sharing it with the outsiders (or a competition authority) and what the optimal level of dilution is.

It is assumed that  $\tilde{\delta}$  is a random variable that is normally distributed with mean  $\delta$ <sup>19</sup> and variance  $\eta$ . Before choosing their pricing strategy the merging firms observe a signal for their efficiency gains:

$$z_t = \tilde{\delta} + e_t \tag{22}$$

where  $e_t \sim N(0, m)$  and where  $e_t$  and  $\tilde{\delta}$  are independently distributed.

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<sup>19</sup>Without loss of generality, the mean of  $\delta$  could also be normalized to zero.

When revealing information to the outsiders, the insiders themselves share a signal in the form of:

$$\hat{z}_t = z_t + f_t \tag{23}$$

where  $f_t \sim N(0, s_t)$ .

Prior to receiving their own signal, though, the insiders choose an information revelation strategy following the five stage game. In this case, they choose the amount of noise,  $s_t$ , with which they pass on their private signal e.g. to competition authorities<sup>20</sup>. If  $s_t = 0$ , the insiders perfectly reveal their private information, if  $s = \infty$  the insiders generate infinite noise in their signal so that the informational content of their signal is worthless. If  $0 < s_t < \infty$ , insiders partially reveal their private information.

As discussed previously, the insiders' efficiency gain uncertainty translates into a (residual) demand uncertainty for the outsiders. Accordingly, the insiders' signal conveys information about the realisation of the outsiders' residual demand illustrated in (8). The outsiders' uncertainty might differ among the outsiders, depending on the individual signal they receive. However, given that the uncertainty stems from the same source, i.e. the insiders' efficiency gains, it can be assumed that this information about the realisation of the insiders' efficiency gains received by one outsider is positively correlated with the information received by another outsider. The parameter  $h$  determines this correlation. When  $h = 0$ , private signals are completely uncorrelated<sup>21</sup>. When  $h = \eta$ , the coefficient of correlation between the demand shocks observed by the outsiders is one.<sup>22</sup>

The reported information is subsequently used by each firm to select its pricing strategy. The information set of the insiders is denoted by  $t_t = (z_t, \hat{z}_t, s_t)$  and the one of the outsiders is given by  $t_i = (\hat{z}_t, s_t)$ . Hence, each firm can condition its pricing strategy on its respective information set.

### **Determination of the insiders' partial information revelation strategy**

Following Gal-Or (1985, 1986), I consider only sub-game perfect equilibria. Hence it has to be guaranteed that the strategy choice made by each firm initially remains optimal at the time of

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<sup>20</sup>The assumption is that the insiders have to inform the competition authorities on achievable efficiency gains in order to receive merger clearance: Efficiency gains may increase social welfare (Cumbul, 2011) and thereby increase the probability of merger clearance.

<sup>21</sup>This condition coincides with Raith (1996)'s notion of independent values and, more generally, with Amir, Jin & Troege (2010)'s information structure, where only firm-specific information is revealed and signals are uncorrelated.

<sup>22</sup>Since the source of the uncertainty is the same for all demand shocks, i.e. the insiders' signal about the realisation of its efficiency gains, this case is of particular interest.

the pricing decision. This problem can be solved through backward induction, starting with the pricing decision for a given level of garbling  $s_t$ .

Since both, insiders and outsiders, are still exposed to uncertainty at the time of setting their pricing strategy, the insiders and the outsiders follow (2), where the pricing strategy though specifically depends on the private information set,  $t_t$  and  $t_i$ .

*Proposition:* For given  $s_t$ , the following equilibrium outputs are the unique Nash equilibrium under Bertrand competition of the maximisation sub-game,

$$x_t = C_0 + C_1 z_t + C_2 \hat{z}_i$$

and

$$x_i = B_0 + B_1 \hat{z}_i$$

As shown in Appendix D, the equilibrium price of the merging firms becomes

$$\begin{aligned} C_0 &= \frac{(1 + Lc^2)(\alpha + \gamma(n - k)(\alpha + (\beta - \gamma(n - k - 1) + R\sigma^2)c))}{(2 - Lc^2)(\beta - \gamma(k - 1))A - (1 + Lc^2)\gamma(n - k)\gamma k} \\ C_2 &= \frac{\frac{m}{\sigma + m + (k - 1)h}c}{2 + Lc^2} \\ C_1 &= \frac{\gamma k \gamma(n - k)c \frac{\sigma + m}{\sigma + m + s_t}}{\left(\frac{\beta - \gamma(k - 1)}{1 + Lc^2} - 1\right)((\beta - \gamma(k - 1))A - \gamma(n - k)\gamma k)} \end{aligned} \quad (24)$$

where  $L = (\beta - \gamma(k - 1))(1 + (k - 1)\rho)R\sigma^2$  and  $A = 2\beta - \gamma(n - k - 1) + R\sigma^2$

Since the insiders are still exposed to uncertainty as long as they do not receive a perfect signal for the realisation of their efficiency gains, the maximisation problem is identical to the maximisation problem in section 4.2.

All else equal, the more noise the insiders produce when sharing their private efficiency gains information, the higher the price the insiders set. In contrast, the more information the insiders reveal, the lower the prices the insiders set.

*Proof:* The only pricing component of the insiders affected by the level of information revelation,  $s_t$ , is  $C_1$ . This component  $C_1$  is negative and approaches zero as the level of information revelation decreases, i.e.  $s_t \rightsquigarrow \infty$ .

However, in order to identify the optimal information sharing rule for the insiders to maximise their profit (i.e. maximise private merger profitability), the outsiders' reaction and their influence on the insiders' profit has to be analysed. As shown by Asplund (2002), and while

outsiders will always increase their price, the level of risk aversion is decisive for the insiders' optimal price setting decision: In the case of high risk aversion, a price increase of the insiders would lead to a decrease in the insiders' profit. In the case of low risk aversion, a price increase leads to an increase in the insiders' profit.

Therefore, the insiders' information sharing analysis has to distinguish between different levels of risk aversion and has to take into account the outsiders' reaction to each given level of risk aversion.

### **Low level of risk aversion**

In the case of low risk aversion, a price increase of the outsiders leads to higher profits for the insiders as shown by Asplund (2002). This can best be achieved through a full information revelation strategy:

In the case of low risk aversion, the higher the information revelation of the insiders, the higher the price the outsiders may set. The outsiders set higher prices than they would otherwise have done if they had not known the insiders' private information about the insiders' efficiency gains. The effect is strengthened, the more differentiated the products are.

Therefore, a full information sharing rule is optimal for the insiders in the case of low risk aversion.

*Proof:* For this to be true,  $|C_1| < |C_2|$  or  $C_1 > 0$ . This is the case if the risk aversion is sufficiently low and  $C_1$  can be positive, if the products are differentiated, i.e.  $\beta - \gamma(n-1) > 1$ . Since  $C_1$  is negative or positive depending on the degree of product differentiation (and risk aversion, which is low in this case) and  $C_2$  is positive,  $B_1$  in Appendix D is positive under the assumption laid out first in this proof. The price increasing effect of  $C_2$  (and  $C_1$  if positive) on  $B_1$  is highest in the case of full information revelation, i.e.  $s_t = 0$ . Additionally, if  $R$  is sufficiently low,  $B_0$  is positive, leading to a price increasing behaviour of the outsiders.

### **High level of risk aversion**

In the case of high risk aversion, the insiders would like to set lower prices (see section 4.2); all else equal, they themselves would therefore reveal the information they have.

In the case of high risk aversion, the outsiders tend to set a lower price than in the case of low risk aversion, all else equal.

*Proof:* As  $R$  increases,  $C_0$  becomes negative and affects  $B_0$  negatively. Furthermore,  $|C_1| > |C_2|$ . Since  $C_1$  negative and  $C_2$  positive,  $B_1$  is negative.

The reaction of the outsiders is independent of the insiders' information revelation decision.

*Proof:* An analysis of the outsiders' pricing component  $B_1$  in Appendix D is necessary as only this pricing component of the outsiders is affected by the insiders information revelation strategy. As  $R$  is high, the negative  $C_1$  as well as the positive  $C_2$  approach zero. Both are multiplied by the same term affected by the information revelation strategy,  $\frac{\sigma+m}{\sigma+m+s}$ . Therefore, the direction of the outsiders' pricing decision is independent of the insiders' information revelation strategy and only depends on the term  $\frac{\frac{m}{\sigma+m+(k-1)h}}{2+Lc^2} + \frac{\gamma k \gamma(n-k)}{(\frac{\beta-\gamma(k-1)}{1+Lc^2}-1)((\beta-\gamma(k-1))A-\gamma(n-k)\gamma k)}$ .

## 5. Consumer Welfare Analysis

Upon deciding about merger clearance, competition authorities have to consider the effect of the proposed merger on different stakeholders (e.g. consumers, industry participants, suppliers, etc.). Generally, two welfare standards have evolved to determine which stakeholders should be included in the assessment of the merger.

First, the consumer welfare standard considers consumers to be the decisive stakeholders and promulgates that the consumers shall not be harmed by the effects of a merger. In the US, a merger that increases market concentration might be challenged unless it is expected to deliver cost savings such that the merger becomes beneficial for consumers. In the EU, the EC Merger Regulation stipulates that concentrations are allowed unless they significantly impede effective competition, which is the case if the concentration harms consumers' interests.

Second, the total welfare standard considers the effect of mergers on both, consumers and producers, in the assessment of the merger, stating that the total welfare, i.e. the sum of consumer and producer surplus, should increase post-merger.

As the regulations, and therefore the competition authorities, tend to increasingly apply the consumer welfare standard, the following analysis focuses on this welfare standard.

Technically, for consumer surplus to increase, the industry price level has to decrease post-merger assuming that the number of products offered does not change. Put differently, if all products are sold before and after the merger, a sufficient condition for consumer surplus to increase is that the prices of all products decrease post-merger (Motta, 2004). Alternatively, the industry price level has to decrease post-merger: This implies, either party, insiders or outsiders, have to have the incentive to decrease their prices sufficiently post-merger to compensate a price increase by the other party. It therefore has to be analysed under which conditions the prices increase or decrease post-merger in the cases analysed in section 4. The optimal pricing decision for each information structure is analysed in turn below. In the first case, analysed in section 4.2, neither the insiders nor the outsiders are informed about the insiders' efficiency gains. In the second case, analysed in section 4.3, the insiders are informed about their efficiency gains and fully reveal this information.

### Uninformed insiders and outsiders

In order to analyse under which conditions the industry prices drop or increase post-merger for the case of uninformed insiders and outsiders, (13) and (14) have to be compared to the pre-merger industry price  $p = \frac{\alpha + c(\beta - \gamma(n-1))}{2\beta - \gamma(n-1)}$ .

The insiders' price post-merger is larger than the pre-merger price, since

$$\begin{aligned} & (1 + cL)(\alpha + c(\beta - \gamma(n-1)))(\beta - \gamma(k-1))N^- - \gamma(n-k)\gamma k(\alpha + c(\beta - \gamma(n-1))) \\ & + N(\alpha + c(\beta - \gamma(n-1))) \\ & < \\ & ((1 + cL)((\alpha + \gamma(n-k)c)N^- + \gamma(n-k)(\alpha - c\beta)) + (1 - \delta)cN)(2\beta - \gamma(n-1)) \end{aligned} \quad (25)$$

The outsiders' price post-merger, however, may be below the pre-merger price, if

$$\frac{C}{B} < R\sigma^2 \left(1 + \frac{cL(\beta - \gamma(k-1))((\alpha + c(\beta - \gamma(n-1))) - 1)}{|B|}\right) \quad (26)$$

where,

$$\begin{aligned} C = & (\alpha + c(\beta - \gamma(n-1))((2\beta - \gamma(n-k-1))(\beta - \gamma(k-1)) - \gamma(n-k)k\gamma) - ((\alpha - c\beta)(\beta - \\ & \gamma(k-1)) + k\gamma(\alpha + \gamma(n-k)c)) - (\alpha - c\beta)(\beta - \gamma(n-1)) - k\gamma(1 - \delta)c(\beta - \gamma(k-1)) - c(\beta - \\ & \gamma(k-1))(2\beta - \gamma(n-k-1)) - (2\beta - \gamma(n-k-1))(\beta - \gamma(k-1)) - \gamma(n-k)k\gamma) \end{aligned}$$

and

$$\begin{aligned} B = & -((\alpha + c(\beta - \gamma(n-1))(\beta - \gamma(k-1)) + 1) - (c + (\beta - \gamma(k-1))) + c(\beta - \gamma(n-1))(1 + \\ & \rho(n-1))(2\beta - \gamma(n-k-1))(\beta - \gamma(k-1)) - \gamma(n-k)k\gamma)(\alpha - c\beta - \gamma(n-1)) - 1) \end{aligned}$$

It can easily be verified that both,  $B < 0$  and  $C < 0$ , which leads to a positive independent term in (26). Consequently, the higher the level of risk aversion, the lower the price of the outsiders post-merger and the higher the likelihood that the industry price level post-merger is below the industry price level pre-merger, leading to a positive effect on consumer surplus.

Since  $C < 0$ ,  $C \rightsquigarrow 0$  and as efficiency gains,  $\delta$ , increase, the probability that the post-merger price is below the pre-merger price also increases as both, insiders and outsiders, have the incentive to decrease prices when the insiders generate efficiency gains.

### Informed insiders and outsiders

In order to analyse under which conditions the industry prices drop or increase post-merger for

the case of informed insiders and outsiders, (18) and (19) have to be compared to the pre-merger industry price  $p = \frac{\alpha+c(\beta-\gamma(n-1))}{2\beta-\gamma(n-1)}$ .  $N_{conceal}^-$  has to be substituted by  $N_{reveal}^-$  as analysed in section 4.3.

While it is easy to verify that the insiders' post-merger price is above the pre-merger price, the outsiders' price level may be below the pre-merger price level, which may lead to a decrease in the overall industry price level.

For the outsiders' price to be below the pre-merger price level, i.e.  $(19) < p_i = \frac{\alpha+c(\beta-\gamma(n-1))}{2\beta-\gamma}$ , the products need to be close substitutes leading to  $(\beta - \gamma(n - 1)) > 1$ . The closer substitutes the products are, the higher are the incentives of the outsiders to lower their price to capture more market share.

## 6. Conclusion

The standard Bertrand merger analysis has previously claimed that industry prices increase post-merger and that mergers are always privately profitable for the insiders (e.g. Deneckere & Davidson, 1985). While I maintain the basic assumptions of substitute goods and strategic complements, I relax other critical assumptions of the standard horizontal merger literature by introducing risk-averse behaviour and uncertain efficiency gains and try to explain the effects these have on the insiders' merger incentives, industry prices as well as consumer welfare.

I find that risk aversion and uncertain efficiency gains increase the merger incentives for the insiders: Efficiency gains lead to lower costs and higher price-cost margins for the insiders, while risk aversion also leads to higher price-cost margins due to upward pricing pressure. Homogeneity and industry size have a negative effect on merger profitability as these effects intensify competition: Insiders may lose market share due to tough acting outsiders.

If the insiders are aware of their efficiency gains, it is optimal for them to fully share this information with the outsiders. As the outsiders are informed about the insiders' efficiency gains, they increase prices, thereby softening competition and increasing the insiders' merger profitability. I also find that the insiders have no incentive to partially dilute this information when sharing this information with the outsiders, but should rather fully reveal their private information about their efficiency gains.

As a consequence, competition authorities and firms should put particular emphasis on the evaluation of the size of synergies generated in the course of a merger as well as an understanding of the inherent risk structure of the industry and its participants. Merging firms should understand that e.g. industry-wide caution and crisis have an influence on their optimal strategy. Also, they should fully communicate information about the cost efficiencies to be generated through an intended merger with the competition authority.

From a consumer point of view, while the standard Bertrand analysis asserted that consumers are worse off upon a merger due to increasing industry prices, I find that this may not necessarily

be the case: The outsiders in particular may have the incentive to lower their prices leading to a decrease in the average industry price depending on the level of risk aversion as well as the size of the efficiency gains.

Competition authorities should therefore take into account that under the outlined industry characteristics a merger in a Bertrand industry does not necessarily harm the consumers and the effect on consumers heavily depends on the outsiders' pricing behaviour.

## A. Private merger profitability of uninformed insiders

To maximise expected utility, the firms maximise  $E(\pi) - \frac{R}{2}Var(\pi)$  as shown above. The comparison of the firms' results of their pre-merger maximisation problem, where  $Var(\pi) = 0$ , (10) with the insiders' post-merger maximisation problem (15) sheds light on the insiders' merger profitability.

Hence, for the merger to be privately profitable,

$$\pi = (1 + \frac{1}{2}c^2L)(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N^- - ((1-\delta)c)N + \gamma(n-k)(\alpha - c\beta + k\gamma(1-\delta)c)}{A} \right)^2 \quad (27)$$

needs to exceed

$$\pi = \frac{(\beta\alpha - c(\beta - \gamma(n-1))^2)(\alpha - c\beta)}{(2\beta - \gamma(n-1))^2} \quad (28)$$

where  $L = R\sigma^2(1 + (k-1)\rho)(\beta - \gamma(k-1))$  and  $A = 2N - \gamma^2(n-k)k + c^2L(N - \gamma^2(n-k)k)$ .

Multiplying (27) with the denominator of (28) and re-substituting in  $A$  yields for (27),

$$\begin{aligned} & (1 + \frac{1}{2}c^2L)(\beta - \gamma(k-1))(N^-N^- \alpha\gamma(n-k)c - 2NN^-(1-\delta)c\alpha + 2N^- \alpha^2\gamma(n-k) - \\ & 2N^- \alpha\gamma(n-k)c\beta + 2N^- \alpha\gamma^2(n-k)k(1-\delta)c + N^- \gamma^2(n-k)^2c - \\ & 2NN^- \gamma(n-k)(1-\delta)c^2 + 2\gamma^2(n-k)^2N^-c\alpha - 2N^- \gamma^2(n-k)^2c^2\beta + \\ & 2\gamma^3(n-k)^2kN^-(1-\delta)c^2 + (1-\delta)^2c^2N^2 - 2N(1-\delta)c\gamma(n-k)\alpha + 2N(1-\delta)c^2\gamma(n-k)\beta \\ & - 2N(1-\delta)^2c^2\gamma^2(n-k)k + \gamma^2(n-k)^2\alpha^2 - 2\gamma^2(n-k)^2\alpha c\beta + \\ & 2\gamma^3(n-k)^2k\alpha(1-\delta)c + \gamma^2(n-k)^2c^2\beta^2 - 2\gamma^3(n-k)^2k\beta(1-\delta)c^2 + \\ & \gamma^4(n-k)^2k^2(1-\delta)^2c^2)(4\beta^2 - 4\beta\gamma(n-1) + \gamma^2(n-1)^2) \quad (29) \end{aligned}$$

Multiplying (28) with the denominator of (27) yields for (28),

$$\begin{aligned} & (\beta\alpha^2 - 2c\beta^2\alpha + (2\beta\gamma(n-1)c - \gamma^2(n-1)^2c)(\alpha - c\beta) + \beta^3c^2) \\ & (4N^2 - 4N\gamma^2(n-k)k + 4N^2c^2L - 4NcL\gamma^2(n-k)k + \gamma^4(n-k)^2k^2 - 2NcL\gamma^2(n-k)k + \\ & 2c^2L\gamma^4(n-k)^2k^2 + c^4L^2N^2 - 2c^4L^2N\gamma^2(n-k)k + c^4L^2\gamma^4(n-k)^2k^2) \quad (30) \end{aligned}$$

For the merger to be privately profitable, substituting (30) from (29) needs to yield a positive result.

The result of substituting (30) from (29) can be rewritten in four terms, where the first three depend on previously defined terms, which all incorporate risk aversion:  $\frac{1}{2}c^2L(\beta - \gamma(k-1))$ ,  $N^2$ , and  $N$ . A sufficient condition for the merger to be privately profitable is hence for the sum of the following terms to be positive.

$$D = \frac{1}{2}c^2L(\beta - \gamma(k-1))(N^-(\alpha + \gamma(n-k)c) - (1-\delta)cN + \gamma(n-k)(\alpha - c\beta + k\gamma(1-\delta)c))^2(2\beta - \gamma(n-1))^2 - (c^2L(4 + c^2L)N^2 - 2\gamma^2(n-k)kc^2L(3 + c^2L)N + \gamma^4(n-k)^2k^2c^2L(2 + cL))(\alpha^2\beta - 2\alpha\beta^2c + 2\beta\gamma(n-1)c(\alpha - c\beta) - \gamma^2(n-1)^2c(a - c\beta) + \beta^3c^2)$$

and

$$E = (N^2(\beta - \gamma(n-1))(4\beta c(\beta(1-\delta)^2c - \gamma(k-1)(1-\delta)^2c - 2\alpha(1-\delta) - 2\gamma(n-k)(1-\delta)c + 2\alpha + \gamma(n-1)c) + \gamma^2(n-1)^2((\beta - \gamma(k-1))(1-\delta)^2c^2 - 2\alpha(1-\delta)c - 2\gamma(n-k)(1-\delta)c^2 + 4\alpha c)) - 4\beta(\alpha^2 + \beta^2c^2) + 4\gamma(n-1)\beta^2c^2) + (NN^-(\beta - \gamma(n-1))4\alpha\beta + \alpha\beta\gamma^2(n-1)^2)(\alpha + 2\gamma(n-k)c))$$

and

$$F = N((\beta - \gamma(n-1))4((\beta - \gamma(k-1))(2\beta^2\gamma(n-k)(1-\delta)c^2 - 2\beta\gamma^2(n-k)k(1-\delta)^2c^2 - 2\alpha\beta\gamma(n-k)(1-\delta)c) + 2\alpha\beta\gamma(n-k)(\alpha - \beta c + \gamma k(1-\delta)c + \gamma(n-k)c) + \beta\gamma^2(n-k)^2c(c - 2\beta c + 2\gamma k(1-\delta)c) - \gamma^2(n-k)k(2\alpha\beta c + \gamma(n-1)\beta c^2)) + 2\alpha\gamma^3(n-1)^2(n-k)(\alpha - c\beta + (1-\delta)ck\gamma + \gamma(n-k)c - (\beta - \gamma(k-1))(1-\delta)c) + \gamma^3(n-1)^2(n-k)c(\gamma(n-k)c - 2\beta\gamma(n-k)c + 2\gamma^2k(n-k)(1-\delta)c + 2\beta^2(1-\delta)c - 2\beta\gamma(k-1)(1-\delta)c - 2\beta\gamma k(1-\delta)^2c + 2\gamma^2(k-1)k(1-\delta)^2c) + 4\gamma^2(n-k)k(\beta(\alpha^2 + \beta^2c^2) - \gamma(n-1)(\beta^2c^2 + \gamma(n-1)\alpha c)))$$

and

$$G = (\beta - \gamma(k-1))\gamma^2(n-k)^2(4\beta(\alpha^2\beta - 2\alpha\beta^2c + 2\alpha\beta\gamma k(1-\delta)c + \beta^3c^2 - 2\beta^2\gamma k(1-\delta)c^2 + \beta\gamma^2k^2(1-\delta)^2c^2 - \alpha^2\gamma(n-1) + 2\alpha\beta\gamma(n-1)c - 2\alpha\gamma^2(n-1)k(1-\delta)c - \beta^2\gamma(n-1)c^2 + 2\beta\gamma^2(n-1)k(1-\delta)c^2 - \gamma^3(n-1)k^2(1-\delta)^2c^2) + \gamma^2(n-1)^2(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2)) - \gamma^4(n-k)^2k^2(\alpha^2\beta - 2\alpha\beta^2c + 2\alpha\beta\gamma(n-1)c - 2\beta^2\gamma(n-1)c^2 - \alpha\gamma^2(n-1)^2c + \beta\gamma^2(n-1)^2c^2 + \beta^3c^3)$$

, where  $L = (\beta - \gamma(k-1))(1 + (k-1)\rho)R\sigma^2 > 0$ ,  $N = (\beta - \gamma(k-1)) > 0$  and  $N^- = 2\beta - \gamma(n-k-1) + R\sigma^2 > 0$ .

### Analysis of the term $D$

The term  $D$  can be broken down into individual components  $D.1$  to  $D.4$  as follows.

$$D.1 = \frac{1}{2}c^2L(\beta - \gamma(k-1))(N^-(\alpha + \gamma(n-k)c) - (1-\delta)cN + \gamma(n-k)(\alpha - c\beta + k\gamma(1-\delta)c))^2(2\beta - \gamma(n-1))^2$$

$$D.2 = -c^2L(4 + c^2L)N^2(\alpha^2\beta - 2\alpha\beta^2c + 2\beta\gamma(n-1)c(\alpha - c\beta) - \gamma^2(n-1)^2c(a - c\beta) + \beta^3c^2)$$

$$D.3 = 2\gamma^2(n-k)kc^2L(3 + c^2L)N(\alpha^2\beta - 2\alpha\beta^2c + 2\beta\gamma(n-1)c(\alpha - c\beta) - \gamma^2(n-1)^2c(a - c\beta) + \beta^3c^2)$$

$$D.4 = -\gamma^4(n-k)^2k^2c^2L(2 + cL)(\alpha^2\beta - 2\alpha\beta^2c + 2\beta\gamma(n-1)c(\alpha - c\beta) - \gamma^2(n-1)^2c(a - c\beta) + \beta^3c^2)$$

$D.1$  is positive as  $L > 0$  and the bracket terms are squared.

$D.2$  can be simplified to,

$$D.2 = N^2Lc^2(-4\beta(\alpha^2 - 2\alpha\beta c + \beta^2c^2) - L\beta c^2(\alpha^2 - 2\alpha\beta c + \beta^2c^2) - 4\gamma(n-1)c(\alpha - c\beta)(2\beta - \gamma(n-1)) - \gamma(n-1)c^3L(\alpha - c\beta)(2\beta - \gamma(n-1)))$$

Given that  $N^2 > 0, L > 0, c > 0, (\alpha^2 - 2\alpha\beta c + \beta^2c^2) > 0, (\alpha - c\beta)(2\beta - \gamma(n-1)) > 0$ , the term  $D.2 < 0$ .

$D.3$  can be simplified to,

$$D.3 = 2\gamma^2(n-k)kc^2L(3 + c^2L)N(\alpha - 2\beta c)\alpha\beta + (2\beta\gamma(n-1) - \gamma^2(n-1)^2c)(\alpha - \beta c) + \beta^3c^2$$

Or,

$$D.3 = 2\gamma^2(n-k)kc^2L(3 + c^2L)N(\alpha - \beta c)(\alpha\beta + 2\beta\gamma(n-1) - \gamma^2(n-1)^2c - \beta^2c)$$

$2\gamma^2(n-k)kc^2L(3 + c^2L)N$  is positive. Since  $\beta - \gamma(n-1) > 0$ , and if  $\alpha - \beta c > 0$ , the last bracket term is positive and hence,  $D.3$  is positive.

$D.4$  can be simplified to,

$$D.4 = (2c^2L\gamma^4(n-k)^2k^2 - c^4L^2\gamma^4(n-k)^2k^2)(-\alpha^2\beta + 2\alpha\beta^2c - \beta^3c^2 - \gamma(n-1)c(\alpha - c\beta)(2\beta - \gamma(n-1)))$$

The first bracket term,  $(2c^2L\gamma^4(n-k)^2k^2 - c^4L^2\gamma^4(n-k)^2k^2)$  or simplified,  $(2 - c^2L)c^2L\gamma^4(n-k)^2k^2$  becomes negative as the marginal cost level as well as risk aversion and uncertainty increases. The second bracket term is negative. Hence, the multiplication of the bracket term leads to  $D.4 > 0$ .

### **Analysis of the terms $E$ and $F$**

The sum of the terms  $E$  and  $F$  can be broken down into six individual components,  $E.F.1$  to  $E.F.6$ :

$$E.F.1 = N(\beta - \gamma(n-1))(4\beta(2\beta - \gamma(n-k-1))(\alpha^2 + 2\alpha\gamma(n-1)c + 2\alpha\beta c - 2\alpha\beta c(1-\delta) + 2\alpha\gamma(k-1)(1-\delta)c - 2\beta\gamma(k-1)(1-\delta)^2c^2 + \beta^2(1-\delta)^2c^2 + \gamma^2(k-1)^2(1-\delta)^2c^2 + (\beta - \gamma(k-1))(\gamma(n-1)c^2 - 2\gamma(n-k)(1-\delta)c^2))$$

$$E.F.2 = N(\beta - \gamma(n-1))(4\beta(\gamma(n-k)c(2\alpha\gamma(k-1)(1-\delta) - 2\alpha\beta(1-\delta) + 2\alpha\gamma k(1-\delta) - 2\alpha\gamma k + 2\gamma^2(n-k)k(1-\delta) - 2\beta\gamma(n-k)c + 2\alpha\gamma(n-k) - 2\alpha\beta)))$$

$$E.F.3 = N(2\beta - \gamma(n-k-1))\gamma^2(n-1)^2((\beta - \gamma(k-1))^2(1-\delta)^2c^2 + 4\alpha\beta c + \alpha^2\beta - 2\alpha\beta(1-\delta)c + 2\alpha\gamma(k-1)(1-\delta)c - 4\alpha\gamma(k-1)c + 2\alpha\beta\gamma(n-k)c - 2\beta\gamma(n-k)(1-\delta)c^2 + 2\gamma^2(n-k)(k-1)(1-\delta)c^2)$$

$$E.F.4 = -N(2\beta - \gamma(n-k-1))(4\beta(\beta - \gamma(k-1))(\alpha^2\beta + \beta^3c^2 - \gamma(n-1)\beta^2c^2))$$

$$E.F.5 = 2\gamma(n-k)(\alpha\gamma^2(n-1)^2 + 2\alpha^2\beta\gamma k + \alpha\gamma^3(n-1)^2k(1-\delta)c - \alpha\beta\gamma^2(n-1)^2c(1-\delta) - \beta\gamma^3(n-1)^2(n-k)c^2 + 2\beta^2\gamma kc^2 - 2\alpha\gamma^3(n-k)^2kc + \gamma^5(n-1)^2(n-k)k(n-1)(1-\delta)c^2 + \beta\gamma^3(n-1)^3(1-\delta)c^2 - 2\beta^2\gamma^3(n-1)^2kc^2 - \gamma^2(n-k)k(1-\delta)^2c^2(\beta - \gamma(k-1)) - \alpha\beta\gamma^2(n-1)^2c + \alpha\gamma^3(n-1)^2(n-k)c + \alpha\gamma^3(n-1)^2(k-1)(1-\delta)c - \beta\gamma^3(n-1)^2(k-1)(1-\delta)c^2)$$

$$E.F.6 = \gamma^5(n-1)^3(n-k)^2c^2$$

Given that  $\gamma > 0$ ,  $E.F.6 > 0$ .

Given that  $\beta - \gamma(n-1) > 0$ , and  $\beta, \gamma > 0$ , and if  $\alpha > \beta c$ , then  $E.F.2 > 0$ .

As  $\alpha > \beta c$  and  $\beta - \gamma(n-1) > 0$ , where  $\beta, \gamma > 0$ , it follows that  $4\alpha c(\beta - \gamma(k-1)) > 2\alpha(1-\delta)c(\beta - \gamma(k-1)) + 2\gamma(n-k)(1-\delta)c^2(\beta - \gamma(k-1))$  and  $E.F.3 > 0$ .

$E.F.5 > 0$  since, first,  $\gamma^3(n-1)^2(k-1)(1-\delta)c^2(\gamma^2(n-k)k - \beta) > \gamma^2(n-k)(k-1)(1-\delta)^2c^2(\beta - \gamma(k-1))$ , assuming  $\gamma^2(n-k)k - \beta > 0$ , given that  $(1-\delta) > (1-\delta)^2$  and  $\gamma^3(n-1)^2 > \gamma(n-k)$ . Second,  $\alpha\gamma^3(n-1)^2(n-k)c > (\beta - \gamma k)\alpha\gamma^2(n-1)^2c(1-\delta)c$ , given the efficiency gains component on the right-hand side and as  $\beta - \gamma k \leq \gamma(n-k-1)$  and  $\gamma(n-k) > \gamma(n-k-1)$ . Third,  $E.F.5$  is positive as the additional unambiguously positive terms  $2\alpha\gamma k(\alpha\beta - \gamma^2(n-k)^2c)$ ,  $\alpha\gamma^2(n-1)^2$ , and  $\alpha\gamma^3(n-1)^2(k-1)(1-\delta)c$  exceed the term  $(1 - \gamma(n-1)^2)2\beta^2\gamma kc^2$ , which is only a necessary condition if  $1 < \gamma(n-1)^2$ .

The sum of  $E.F.1$  and  $E.F.4$  is positive. Both,  $E.F.1$  and  $E.F.4$ , are multiplied by the positive terms  $N(2\beta - \gamma(n-k-1)4\beta$  and  $E.F.1$  by  $\beta - \gamma(n-1)$  and  $E.F.4$  by  $\beta - \gamma(k-1)$ , where  $n \geq k$ . First,  $\beta^2(1-\delta)^2c^2 + \beta\gamma(n-1)c^2 \approx 2\beta\gamma(n-1)(1-\delta)c^2$ . Second,  $2\alpha\beta c > 2\alpha\beta(1-\delta)c$ , given that  $\delta > 0$ . At the same time,  $\gamma^2(k-1)^2(1-\delta)^2c^2 < \gamma^2(k-1)(n-1)c^2$ , again due to the efficiency gains term  $\delta$ . However,  $2\alpha\beta c > \gamma(k-1)c^2$  when  $\alpha > \beta c$ , hence the positive difference in the former outweighs the negative difference in the latter. Furthermore,  $\alpha^2 + 2\alpha\gamma(n-1)c > \alpha^2\beta$ , especially if the products are close substitutes. The same holds true

for  $\beta^2\gamma(n-1)c^2 + 2\gamma^2(n-k)(k-1)(1-\delta)c^2 > \beta^3c^2$ , since as the products become closer substitutes,  $\gamma$  increases: In the limit case of perfect substitutes,  $b = d$  and  $\gamma$  is defined as  $\gamma = \frac{d}{(b+(n-1)d)(b-d)}$ . Hence, the sum of *E.F.1* and *E.F.4* is positive by the remaining positive term  $2\alpha\gamma(k-1)(1-\delta)c$  and the outweighed differences in the terms shown above.

### Analysis of the term *G*

Term *G* can be broken down into five individual components *G.1* to *G.5*. All components are independent of the degree of risk aversion.

$$G.1 = (\beta - \gamma(k-1))\gamma^2(n-k)^2(4\beta^2(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2))$$

$$G.2 = -(\beta - \gamma(k-1))\gamma^2(n-k)^2(4\beta\gamma(n-1)(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2))$$

$$G.3 = (\beta - \gamma(k-1))\gamma^2(n-k)^2(\gamma^2(n-1)^2(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2))$$

$$G.4 = -\gamma^4(n-k)^2k^2\beta(\alpha^2 - 2\alpha\beta c + \beta^2c^3)$$

$$G.5 = -\gamma^4(n-k)^2k^2((\alpha - \beta c)(2\beta\gamma(n-1)c - \gamma^2(n-1)^2c))$$

As defined above,  $\beta - \gamma(n-1) > 0$ . Hence, for *G.1* to exceed *G.2*, the bracket term  $(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2)$  needs to be positive. This is the case if  $\alpha - \beta c > 0$  as by rearranging,  $(\alpha - \beta c)(\alpha + 2\gamma k(1-\delta)c) - \alpha\beta c + \beta^2c^2 + \gamma^2k^2(1-\delta)^2c^2 > 0$ , if  $\alpha\beta c < \beta^2c^2 + \gamma^2k^2(1-\delta)^2c^2$ .

For the term *G* to be unambiguously positive, positive *G.3* needs to exceed the sum of negative *G.4* and *G.5*.

Hence, after canceling  $\gamma^2(n-k)^2$  on both sides, it needs to be true that,

$$\begin{aligned} & (\beta - \gamma(k-1))\gamma^2(n-1)^2(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma k(1-\delta)c + \beta^2c^2 - 2\beta\gamma k(1-\delta)c^2 + \gamma^2k^2(1-\delta)^2c^2) \\ & > \\ & \gamma^2k^2(\beta(\alpha^2 - 2\alpha\beta c + 2\alpha\gamma(n-1)c + \beta^2c^3 - 2\beta\gamma(n-1)c^2 + \gamma^2(n-1)^2c^2) - \alpha\gamma^2(n-1)^2c) \end{aligned} \quad (31)$$

Comparing the first terms on the each side, it is clear that  $(\beta - \gamma(k-1))\gamma^2(n-1)^2 > \gamma^2k^2\beta$  as long as the merger scale  $k$  is not too large, i.e. approaches  $n$ . Second, if the merger scale

increases, the second term the left hand side increases, while the second term on the right-hand side is unaffected.

## B. Insiders' optimal sharing rule

As before, to finally maximise expected utility, the firms maximise  $E(\pi) - \frac{R}{2}Var(\pi)$ . When the insiders conceal their private information, only the outsiders are exposed to uncertainty. If the insiders reveal their private information, both, insiders and outsiders, compete in a deterministic setting, i.e.  $Var(\pi) = 0$ . The difference in the insiders' results of their maximisation problem when they conceal their private information (see (20)) and when they reveal their private information (see (21)) hence relates to the risk aversion coefficient  $R\sigma^2$  as laid out in section 4.3. In order to identify the insiders' optimal sharing rule, the results of their maximisation problems have to be compared.

Restating (20) to show the difference in risk aversion to the case, where insiders reveal their information, (20) becomes:

$$(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N_{reveal}^- + (\alpha + \gamma(n-k)c)R\sigma^2 - (1-\delta)cN - (1-\delta)c(\beta - \gamma(k-1))R\sigma^2}{B + 2(\beta - \gamma(k-1))R\sigma^2} + \frac{\gamma(n-k)(\alpha - c\beta + (1-\delta)ck\gamma)}{B + 2(\beta - \gamma(k-1))R\sigma^2} \right)^2$$

where  $N_{reveal}^- = 2\beta - \gamma(n-k-1)$  and  $B = 2N - \gamma(n-k)k\gamma$ .

The restated solution to the insiders' maximisation problem, when they conceal the information, can now be compared to the solution to the insiders' maximisation problem, when they reveal their information, i.e. (21):

$$(\beta - \gamma(k-1)) \left( \frac{(\alpha + \gamma(n-k)c)N_{reveal}^- + (1-\delta)cN + \gamma(n-k)(\alpha - c\beta + (1-\delta)ck\gamma)}{B} \right)^2 \quad (32)$$

The denominators in both equations are positive, since  $\beta - \gamma(n-1) > 0$ , and  $\beta, \gamma > 0$  in the analysed case of substitutes. Multiplying with the denominators and cancelling common terms yields for revealing to be a dominant strategy,

$$(\beta - \gamma(k-1))(R\sigma^2\gamma(n-k)((\beta - \gamma(k-1))(2\alpha - (1-\delta)ck\gamma - 2c\beta) - k\gamma(\alpha + \gamma(n-k)c)) < 0 \quad (33)$$

Further simplifying the last bracket term shows that revealing is an optimal information sharing rule, since

$$(\beta - \gamma(k-1))(R\sigma^2\gamma(n-k)((\beta - \gamma(k-1))(2\alpha - 2c\beta) - k\gamma(\alpha + \gamma(n-k)c + (\beta - \gamma(k-1))(1 - \delta)c)) < 0 \quad (34)$$

The first terms on the left-hand side,  $\beta - \gamma(k-1)$ ,  $R\sigma^2\gamma(n-k)$ , and  $\beta - \gamma(k-1)$  are all positive, given the above definitions that  $\beta - \gamma(n-1) > 0$ , and  $\beta, \gamma > 0$ . Hence, in order to determine, whether the left-hand side is negative, the last bracket term  $((\beta - \gamma(k-1))(2\alpha - 2c\beta) - k\gamma(\alpha + \gamma(n-k)c + (\beta - \gamma(k-1))(1 - \delta)c))$  must be negative. While  $(\beta - \gamma(k-1))(2\alpha - 2c\beta) > 0$ , the bracket term becomes negative as  $k\gamma(\alpha + \gamma(n-k)c + (\beta - \gamma(k-1))(1 - \delta)c)$  is negative and  $(\beta - \gamma(k-1))(2\alpha - 2c\beta) < k\gamma(\alpha + \gamma(n-k)c + (\beta - \gamma(k-1))(1 - \delta)c)$  as  $k > 1$  and if  $\gamma$  increases, i.e. the products become more homogeneous or closer substitutes.

In addition, the revelation strategy is increasing in the level of risk aversion,  $R\sigma^2$ . Risk aversion,  $R\sigma^2$ , has an enhancing effect and, as the bracket term becomes negative, enhances the revelation strategy.

### C. Private merger profitability of informed insiders

In order to determine, whether the merger is profitable once the insiders revealed their private information, the results of the maximisation problem pre-merger (see Appendix A) and post-merger (see (21)) have to be compared. As the insiders are informed about the realisation of their efficiency gains, they are not exposed to uncertainty, i.e.  $Var(\pi) = 0$ .

The comparison yields that the merger is profitable, if:

$$\begin{aligned} & \sqrt{(\beta - \gamma(k-1))((\alpha + \gamma(n-k)c)N_{reveal}^- - (1 - \delta)N + \gamma(n-k)(\alpha - c\beta + (1 - \delta)c\gamma k))}(2\beta - \gamma(n-1)) \\ & > \\ & \sqrt{\beta(\alpha - c\beta)(2N - \gamma^2(n-k)k) - \sqrt{c\gamma(n-1)(2\beta - \gamma(n-1))(\alpha - c\beta)}(2N - \gamma^2(n-k)k)} \end{aligned}$$

This is specifically the case if  $\beta < c\gamma(n-1)$ .

### D. Partially informed insiders

The insiders receive the signal

$$z_t = \tilde{\delta}_t + e_t \quad (35)$$

$$\begin{aligned}\tilde{\delta}_t &\sim N(\delta_t, \eta) \\ e_t &\sim N(0, m)\end{aligned}$$

and produce the signal

$$\hat{z}_t = z_t + f_t \tag{36}$$

$$\begin{aligned}z_t &\sim N(\delta_t, \eta + m) \\ f_t &\sim N(0, s_t)\end{aligned}$$

The outsiders receive this signal, which equivalently conveys information about the realisation of their residual demand. Specifically, if the outsiders receive information about the efficiency gains of the insiders, this signal of the insiders,  $\hat{z}_t$ , conveys diluted information about insiders' efficiency gains as well as outsiders' random demand.

Since the distribution of priors and private signals is normal and demand is linear, each firm follows a linear decision rule (Radner, 1962) of the form

$$\begin{aligned}x_t &= C_0 + C_1 \hat{z}_t + C_2 z_t \\ x_i &= B_0 + B_1 \hat{z}_i\end{aligned} \tag{37}$$

Since both, insiders and outsiders, are still uncertain about the insiders' efficiency gains and their residual demand respectively, the first-order conditions of the insiders and the outsiders, respectively, follow from (2),

$$\begin{aligned}E\left(\alpha - (2\beta - 2\gamma(k-1))\left(C_0 + \sum_{t=1}^k C_1 \hat{z}_t + \sum_{t=1}^k C_2 z_t\right) + \gamma \sum_{i=k+1}^n (B_0 + B_1 \hat{z}_i)\right. \\ \left. + (\beta - \gamma(k-1))(1 - \delta_t)c + \right. \\ \left. R\sigma^2 c^2 (1 + (k-1)\rho) \left(\alpha + \gamma(n-k) \left(B_0 + B_1 \hat{z}_i - (\beta - \gamma(k-1)) \left(C_0 + \sum_{t=1}^k C_1 \hat{z}_t + \sum_{t=1}^k C_2 z_t\right)\right)\right)\right) = 0\end{aligned} \tag{38}$$

$$E\left(\alpha - (2\beta - \gamma(n - k - 1))\left(B_0 + B_1\hat{z}_i\right) + \gamma k\left(C_0 + \sum_{t=1}^k C_1\hat{z}_t + \sum_{t=1}^k C_2z_t\right) + (\beta - \gamma(n - k - 1))c - R\sigma^2\left(\left(B_0 + B_1\hat{z}_i\right) - c\right)\right) = 0 \quad (39)$$

Using the distributional properties of  $\hat{z}_t$ ,  $z_t$ , and  $\delta_t$ , the posterior expected values for the unobserved variables  $\delta_t$  for the insiders and  $z_t$  for the outsiders can be derived as follows:

$$1) E(\delta_t | z_1 \cdots z_k)$$

The signal the insiders receive can be decomposed to,

$$z_t = \delta_t + e_t \rightarrow \frac{\sum_{t=1}^k z_t}{k} = \frac{\sum_{t=1}^k \delta_t}{k} + \frac{\sum_{t=1}^k e_t}{k} \quad (40)$$

Using expected operators on the unknown variables yields,

$$E\left(\frac{\sum_{t=1}^k \delta_t}{k} | z_1 \cdots z_k\right) = \frac{\sum_{t=1}^k z_t}{k} - E\left(\frac{\sum_{t=1}^k e_t}{k} | z_1 \cdots z_k\right) \quad (41)$$

Accordingly, to find the posterior expected value of  $\delta_t$ , since  $z_t$  is observed by the insiders, only the expected value of  $e_t$  has to be computed using the respective variance-covariance matrix,

$$\begin{matrix}
e_t & z_1 & \dots & z & \dots & z_n \\
e_t & \left( \begin{matrix} m & 0 & \dots & m & \dots & 0 \\ z_1 & 0 & \eta + m & \dots & h & \dots & h \\ \vdots & \vdots & & \ddots & \vdots & & \vdots \\ z & m & h & \dots & \ddots & & \vdots \\ \vdots & \vdots & & & \ddots & & \vdots \\ z_n & 0 & h & \dots & \dots & & \eta + m \end{matrix} \right) & \begin{pmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{pmatrix}
\end{matrix}$$

Based upon DeGroot (1970),

$$E(e_t | z_1 \dots z_k) = S_{12} S_{22}^{-1} \begin{pmatrix} z_1 \\ \vdots \\ z_k \end{pmatrix}$$

Substituting in yields,

$$\begin{pmatrix} 0 & \dots & m & \dots & 0 \end{pmatrix} \begin{pmatrix} \eta + m & h & \dots & h \\ h & \eta + m & & \vdots \\ \vdots & & \ddots & \vdots \\ h & & & \eta + m \end{pmatrix} \begin{pmatrix} z_1 \\ \vdots \\ \vdots \\ z_k \end{pmatrix}$$

Therefore,

$$E\left(\frac{\sum_{i=1}^k e_t}{k}\right) = \frac{m \sum_{i=1}^k z_t}{(\eta + m + (k-1)h)k} \tag{42}$$

Substituting in (40) yields the posterior expected value for  $\delta_t$ ,

$$E\left(\delta_t | z_1 \dots z_k\right) = \frac{\sum_{i=1}^k z_t}{k} - \frac{m \sum_{i=1}^k z_t}{(\eta + m + (k-1)h)k} = \frac{\eta + (k-1)h}{\eta + m + (k-1)h} z_t \tag{43}$$

2)  $E(z_t | \hat{z}_i)$

Using the variance-covariance matrix,

$$\begin{pmatrix} \eta + m + s_t & \eta + m \\ \eta + m & \eta + m + s_t \end{pmatrix} \begin{pmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{pmatrix} \quad (44)$$

and DeGroot's rule,  $S_{12}S_{22}^{-1}\hat{z}_i$ , the expected posterior value for  $E(z_t | \hat{z}_i)$  becomes,

$$E(z_t | \hat{z}_i) = \frac{\eta + m}{\eta + m + s_t} \hat{z}_t \quad (45)$$

since  $\hat{z}_i = \hat{z}_t$ .

Substituting the posterior expected values into the first-order conditions (38) and (39) yields a system of five equations with five unknowns,

$$\begin{aligned} (1) \quad & \alpha - (2\beta - 2\gamma(k-1))C_0 + \gamma(n-k)B_0 \\ & + R\sigma^2 c^2(1 + (k-1)\rho)(\beta - \gamma(k-1))(\alpha + \gamma(n-k)B_0 - (\beta - \gamma(k-1))C_0) = 0 \\ (2) \quad & \alpha - (2\beta - \gamma(n-k-1))B_0 + \gamma k C_0 + (\beta - \gamma(n-k-1))c - R\sigma^2(B_0 - c) = 0 \\ (3) \quad & -(2\beta - 2\gamma(k-1))C_2 z_t + (\beta - \gamma(k-1))(1 - \delta|z_t)c \\ & - R\sigma^2 c^2(1 + (k-1)\rho)(\beta - \gamma(k-1))^2 C_3 z_t = 0 \\ (4) \quad & -(2\beta - 2\gamma(k-1))C_1 \hat{z}_t + \gamma(n-k)B_1 \hat{z}_t \\ & + R\sigma^2 c^2(1 + (k-1)\rho)(\beta - \gamma(k-1))(\gamma(n-k)B_1 \hat{z}_t - (\beta - \gamma(k-1))C_1 \hat{z}_t) = 0 \\ (5) \quad & -(2\beta - \gamma(n-k-1))B_1 \hat{z}_t + \gamma k C_1 \hat{z}_t - R\sigma^2 B_1 \hat{z}_t + \gamma C_2 z_t | \hat{z}_t = 0 \end{aligned} \quad (46)$$

Solving for the five unknowns yields,

$$\begin{aligned}
B_0 &= \frac{\alpha + (\beta - \gamma + R\sigma^2)c + \gamma k C_0}{2\beta - \gamma(n - k - 1) + R\sigma^2} \\
B_1 &= \frac{\gamma^k}{2\beta - \gamma(n - k - 1) + R\sigma^2} \left( C_1 + C_2 \frac{\eta + m}{\eta + m + s_t} \right) \\
C_0 &= \frac{(1 + Lc^2)(\alpha + \gamma(n - k)(\alpha + (\beta - \gamma(n - k - 1) + R\sigma^2)c))}{(2 - Lc^2)(\beta - \gamma(k - 1))A - (1 + Lc^2)\gamma(n - k)\gamma k} \\
C_2 &= \frac{\frac{m}{\sigma + m + (k-1)h} c}{2 + Lc^2} \\
C_1 &= \frac{\gamma k \gamma(n - k) c \frac{\sigma + m}{\sigma + m + s_t}}{\left( \frac{\beta - \gamma(k-1)}{1 + Lc^2} - 1 \right) ((\beta - \gamma(k - 1))A - \gamma(n - k)\gamma k)}
\end{aligned} \tag{47}$$

where,

$$A = N + (1 + c^2 L)(N - \gamma(n - k)k\gamma), N = (\beta - \gamma(k - 1))N^-, \text{ and } N^- = (2\beta - \gamma(n - k - 1) + R\sigma^2)$$

# **Economic rationales used in EC Merger Control post-2004 and comparison to US Merger Control**

Claas Hendrik Fügemann<sup>1</sup>

In 2004, the European Commission changed its merger control procedures significantly: New Merger Regulation and Guidelines as well as internal reforms at DG Competition aimed at implementing a more economics-based and internationally aligned approach to merger control. This paper investigates merger control decisions by the European Commission, the DOJ and the FTC since 2005 to identify and compare the economic rationales taken across industries as well as in specific industries. I find that the Commission and the US regimes converge in the economic rationales they take in their merger reviews. First, the competition authorities use similar criteria and prefer arguments focusing on actual competition over arguments regarding possible future changes in behavior. Thereby, the alignment of merger decisions is also fostered. Second, the competition authorities also resolve cases, which show pro- and anti-competitive effects at the same time, with the tools at hand. This strengthens the view that both regimes use their economic rationales consistently across merger reviews. Furthermore, the European Commission follows a balanced approach of weighing pro- and anti-competitive effects of a merger carefully. Finally, the merger review process has become more effective in terms of preventing potentially incorrect merger review decisions and implementing a more competition-focused approach to merger reviews.

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## 1. Introduction

In 2004, the European Commission (“the Commission” or “the EC”) adopted new Merger Regulation<sup>2</sup> as well as its first Merger Guidelines<sup>3</sup> with the objectives to align merger review processes across the globe and to provide an effective one-stop merger review solution to an enlarged European Union of then 25 member states. In the course of this reform (“the 2004 reform”), various microeconomic concepts and criteria, structural and organizational changes at DG Competition (“DG COMP”), as well as jurisdictional and procedural reforms have been implemented in the merger review process. Now, thirteen years later, it needs to be investigated, whether the Commission has achieved its objectives of aligning international merger review practices and conducting more effective merger controls in Europe. This paper looks at the substantive reform, promulgated by the new Significant Impediment to Effective Competition (SIEC) test as set forth in the 2004 Merger Guidelines, its underlying economic rationales, and its effect on meeting the objectives the Commission announced at the time of the reform.

The new Merger Regulation entered into force on May 1, 2004, together with the EU expansion from 15 to 25 member states. Particularly interesting for this paper was the goal to improve the Commission’s decision-making process. In addition to the new Merger Regulation, the EC also released guidelines on the assessment of horizontal mergers (“the Merger Guidelines”). The Merger Guidelines explain how mergers should be analysed and identify the assessment criteria to be used in the merger review process. The Merger Guidelines were intended to create a more predictable climate and to achieve benefits in the European Union similar to those achieved by the implementation of the first US Horizontal Merger Guidelines in 1982 (Levy, 2003). Also, DG COMP was reorganized by eliminating the Merger Task Force, putting in place a new Chief Competition Economist, and setting up the European Advisory Group on Competition policy (EAGCP) (Kokkoris & Shelanski, 2014).

One trigger for the 2004 reform was the General Court’s decision to overrule DG COMP’s prohibition of three merger cases<sup>4</sup>. In addition, DG COMP’s decision in the *General*

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<sup>2</sup> Council Regulation (EC) No 139/2004 of 20 January 2004.

<sup>3</sup> Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings, OJ 2004/C 31/03 of 05.02.2004.

<sup>4</sup> Case COMP/M.1524, Case COMP/M.2416, Case COMP/M.2283.

*Electric/Honeywell*<sup>5</sup> case was criticised heavily, but upheld. In the *Schneider/Legrand* case, the General Court found errors, omissions and contradictions in the Commission's analysis, which led to flaws in the economic reasoning of the Commission and the overestimation of the market power of the merged entity. As the prohibition was fundamentally based on the flawed concentration assessment, the Court annulled the Commission's decision to prohibit the merger. In the *Tetra Laval/Sidel* case, the General Court argued that a pre-merger dominant position of one of the merging parties does not necessarily lead to an impediment to effective competition. Factors outside the current market, which may change the market conduct post-merger (e.g. imports, entry, elimination of potential competition) as well as market growth, have to be taken into account as well. Finally, the effect of the merger on incentives to act pro-competitively should also be considered in the assessment. In the *Airtours/First Choice* case, the General Court found multiple assessment criteria not to have been looked at thoroughly by the Commission, including volatile demand, capacity restrictions, intransparent markets, barriers to entry and consumers' possibility to switch suppliers. Also, it did not find grounds for the suppliers to coordinate post-merger given that the market is intransparent, no deterrent mechanism exists and outsiders can jeopardize the coordination outcome. In the *General Electric/Honeywell* case, the Court did not annul the Commission's decision, even though it concluded that the Commission had made errors in relation to the analysis of conglomerate effects<sup>6</sup>. The Commission's decision in the *General Electric/Honeywell* case received particular criticism: The Commission was sought to have almost solely looked at potential future behaviour, while disregarding actual competition (Schmitz 2002). The Commission was also accused not to have based its decision on solid economics, but rather on an ad hoc analysis (Robertson, 2008). Finally, the lack of an efficiency defence in the regulation as such also received criticism (Schmitz, 2002). As a conclusion, this criticism and the annulments by the General Court might raise the suspicion that systematic errors may have been made by the Commission, at least with respect to pro-competitive mergers.

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<sup>5</sup> Case COMP/M.2220.

<sup>6</sup> The Court found errors with regards to the competitive effects from the vertical overlap of General Electric and Honeywell products, where General Electric manufactures engines and Honeywell supplies engine starters to General Electric and its competitors, the extension of General Electric's practices to Honeywell's products and the likelihood of bundling. The Commission had argued that the merged entity "(would) have the ability to engage in packaged offers of engines, avionics, and other services" (Case COMP/M.2220). As no competitor had a similar offering, General Electric could be expected to strengthen its dominant position through possible future bundling.

The Commission's reaction to these annulments and the criticism signal their importance for the 2004 reform: The Commission acknowledged that "*the system put in place in 1990 [was] showing some signs of strain*" (Monti, 2002) and recognized that a "*radical*" (European Commission, 2002) reform was needed. The first Merger Guidelines were to "*[set] out a sound economic framework for the assessment*" (European Commission, 2002), focusing on "*how the effect of a merger on competition in a market should be analysed*" (European Commission, 2002). The Merger Guidelines were also to provide "*particular factors that could mitigate an initial finding of likely harm to competition - factors such as buyer power, ease of market entry, and efficiencies*" (European Commission, 2002).

The 2004 reform formally started with the *Green Paper* on the review of the Merger Regulation (European Commission, 2001b). Commissioner Monti indicated that "*the time has come to look at whether more mergers should benefit from the one-stop review and to adapt the rules to the realities of an increasingly globalised business environment and to an enlarging Union*" (European Commission, 2001c), where the objective of the Green Paper was to "*meet the challenges posed by global mergers, monetary union, market integration, enlargement and the need to cooperate with other jurisdictions*" (European Commission, 2001b), clearly referencing to the inclusion of new member states into the EU as well as the convergence of merger regulations across jurisdictions and continents. Among others, the Green Paper initiated the discussions on the *substantive test*, i.e. the competitive assessment undertaken by competition authorities based on specific assessment criteria, and the difference between the formerly used dominance test in the EC and the significant lessening of competition test applied in the Anglo-Saxan world. Ultimately, this led to the creation of the Significant Impediment to Effective Competition (SIEC) test.

Prior to 2004, the Commission assessed mergers based on the dominance test. According to the dominance test "*a concentration which creates or strengthens a dominant position as a result of which effective competition would be significantly impeded in the common market or in a substantial part of it shall be declared incompatible with the common market*"<sup>7</sup>. The SIEC test, on the other hand, focuses on competition ("*significant impediment to effective competition*"), rather than dominance. Consequently, under the SIEC test, factors which affect competition have to be evaluated during a merger review. These factors, hereinafter named assessment

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<sup>7</sup> EUMR Art. 2(3).

criteria, determine how a competition authority shall evaluate the competitive effects resulting from a merger. The SIEC test was to provide merging firms with enhanced guidance so they can improve the anticipation and gauging of the competitive issues raised by the notified merger. In addition, the SIEC test intended to enable the Commission to assess individual transactions based on their likely impact on consumer welfare, without relying too heavily on structural parameters (Kokkoris & Shelanski, 2014).

From a purely substantive point of view<sup>8</sup>, the 2004 reform has as a result led to the inclusion of various microeconomic effects and criteria in the merger review process. The primary justification was to eliminate the requirement to show *dominance* to challenge a merger (Röller & de la Mano, 2006):<sup>9</sup> Closer to the US practice of a “*substantial lessening of competition*” (SLC)<sup>10</sup> test, the SIEC test does not insist on dominance being a necessary or sufficient criterion. Theories of harm therefore rather include, for example, the elimination of potential competition, raising entry barriers or rivals costs, as well as reducing buyer power. Another objective was to reduce the number of prohibited pro-competitive mergers (so called “type I errors”), which could be tackled with the assessment of criteria like substitution / closeness of competition, efficiencies, countervailing buyer power, but also dominance (Röller & de la Mano, 2006). Also, *efficiencies* have been included as a countervailing factor, if they are merger-specific, verifiable, and beneficial for consumers. The lack of an efficiency defence in the regulations was a major criticism against the Commission’s prohibition of the *General Electric/Honeywell* merger (Schmitz, 2002). In general, the 2004 reform took particular note of the criticism and embodied processes and procedures into the new 2004 Merger Guidelines, which account for a more economic and competition-focused approach, as well as for looking at actual rather than potential competition. Finally, a “gap” has been closed in the Merger Guidelines: In essence, a merger can have three effects: A merger can create or strengthen a dominant market position (i.e. single dominance based on unilateral effects), a merger can change the competitive structure in an oligopolistic market (i.e. collective dominance based on coordinated effects), and a merger can reduce the extent of competition in an oligopolistic

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<sup>8</sup> For a discussion on procedural, jurisdictional and institutional changes resulting from the 2004 reform, please see Christiansen (2006), Christiansen (2006b), Kokkoris and Shelanski (2014).

<sup>9</sup> According to Röller and de la Mano (2006), the aim of this change is to reduce clearing of anti-competitive mergers. Please be referred to Chapter 2.1 for the empirical assessment of the effects and frequency of these “type I errors” as well as the subsequently discussed “type II errors” in merger review.

<sup>10</sup> Section 7 of the Clayton Act. Clayton Act, 15 U.S.C. para. 12-27; 29 U.S.C. para. 52-53.

market (Riesenkampff, 2004), i.e. a merger, where the merging parties do not necessarily have a market share, which indicates dominance, can still lead to unilateral effects if it eliminates an important competitive constraint. Put differently, a merger may eliminate important competitive constraints (e.g. a pricing maverick, an innovator, etc.), allowing one or more suppliers to raise prices. Again, this illustrates the change in the Merger Guidelines from a dominance-focused to a competition-focused assessment.

Further assessment criteria referred to in the Merger Guidelines include the market position of the merging parties, the alternatives available, barriers to entry, interests of consumers, supply and demand trends, development of technological and economic progress. The assessment included in the Merger Guidelines are explained in detail in Chapter 4.

In sum, the 2014 reform led to the inclusion of microeconomic concepts and related criteria and an efficiency defence clause into the Merger Guidelines, closing a “gap” case covering unilateral effects in oligopolistic markets, creating the office of the chief economist and his team, issuing guidelines for horizontal mergers, and replacing the old ‘dominance test’ with the SIEC test.<sup>11</sup> As these new assessment criteria follow the competition-focused assessment of the US Merger Guidelines more closely, the 2004 reform has led to a formal convergence of US and EC merger control regimes (Coppi & Walker, 2004; Riesenkampff, 2004). This paper investigates, in how far this convergence has also been put in practice in day-to-day merger control reviews.

In the empirical evaluation of the EC and US merger decisions, I find that the Commission and the US regimes converge in the economic rationales they take in their merger reviews as the European Commission uses the new approach consistently and to a great extent. First, the competition authorities prefer arguments around actual competition over arguments focusing on possible future changes in behaviour and reactions brought about by the merger (e.g. entry, imports, customer behaviour). Second, the competition authorities use their respective approach closely and resolve also cases, which show pro- and anti-competitive effects, with the tools at hand. This strengthens the view that both regimes use their economic rationales consistently for all merger reviews. Third, the competition authorities converge in taking the same economic rationales in their merger reviews and reach aligned conclusions. Furthermore, the European

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<sup>11</sup> Further changes brought about by the 2004 reform, which are of less relevance for this paper, include also the improvement of the timetable for remedies as well as the update of the best practices of DG COMP.

Commission follows a balanced approach of weighing pro- and anti-competitive effects of a merger carefully. Also, I find that the Commission's merger review process has become more effective in terms of preventing potentially incorrect merger review decisions and meets the objectives set for the 2004 reform.

The following Chapter provides an overview of the empirical literature for the assessment of the consistency of merger review decisions. Chapter 3 describes the data used in the empirical analysis, while Chapter 4 develops the framework in order to test the consistency of the economic rationales taken by the Commission as well as the US competition authorities in their merger review decisions. Chapter 5 explains the results of the analysis. Chapter 6 analyses recent mergers in the small package delivery as well as the crop protection industry in order to determine, whether the assessment criteria help to solve complex merger cases and whether any predictions can be made on merger decisions for about upcoming mergers. Also, the convergence of the merger assessment between the Commission and the DOJ is in the focus of this Chapter based on the example of the *Dow/DuPont* merger. Finally, Chapter 7 concludes.

## **2. Literature Review of the assessment of the consistency of merger control decisions**

The consistency of merger review decisions has been under scrutiny ever since the first EC Merger Regulation in 1990<sup>12</sup> as well as the first US Merger Guidelines in 1982<sup>13</sup>. Consistency can refer to internal consistency, i.e. consistent assessments over time and based on own regulations, as well as external consistency, i.e. the decisions are consistent with the assessments of other parties. The following subchapters outline two approaches taken to evaluate the consistency of merger control decisions empirically. First, event studies based on stock market returns of the merging parties following the merger announcement look at whether the market and the Commission assess the pro- and anti-competitive nature of the merger consistently. Second, evaluations of the economic rationale taken in the merger control assessment identify whether the economic rationales are consistent over time and with the self-imposed rules and whether they converge between the regimes. The economic rationales can best be tested through the use of and reference to the assessment criteria by the competition authority in its reviews.

### **2.1 Evaluation of consistency of EC merger control decisions based on stock market returns**

In this subchapter, the literature testing the consistency of market and competition authority assessments regarding the anti- and pro-competitive nature of a merger is outlined. Particular attention is drawn to studies, which test the effectiveness of the 2004 reform.

The evaluation of merger control decisions based on stock market returns has largely been influenced by Duso, Neven, and Röller (2007), who investigated whether the stock market anticipated which mergers were anti-competitive at the time of the merger announcement. Based on the reaction of competitors' stock market price, they distinguish between cases where the EC has prohibited mergers and which the stock market regarded as pro-competitive (type I errors) as well as instances where the EC has failed to prevent mergers that were regarded as anti-competitive by the stock market (type II errors): Competitors' stock prices react negatively in case of a pro-competitive merger<sup>14</sup>, while the opposite holds true for anti-competitive

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<sup>12</sup> Council Regulation (EC) No. 4064/89 of 21 December 1989.

<sup>13</sup> The 1982 Merger Guidelines refer to efficiencies and failing firm defence (Sec. V. Defenses of the 1982 Merger Guidelines) as well as ease of entry (Sec. III. Horizontal Mergers).

<sup>14</sup> For the reasoning why a merger, which hurts competitors, will tend to be pro-competitive see Eckbo (1983).

mergers. This empirical approach for the evaluation of merger control decisions has the benefit of an independent alternative assessment by the market based on stock market data. However, merger anticipation may already have been priced in the stock market or stock holders may already factor in competitors' reactions (e.g. own merger plans), for which reason the stock market price may not only be driven by the merger announcement. Also, this approach assumes the market efficiency hypothesis to hold, i.e. the change in the stock price is driven by an expected change in profits.

The authors find that the Commission blocked in 28% of the cases a merger, which the stock market regarded as pro-competitive (type I error). Regarding type II errors, i.e. the clearance of anti-competitive mergers, they find that the Commission and the stock market were not consistent in their assessment of the competitive nature of the merger in 23% of the cases. The results furthermore suggest that the Commission's decisions are affected by the institutional and political environment. Interestingly, more errors occurred between 1999 and 2004, i.e. right before the change in the EC merger control proceedings, which also indicates the need for the 2004 reform.

Rijvers (2009) constructed a similar model for merger control decision by the Dutch competition authority, indicating that the Dutch competition authority cleared an anti-competitive merger in roughly 36% of the cases.<sup>15</sup>

Serdarevic and Teply (2011), analysing EC merger control decisions between 1990 and 2008, find that the 2004 reform has enhanced the EC merger control procedures as merger control decisions under the new regulation are more consistent with the market evaluations. The market would have blocked the same mergers as the Commission did (i.e. the probability of an anti-competitive deal being cleared [type II errors] decreases significantly under the new regulatory framework). Duso, Gugler, and Szücs (2013), based on EC merger control decision between 1990 and 2007, find that while type II errors were in deed reduced, the Commission though challenged or remedied more mergers, which the stock market regarded as pro-competitive (weakened<sup>16</sup> type I errors).

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<sup>15</sup> The Dutch competition authority did not block a merger in the relevant time period, hence it cannot have blocked a pro-competitive merger (type I error).

<sup>16</sup> Duso et al. (2007) define a type I error as the blocking, not the remedying, of mergers, which are evaluated to be pro-competitive by the market.

Duso, Gugler, and Yurtoglu (2011) investigate, whether the EC merger control decision is able to reverse any anti-competitive effects resulting from the merger (“rent-reversion”), which are expected by the market. This rent reversion can be in the form of remedies or prohibitions. They compare the stock market reaction to merger announcement and to merger control announcements. They expect that anti-competitive rents generated by the merger and measured at the time of the announcement should be resolved by the merger review decision, if this is effective (i.e. a negative relation between abnormal returns at the decision time and at the announcement). They find that the extreme merger control decisions, prohibitions, eliminate all abnormal stock market returns. Remedies are not as effective in restoring effective competition and eliminating all anti-competitive concerns of the market. Duso et al. (2013), looking at the effect of the 2004 reform, though find that rent-reversion has improved for cases, where remedies were included.<sup>17</sup>

## **2.2 Evaluation of merger control decisions based on the assessment criteria used**

A further literature strand has investigated empirically, in how far competition authorities consistently use specific economic rationales in their competitive assessments.

For the US, Coate and Mc Chesney (1992) evaluated whether the FTC’s decision to challenge mergers can be well predicted by the factors listed in the merger guidelines (i.e. the assessment criteria) and find that concentration and entry barriers are a necessary, but not a sufficient condition to raise competition concerns, whereas the inclusion of efficiency claims did not have any bearing on the decision. Khemani and Shapiro (1993) conducted a similar exercise for the Canadian merger review process.

Bergman, Jakobsson, and Razo (2005) studied merger control decisions by the Commission using a sample of 96 mergers from 1990 through 2002. The authors find that market shares and barriers to entry were positively related to merger prohibitions, while the fact that the parties were incorporated in the US or in one of the five largest member countries of the EU generally had no significant effect. Lindsay, Lecchi, and Williams (2003) reported similar findings: Using a sample of 245 mergers from the period 2000 to 2002, the authors find that high market shares and barriers to entry are the main causes of prohibitions, while being incorporated in the USA or in a Nordic country had no significant effects. Bougette and Turolla (2008) also find that

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<sup>17</sup> Duso et al. (2013) could not identify any effects relating to prohibitions as the EC had only blocked two mergers at the time of their study after the 2004 reform.

high market power increases the likelihood of remedies (i.e. finding competition concerns), but also account for the degree of innovation of the industry: Competition concerns are more likely to occur in more innovative (and thereby, less stable) industries. Interestingly, they find that remedies are increasing between 1999 and 2004. This last point leads to two conclusions: First, the increase in remedies is not per se a result of the introduction of the SIEC test and the 2004 reform. Second and referring to Duso et al. (2007), the increase in merger remedies goes in hand with an increase in type I and II errors.

Martinez Fernández, Hashi, and Jegers (2008) investigate the effect of the 2004 reform on the consistency of economic rationales used in the merger review process. By analysing 50 merger decisions after the 2004 reform, they find that the likelihood of challenging a merger increases with market share, the contestability of the market, and the presence of barriers to entry, thereby largely confirming the findings of the previous merger review literature outlined above. However, these results warrant caution as only four of the 50 cases between 2005 and mid-2006 went into phase II investigations and no merger was blocked. More recently, Büttner, Federico, Kühn, and Magos (2013) investigated specific merger decisions in 2011 and 2012 and discover that closer cross-collaboration with the US competition authorities took place as well as new assessment criteria were used thoroughly in the economic assessment (e.g. closeness of competition of the merging parties, efficiencies). Finally, Szücs (2012) also finds an impact of the 2004 reform on the assessment criteria used in merger control: In addition to the consistent importance of barriers to entry, dominance, and market shares (of both, merging parties and competitors) pre- and post-reform, stable markets<sup>18</sup> as well as market concentration increase in importance.<sup>19</sup>

As a conclusion, market shares, market concentration, and entry barriers have commonly been found to be the most important assessment criteria in merger reviews. Some studies have also included criteria such as the post-merger likelihood of collusion (e.g. Bergman et al., 2005; Coate & McChesney, 1992) as well as new competition from imports (e.g. Khemani & Shapiro,

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<sup>18</sup> This result is directly opposite to the result of Bougette and Turola (2008), who find that innovative industries are prone to increased scrutiny post-reform.

<sup>19</sup> For further country-specific merger regulation assessments, please be exemplarily referred to Weir (1992, 1993) for the UK, Khemani and Shapiro (1993) for Canada, and Yang and Pickford (2014) for New Zealand. Yang and Pickford (2014) contributed to the further development of the literature by modelling the merger review process as a two-staged process, thereby mirroring the actual merger review process (phase I vs. phase II). Avalos and De Hoyos (2008) assessed the merger decisions of the Mexican competition authority, while Breunig, Menezes, and Tan (2012) did so for the Australian competition authority.

1993; Avalos & De Hoyos, 2008), which have been found to be important. After the 2004 reform, the commonly assessed criteria (market shares, dominance, barriers to entry) remain important, while further factors appear to gain in significance, but the exact scope of significance remains to be seen.

As outlined by Duso et al. (2007), this empirical approach provides a good test of the consistency of competition authorities (and their ability to recognise factors that will support negative findings). It also provides important insights and in particular a test of whether the competition authorities give appropriate and consistent weights to the assessment criteria that they regard as important ex ante (e.g. in their respective merger guidelines) and that are relevant according to the economic theory.

All these studies focus on the assessment criteria used in the course of the merger review, evaluating whether they have been applied consistently. Except for market shares and concentration indices, a quantification of the assessment criteria is rarely possible, giving rise to the judgmental use of the assessment criteria (Duso et al. 2007) and, consequently, endogeneity as they are based on the competition authority's use of the criteria. Furthermore, the studies outlined above largely focus on the quantifiable (e.g. HHI, market shares, existence of entry barriers, efficiencies, or coordination; see e.g. Bergman et al. (2005) and Yang and Pickford (2014)) and one-sided use of assessment criteria: They regard the assessment criteria to be pro- or anti-competitive, while in fact they can prove both effects. Finally, the categories used in these studies are very broad and do not shed light on the actual economic underlyings, which the detailed assessment criteria refer to.

This paper contributes to the discussion of the consistent use of economic rationales in the merger review process in three important aspects.

First, I make use of a more holistic framework when evaluating the consistency of merger decisions by factoring in the two-sidedness of various assessment criteria, by accounting for less broad categories of assessment criteria (e.g. countervailing factors, actual competition, potential competition), and by considering the underlying economic theory in the use of the assessment criteria.

Second, this paper adds to the literature comparing two merger review regimes, namely the US and the EC regime: Lévêque (2005, 2007) investigated cases where competition authorities in

both regimes decided on the same merger, finding that both regimes come to the same assessment conclusion in the far majority of cases, even more so in a later time period (2000 to 2006). Bergman, Coate, Jakobsson, and Ulrick (2010) find that the merger entities agree in 75% to 85% of the cases. The US merger control seems to put more emphasis on variables that measure buyer power, vertical integration, and evidence from anti-competitive effects.

Third, as already started by event studies as described in Chapter 2.1, a holistic empirical study on the consistent use of assessment criteria by the EC after 2004 can add to the analysis of the effects of the 2004 reform. Martinez Fernández et al. (2008), Büttner et al. (2013) and Szücs (2012) started the analysis using the empirical approach outlined in this subchapter with small data sets. By widening the data sets in terms of the number of merger cases assessed as well as the detail of analysis of the assessment criteria, this paper also brings more clarity on the effect of the 2004 reform and the economic rationales taken by the competition authorities.

### 3. Data

The European Commission merger control procedure governed by the EC Merger Regulation<sup>20</sup> is divided into two phases. Following a notification by the merging parties, the European Commission commences its Phase I investigation. After 25 working days, a decision is taken on whether to clear a merger, possibly with agreed remedies, or in case of competition concerns (“*raises serious doubts as to its compatibility with the Common Market*”<sup>21</sup>) to start Phase II investigations. In this Phase II, the European Commission conducts a market test issuing information requests to customers, competitors and/or suppliers, meets with the notifying parties, issues Statements of Objections summarizing the factual and analytical grounds for opposing the transaction, and after further interaction, issues a Final Decision. The Final Decision can clear the transaction (Art. 8 (1) EC Merger Regulation), possibly with remedies (Art.8 (2) EC Merger Regulation) or block the transaction (Art. 8 (3) EC Merger Regulation). For the purpose of assessing the economic rationales taken by the European Commissions, the Summaries of the Decisions have been investigated. In case these Summaries have not yet been published in the Official Journal of the European Union, the respective Commission’s Press Releases were consulted. As the objective is to study the use of economic rationales following the 2004 reform, all decisions since 2005 have been included in the scope of this analysis. In total 71 decisions were analysed.

In the US, the FTC and the DOJ share the responsibility for merger review based on which competition authority has more expertise with the industry involved. Generally, the FTC tends to review mergers in the defence, pharmaceutical, and retail industries, while the DOJ typically investigates mergers in the financial services, telecommunications, and agricultural industries (Hutchison, n.d.). Clayton Act Section 7 is the principal federal substantive law governing mergers, acquisitions, and joint ventures. Similarly to the European Commission proceedings, the US merger review is also divided into two phases. At the end of Phase II, the competition authority issues a *complaint* in case of competition concerns (“*substantially to lessen competition*”<sup>22</sup>). As the US changed its Horizontal Merger Guidelines in 2010, all complaints since 2010 have been scrutinized to study the economic rationales taken by the competition

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<sup>20</sup> Council Regulation (EC) No 139/2004 of 20 January 2004.

<sup>21</sup> Council Regulation (EC) No 139/2004 of 20 January 2004, Art. 6(1).

<sup>22</sup> 15 U.S.C. § 18, Sec. 7 of the Clayton Act.

authorities in assessing notified mergers. In total, 53 *complaints* were analysed. Unlike in the case of the European Commission decisions, *complaints* by US competition authorities only outline merger reviews, where the competition authority raises competition concerns. These competition concerns can then lead to clearance of the merger with remedies or the merger can be blocked as ordered by the court (“equitable relief”).

## 4. Framework

In this section, I develop a framework in order to assess the consistency of EC merger control decisions and compare their economic rationales to US merger control decisions. In the next step, the Analysis in Chapter 5, EC and US merger control decisions are analysed based on this framework in order to evaluate how consistent the merger control decisions have been in the respective time period.

The framework is fundamentally based on the EC Merger Guidelines<sup>23</sup> and the US Merger Guidelines<sup>24</sup>. The *complaints* issued by the US competition authority summarise the economic rationale taken in the competitive effects section, while EC *decisions* summarise the economic rationale as stipulated in the competitive assessment section of the decisions.

Competition concerns related to horizontal mergers may arise due to non-coordinated as well as coordinated effects. Non-coordinated effects refer to the ability of the merging parties to unilaterally raise prices or decrease quality in a profitable way. The extent of non-coordinated anti-competitive effects therefore depends on the impact the merger has on the merging parties' market position and the restrictions the merging parties face from actual and potential competition as well as customers to raise prices or decrease quality. Coordinated effects are fostered by various industry characteristics, which may give suppliers the ability and incentive for tacit collusion.

Below, I frame and categorize the assessment criteria mentioned in the respective guidelines into six categories in order to analyse their consistent use in Chapter 5.

- *Market shares and concentration*: Market shares and concentration indices may provide a *prima facie* indication of the competitive conduct and market power in the respective market. The EC merger review puts more weight on the analysis of market shares in the merger review. Merging parties' market shares above 25% are considered large and above 50% very large, where market shares below 25% “*may be presumed to be compatible with the common market*”<sup>25</sup> Likewise, the US Horizontal Merger Guidelines indicate that market

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<sup>23</sup> 2004/C 31/03 (“ECHMG04”).

<sup>24</sup> US Horizontal Merger Guidelines (“USHMG”).

<sup>25</sup> ECHMG04 Para. 17 and 18.

shares “*can influence firms’ competitive incentives*”<sup>26</sup>, but the US Merger Guidelines considers the Herfindahl-Hirschman Index more prominently in its merger reviews.<sup>27</sup>

- *Actual Competition between merging parties*: The EC Merger Guidelines as well as the US Merger Guidelines consider the closeness of competition<sup>28</sup> (i.e. the closer the merging firms compete pre-merger, the higher the likelihood of anticompetitive effects from the merger) as a main criterion. In addition, the removal of a maverick/competitive force by the merger, from which strong competition would have resulted in the absence of the merger<sup>29</sup> (i.e. the merger eliminates competitive dynamics e.g. by merging with a low-price, a very innovative firm, or a potential competitor) is particularly prominent in the EC Merger Guidelines.<sup>30</sup>
- *Actual Competition between merging parties and competitors*: The EC Merger Guidelines mainly focus on the competition post-merger<sup>31</sup> (i.e. does a sufficient number of credible alternatives exist post-merger? Can competitors counteract the price increasing effect of the merging parties?), capacity constraints<sup>32</sup> (i.e. if competitors are capacity constrained or capacity expansion is prohibitively costly, merging firms may find it easier to raise profits post-merger by decreasing output and increasing prices) and the likelihood of competitors to increase supply post-merger<sup>33</sup> (i.e. remaining competitors may have no incentive to expand output, thereby increasing the anticompetitive effects of the merger). The US Merger Guidelines focus on the evaluation of capacity in the industry.<sup>34</sup>
- *Potential Competition*: In addition to *actually* existing competition, as evaluated in the previous categories, *potential* competition refers to competitive constraints, which are not yet present on the assessed market, but may arise post-merger. In this respect, the EC Merger Guidelines mention the importance of imports (i.e. in the case of the merger, imports may be an important competitive constraint in the future), the likelihood of entry (e.g. possible entrants may find it economically unprofitable to enter the market although the

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<sup>26</sup> USHMG Section 5.

<sup>27</sup> Unconcentrated market: below 1,500; moderately concentrated: 1,500 to 2,500; highly concentrated: above 2,500; Mergers resulting in moderately concentrated markets that involve an increase in the HHI of more than 100 points potentially raise significant competitive concerns. Mergers resulting in highly concentrated markets that involve an increase in the HHI of more than 200 points will be presumed to be likely to enhance market power.

<sup>28</sup> ECHMG04 Para. 28-30.

<sup>29</sup> ECHMG04 Para. 37f., 58-60.

<sup>30</sup> USHMG Section 6.1.

<sup>31</sup> ECHMG04 Para. 31.

<sup>32</sup> ECHMG04: Para. 33f.

<sup>33</sup> ECHMG04: Para. 33.

<sup>34</sup> USHMG: Section 6.3.

entry barriers are low)<sup>35</sup>, and the merging parties' possibility to hinder entry/expansion<sup>36</sup> (i.e. post-merger, the merging parties have the ability to hinder entry or expansion by competitors), while the US Merger Guidelines do not mention assessment criteria related to potential competition.

- *Customers*<sup>37</sup>: Customers may have limited possibilities to switch suppliers post-merger as they may not have alternatives or may have to incur prohibitive switching costs. At the same time, customers may find it important to multi-source (i.e. have the opportunity to source from different suppliers for e.g. security reasons or to “play off” suppliers), which may be constrained post-merger. Analogously to the EC's view on the effect on customers' buyer power, the US Guidelines focus on the evaluation of the effect of the merger on the bargaining leverage of the merging parties vis-à-vis customers.<sup>38</sup>
- *Coordination*<sup>39</sup>: Post-merger the suppliers may find it profitable to coordinate and raise prices, even without entering into an agreement. Factors influencing such behaviour are the number of credible suppliers on the market<sup>40</sup> (i.e. the lower the number of credible suppliers, the higher the likelihood of coordination), stability<sup>41</sup> (i.e. the more stable the market, the more likely is coordination), homogeneous products<sup>42</sup> (i.e. homogenous products may rather foster coordination), transparency<sup>43</sup> (i.e. the more transparent pricing is, the better can coordination be controlled and therefore the more likely it is to persist), symmetry<sup>44</sup> (i.e. the more symmetric the market is, the less incentives for either supplier to deviate and therefore the more likely it can persist), outsider actions<sup>45</sup> (i.e. the less outsiders can deter the coordination outcome by jeopardizing or entry, the more likely coordination is successful and therefore to occur), and past behaviour<sup>46</sup> (i.e. in case of past coordination efforts in the industry, the more likely coordination is to occur post-merger).

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<sup>35</sup> ECHMG04: Para. 69.

<sup>36</sup> ECHMG04: Para. 36.

<sup>37</sup> ECHMG04: Para. 31.

<sup>38</sup> USHMG: Section 6.2.

<sup>39</sup> USHMG: Section 7.

<sup>40</sup> ECHMG04 Para. 45.

<sup>41</sup> ECHMG04 Para. 45.

<sup>42</sup> ECHMG04 Para. 45.

<sup>43</sup> ECHMG04 Para. 47.

<sup>44</sup> ECHMG04 Para. 48.

<sup>45</sup> ECHMG04 Para. 45 and 56.

<sup>46</sup> ECHMG04 Para. 43.

As can be seen from above, the Commission’s “more economic approach” (Christiansen, 2006, 2006b) to assess mergers is clearly reflected in its Merger Guidelines vis-à-vis the US Merger Guidelines, where the legal system is more prominently based on case law rather than substantive law. Irrespectively and as analysed in Chapter 5, the US competition authorities do take account of assessment criteria mentioned in the EC Merger Guidelines. Additionally, the US Merger Guidelines though particularly take into account the effect a notified merger has on non-price competition (e.g. services, innovation).<sup>47</sup>

At the same time, EC and US Merger Guidelines take into account that countervailing factors may counteract the harmful effects of a merger on competition, including:

- *Entry barriers*: Entry barriers can have a pro-competitive character, if they are low, or an anti-competitive character, if they are found to be significant or high<sup>48</sup>. In order to count as a countervailing factor, the entry needs to be timely, likely, and sufficient to counteract the anticompetitive effects of the merger.
- *Buyer power*: Buyer power can have a pro-competitive character, if it is found to be high, or an anti-competitive character, if it is low or if the merger increases the bargaining leverage of the merging parties vis-à-vis the customers.<sup>49</sup>
- *Efficiencies*: Efficiencies can have a pro-competitive character if they are found to be merger-specific, verifiable, and sufficient to counteract the otherwise anti-competitive effects of the merger and benefit consumers.<sup>50</sup>
- *Failing firm*: A failing firm defence may act as a reason to clear a merger, which would otherwise have been challenged. A failing firm defence necessitates that the failing firm and its assets would leave the market absent the merger and no less anti-competitive alternative than the notified merger exists.<sup>51</sup>

The table below summarises the assessment categories and criteria, which shed light on the economic rationale taken by the competition authorities in each individual decision or complaint.

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<sup>47</sup> USHMG Section 6.4.

<sup>48</sup> ECHMG04 Para. 68-75. USHMG: Section 9

<sup>49</sup> ECHMG04 Para 61-67. USHMG Section 8.

<sup>50</sup> ECHMG04: Para. 76-88. USHMG Section 10.

<sup>51</sup> ECHMG04 Para. 89-91. USHMG Section 11.

**Table 1 Framework for the assessment of horizontal merger decisions**

Market Shares and Concentration	Actual Competition between merging parties	Actual Competition between merging parties and competitors	Potential Competition	Customers	Coordination	Countervailing factors
Market Shares	Closeness of competition	Competition post-merger	Imports	Switching: Alternatives	Number of credible suppliers	Entry barriers
Concentration Index	Removal of competitive force	Capacity constraints	Entry likelihood	Switching: Costs	Stability	Buyer power
Number of suppliers		Likelihood of competitors' increase in supply	Effect on entry barriers	Multi-sourcing	Homogeneity	Efficiencies
				Bargaining leverage / buyer power	Transparency	Failing firm
					Symmetry	
					Outsider actions	
					Past behaviour	

For vertical mergers, competition concerns mainly refer to foreclosure strategies. The merger may increase the *ability* and the *incentives* to foreclose competitors. Foreclosure may relate to two forms:

- *Input foreclosure*: Input foreclosure arises, where, post-merger, the new entity would be likely to restrict access to the products or services that it would have otherwise supplied absent the merger.<sup>52</sup>
- *Customer foreclosure*: Customer foreclosures arises, where a supplier merges with an important customer.<sup>53</sup>

<sup>52</sup> 2008/C 265/07 ("ECMR08") Para. 31.

<sup>53</sup> ECMR08 Para. 58.

## 5. General analysis of EC and US Merger Control decisions post-2004

In this Chapter, I analyse the economic rationales taken by the Commission and the US competition authorities in their merger reviews based on the framework developed in the previous Chapter. First, I analyse merger control decisions by the Commission, while I then compare these findings to the merger control decisions taken by the FTC and the DOJ.

### 5.1 EC Merger Control

The dataset of EC Merger Control decisions consists of 71 decisions taken after phase II investigations by the European Commission between 2005 and 2014. According to Art.8 of the 2004 Merger Regulations<sup>54</sup>, the Commission may file a decision declaring a concentration compatible (Art. 8 (1)), compatible with conditions and obligations (Art. 8 (2)), or incompatible (Art. 8 (3)) with the common market. Out of the 71 decisions, 30 mergers were declared directly compatible, while commitments were requested for 36 mergers (i.e. competition concerns were raised), and 5 mergers were blocked completely. In total, 151 markets were assessed in these 71 decisions and for each market the Commission evaluated, whether competition concerns (“*an impediment to effective competition*”<sup>55</sup>) exist. The Commission raised competition concerns in 68 of the 151 (i.e. 45%) markets.

According to the Merger Guidelines, post-merger market shares provide a *prima facie* indication of whether an impediment of effective competition exists. Market shares below 25% “*may be presumed to be compatible*”<sup>56</sup>, while “*very large market shares of 50% or more may in themselves be evidence of the existence of a dominant market position*”.<sup>57</sup> The Commission assessed the post-merger market shares of the merging parties in 123 of the 151 markets. It found competition concerns in 58 of these markets. Allocating the 123 as well as the sub-group of 58 markets with competition concerns into these three market share categories yields the following picture.

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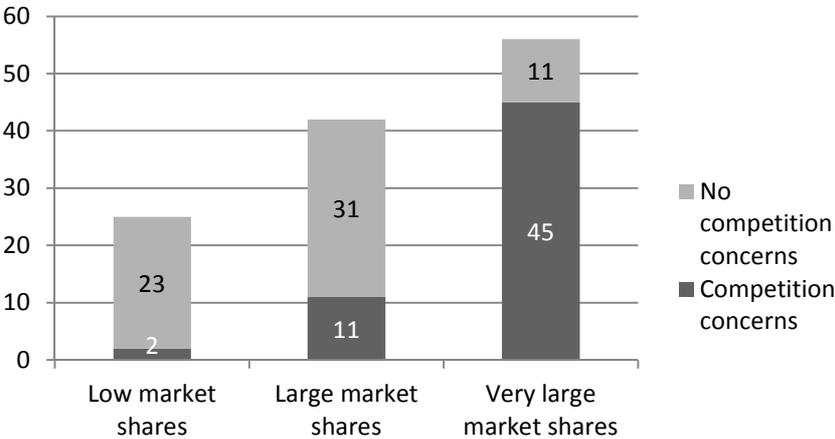
<sup>54</sup> Council Regulation (EC) No 139/2004 of 20 January 2004.

<sup>55</sup> ECHMG04 Para. 1.

<sup>56</sup> ECHMG04 Art. 18.

<sup>57</sup> ECHMG04 Art. 17.

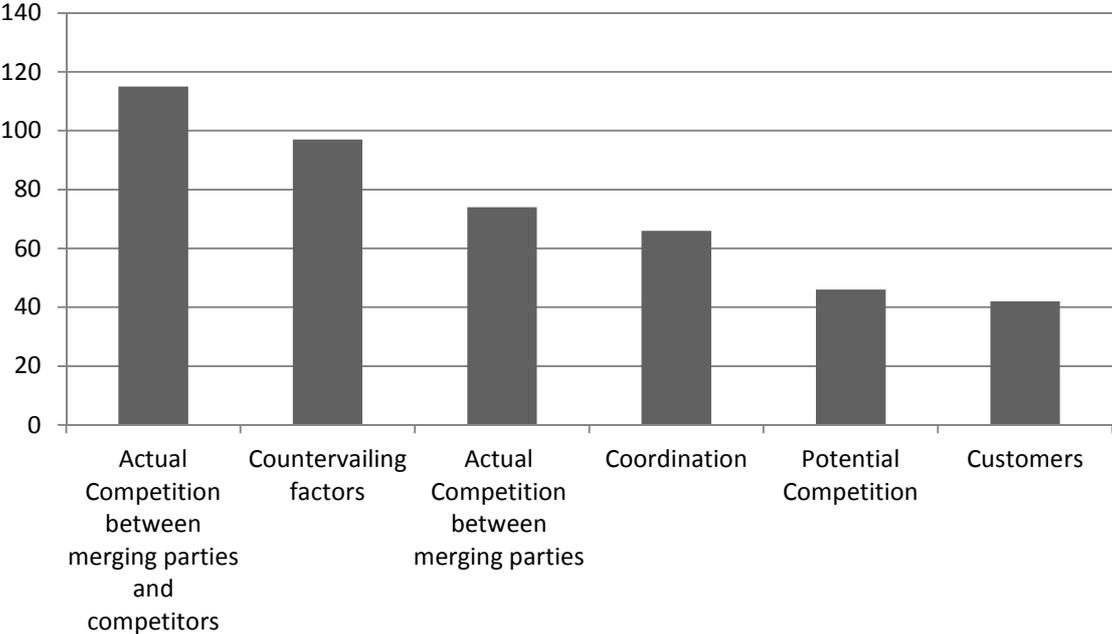
**Figure 1 EC Merger Control reviews by market share category**



The cases which pose the most interesting insights are the two markets with low market shares, for which competition concerns were identified, as well as the eleven markets with very high market shares, for which no competition concerns were raised. I turn to these cases after the discussion of the assessment criteria used in general.

Based on the Framework outlined in Chapter 4, the Commission’s decisions were analysed for the six assessment categories, actual competition between the merging parties, actual competition between the merging parties and competitors, potential competition, customers and coordination as well as countervailing factors. The Commission appears to assess actual competition as well as countervailing factors with particular scrutiny as evident from the frequency of evaluating either category in the 151 markets.

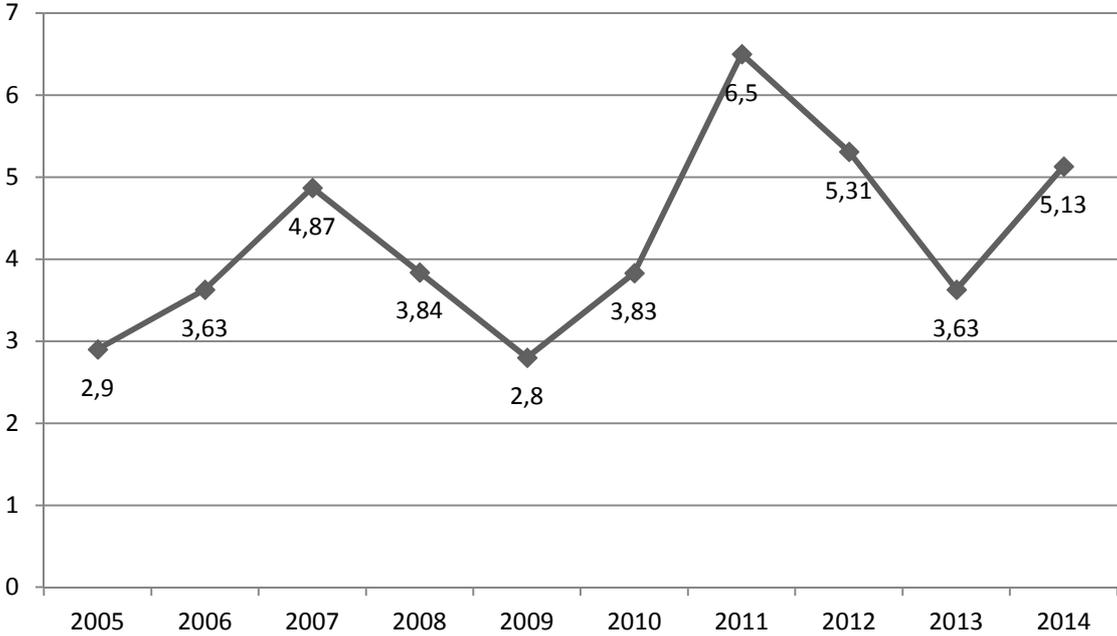
**Figure 2 Number of EC evaluations for each assessment category**



This conveys the picture that *actual* competition and characteristics (e.g. countervailing factors) are of most interest in the merger control review, while *potential future* behaviour (e.g. reactions from customers, future competition, as well as potential post-merger coordination, possible entry and imports) are less important. Thereby, the criticism to the *General Electric/Honeywell* decision on the importance of actual over potential competitive effects as well as the use of a stringent economic approach (Schmitz, 2002; Robertson, 2008) have found their way not only into the Merger Guidelines, but also into the Commission’s day-to-day merger review practice. Detailed findings per assessment category can be found in Table 2 below.

The development of the average number of criteria assessed per market ever since the 2004 reform clearly draws attention to and conveys the picture of a “more economic approach” the Commission takes in its merger control decisions: While assessing only 2.9 criteria per market in 2005, the Commission considered 5.1 criteria per market on average in 2014, when taking a merger control decision.

**Figure 3 Number of assessment criteria used per market**



The Commission puts particular emphasis on the evaluation of the pro- and the anti-competitive effects resulting from a merger, which leads to a well-balanced approach to merger reviews. Three findings give rise to this conclusion. First, the evaluation of the pro- and anti-competitive nature of *each* individual assessment criterion in each case (see Table 2). Second, the fact that the Commission finds pro- and anti-competitive effects at the same time in 33 of the 151 markets (i.e. 22%). Third, the rising importance of a countervailing factor analysis, which is undertaken in 43% of all cases.

The Commission’s approach to the two-sided nature of the assessment criteria, which has not been captured thoroughly in previous studies, can easily be seen in Table 2. All assessment criteria can indicate pro- as well as anti-competitiveness and the Commission assessed the pro- as well as the anticompetitive nature of each assessment criterion in the course of its enforcement activities: It evaluated the assessment criteria to act pro-competitively in 46% of the cases and to act anti-competitively in 54% of the cases. The fact that the assessment criteria are evaluated based on their pro- as well as their anti-competitive effect in each individual case sheds light on the balanced approach of the Commission.

**Table 2 Pro- and anticompetitive assessment of each assessment criterion**

Assessment category	Assessment Criterion	Number of pro-competitive assessments	Number of anti-competitive assessments
<b>Actual competition between merging parties</b>	Closeness of competition	20*	23*
	Removal of competitive force	8	23
<b>Actual Competition between merging parties and competitors</b>	Competition post-merger	52	25
	Capacity constraints	14	8
	Likelihood of competitors' supply increase	3	11
<b>Potential Competition</b>	Imports	4	3
	Entry likelihood	6	16
	Merger effect on entry barriers & expansion	5	12
<b>Customers</b>	Switching: Alternatives	14	7
	Switching: Costs	8	1
	Multi-sourcing	4	6
	Bargaining leverage / Customer buyer power	0	2
<b>Coordination</b>	Number of suppliers	6	2
	Stability	3	2
	Homogeneity	4	3
	Transparency	13	5
	Symmetry	8	3
	Outsider action	6	6
	Past behaviour	3	1
<b>Countervailing factors</b>	Entry barriers	8	47
	Buyer power	5	10
	Failing firm defence	5	3**
	Efficiency claim	3	12**
		<b>46%</b>	<b>54%</b>

Note: \*Closeness of competition was further segregated for the anticompetitive case into closest (8) and close competitors (14) as well as in-between (1); for the procompetitive case, a further segregation into not closest competitors (7) and no competitors (13) took also place. \*\* The notifying parties have the burden of proof for a failing firm defense and efficiency claims; consequently, anti-competitive effects refer to the case, where the Commission did not follow the argumentation of the notifying parties.

In addition, the balanced approach also becomes obvious when looking at the assessment of the competitive impediment for each individual market. Pro- and anti-competitive effects at the same time were found in 33 of the 151 markets (22%). Out of these 33 markets, no competition concerns were raised for 21 markets. This indicates that with the help of the economically-balanced approach, the Commission finds grounds to clear mergers. At the same time, for those 12 markets with pro- and anti-competitive effects where competition concerns exist, the pro-competitive effects only account for 4.8% of all effects, while 95.2% were anti-competitive. Consequently, it appears that the markets were challenged on economically sound rationales - given a careful weighting of pro- and anticompetitive effects- and that *only* those markets were challenged, where considerable economic rationales supported such a decision.

A countervailing factor analysis was undertaken in 43% of the market assessment. In case pro- and anti-competitive effects were present (i.e. the Commission had to weigh strong pro- and anti-competitive effects in order to come to a conclusion on whether competition concerns exist), a countervailing factor analysis was undertaken for 57% of these markets. Again, this conveys the importance of countervailing factor analysis as a means to decide on cases, which are difficult or close to assess. In line with this and referring back to the market share categories, 96% of the cases, when a countervailing factor analysis was undertaken, was in cases with large or very large post-merger market shares (i.e. above 25%). With the help of the countervailing factor analysis, the Commission could assess that no competition concerns existed on eight markets. Thereby, the Commission avoided a potential type I error of prohibiting a pro-competitive merger, which was also the objective of the 2004 reform as indicated by Röller and de la Mano (2006). In sum, countervailing factor analyses were particularly helpful in deciding on merger control cases, for which a closer competitive assessment was needed.

After the discussion of the use of assessment criteria and the countervailing factor analysis, we can now turn back to those two markets, which were challenged though having low post-merger market shares, as well as the eleven cases, which were not challenged despite resulting in very high post-merger market shares of the merging parties.

In the first case, *Hutchison 3G Austria / Orange Austria*<sup>58</sup>, the intended merger was evaluated to be anti-competitive, although the merging parties had low market shares. Market concentration was assessed to be high with only three suppliers remaining post-merger. Further, the merger would have removed a pricing maverick leading to likely higher prices post-merger. This assessment was substantiated through economic evidence (UPP-Test). In addition, no countervailing factors were present. In the second case, *Siemens / VA Tech*<sup>59</sup>, the merger would have given rise to a duopoly in the mechanical metallurgical plant building market and the merging parties could have hindered competitors from expansion in the market. It therefore appears from both cases that a low number of suppliers post-merger as well as the absence or even an anti-competitive effect from countervailing factors can be particularly decisive when deciding on merger cases. In these cases, the Commission could also avoid a potential type II

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<sup>58</sup> Case COMP/M.6497

<sup>59</sup> Case COMP/M.3653

error of clearing an anti-competitive merger, if it had not looked closely at the assessment criteria promulgated by the 2004 reform.

In the cases with very high market shares of the merging parties, but no competitive concerns, all assessed criteria have been found to be pro-competitive *only* in each case. This implies that very strong evidence needs to be in place in order to counter the assumption of market power in cases of very large market shares. Furthermore, the arguments themselves need to be strong as the Commission values arguments for actual competition and countervailing factors highly as seen before: The cases were decided to lead to no competitive harm because of strong competition post-merger<sup>60</sup>, efficiencies and failing firm defense, and existing spare capacity<sup>61</sup>. This again undermines the importance of countervailing factor analysis as well as the Commission's approach emphasizing the importance of actual competition, rather than potential effects and reactions from customers and entry. Furthermore, these cases were "clear cut" cases as the Commission only evaluated 3.45 assessment criteria per market, which is even below its average number of assessment criteria used per market (4.2). In two cases, the market shares were also deemed to be no good indicator for market power. One exception is the merger *Glatfelter/Crompton Assets*<sup>62</sup>, which was deemed to be not competitively harmful due to customers being able to switch suppliers, competitors unlikely to increase supply post-merger, no barriers to expansion, the fact that the merging parties cannot hinder expansion, as well as entries have taken place in the past. However, at the same time, this also confirms the view that if no decision based on the actual competition can be taken, many potential factors need to be present to take a decision, especially when counter-arguing against presumably high market power as in the *Glatfelter/Crompton Assets* case. This also reinforces the conclusion that these difficult to assess cases are also handled and ruled based on the same economic rationales the Commission takes in its other decisions (e.g. importance of actual competition and countervailing factors). Finally, by not raising competition concerns for these markets with *prima facie* dominant market power by the merging parties, the Commission again avoided a potential type I error of prohibiting a pro-competitive merger as a result of the 2004 reform.

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<sup>60</sup> Case COMP/M.4403, Case COMP/M.4513, Case COMP/M.4523, Case COMP/M.5153, Case COMP/M.5141.

<sup>61</sup> Case COMP/M.5153, Case COMP/M.4781.

<sup>62</sup> Case COMP/M.4215.

Also, the fact that a dominant market position now does not necessarily lead to a merger prohibition directly addresses the General Court's criticism in the *Tetra Laval/Sidel* case.

Finally, with regards to vertical mergers, the Commission assessed ten mergers, including 16 markets, on the grounds of anti-competitive foreclosure strategies. In these mergers, the Commission found that the merging parties have the ability and incentive to engage in foreclosure post-merger. In 70% of the cases (i.e. seven mergers), the vertical effects were the only assessed effects in the merger review, while only in 30% of the mergers the vertical effects are supportive to the assessment of the horizontal effects.

## 5.2 Comparison to US Merger Control

The objective of this section is to analyse to what degree the EC and the US merger control regimes use similar economic rationales when finding anti-competitive effects resulting from a merger.

The data used to analyse US merger decisions includes 53 published complaints raised by the FTC or the DOJ between 2010 and 2014. In these complaints, 91 markets were assessed. These complaints outline the merger cases, where the DOJ or the FTC file a lawsuit against the respective merger as they have found anti-competitive effects resulting from the merger.<sup>63</sup> Under the US regime, the competition authorities have to file a lawsuit against the notifying parties in order to block the merger, while the Commission's decisions has the power of an administrative act (Schmitz, 2002).

As outlined in Chapter 4, the US merger control regime focuses on concentration indexes to find *prima facie* indications of whether an impediment to effective competition results from the merger. As for the EC regime, three categories of *prima facie* indications of market power can be determined, low concentration, moderate concentration, and high concentration. 92% of the analysed markets, for which the HHI was mentioned, were highly concentrated, 6% were moderately concentrated and 2% had a low concentration. To draw a comparison to the EC regime, in those markets, which were found by the Commission to be affected anti-competitively by the merger, the merging parties had very high market shares in 78% of the cases, high market shares in 19% of the cases and low market shares in 3% of the cases.

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<sup>63</sup> Consequently, when comparing the EC and the US regime, only those EU markets are considered, where competitive concerns have been raised by the Commission.

The US competition authorities, the FTC and the DOJ, also assessed *actual competition* to be more important than *potential factors* (e.g. customer reactions, potential competition, coordination). These findings are in line with the findings for the reviews undertaken by the EC merger control regime. However, two aspects appear to differ between the two regimes at first sight.

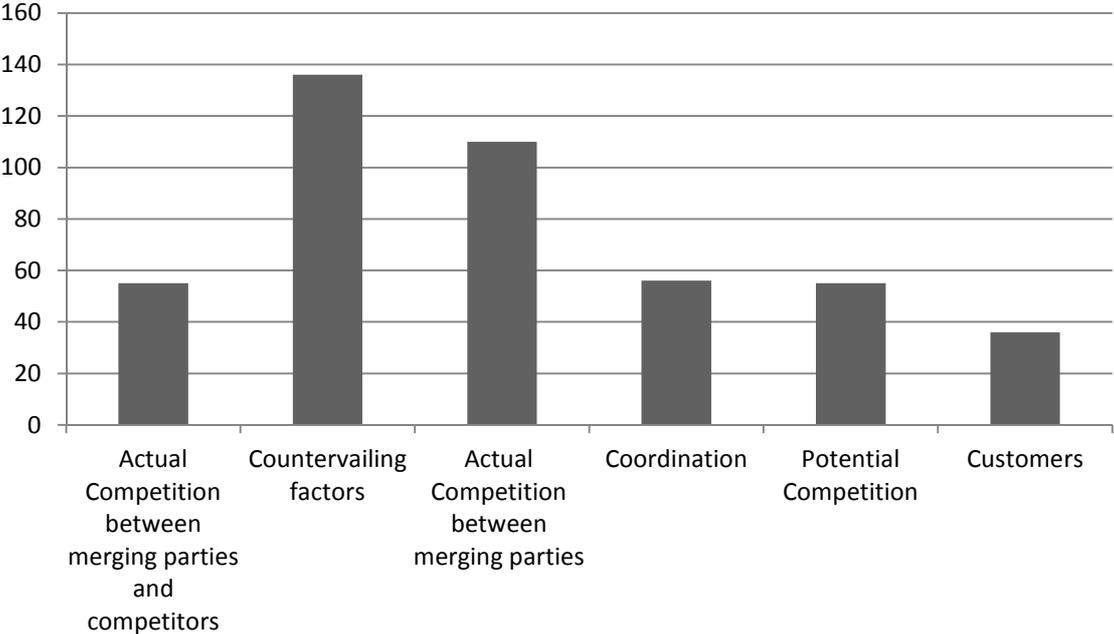
First, the US regime appears to put less weight on the actual competition between the merging parties and competitors than the EC regime. This can potentially be explained by the use of the concentration index over market shares as a *prima facie* indication of market power. The concentration index is more focused on assessing competitive effects than market shares. Thereby, the US regime already considers in its *prima facie* indication the competitive nature of the industry and puts less additional weight on this assessment category in its further investigations. Also, the US regime tends to mention the number of suppliers remaining post-merger, which again provides a hint towards the competitive nature in the industry.

Second, the US regime puts significant importance on the countervailing factor analysis. This can be explained by the inclusion of countervailing factors in the US Merger Guidelines already since 1982<sup>64</sup>, while the EC Merger Guidelines only included these specifically in the course of the 2004 reform. In line with this, the US merger control regime uses a countervailing factor analysis in 92% of its cases, while the EC regime used it only in 62% of the cases, where it raised competitive concerns.

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<sup>64</sup> The 1982 Merger Guidelines refer to efficiencies and failing firm defense (Sec. V. Defenses of the 1982 Merger Guidelines) as well as ease of entry (Sec. III. Horizontal Mergers).

**Figure 4 Number of US evaluations for each assessment category**



The US regime did not evaluate all assessment criteria which the EC regime used in its merger control review (e.g. likelihood that competitors increase supply post-merger, importance of imports, the importance of symmetry and outsider action for coordination). Still it evaluated more criteria per market than the EC regime did: While the US regime considered 5.98 assessment criteria per market on average, the Commission considered (only) 4.4 criteria per market in which competition concerns arise. Like for the countervailing factor analysis, one reason for the finding may be that the US regime has been accustomed to a more economic approach (including the analysis of countervailing factors) for a longer time, thereby also having standardized and tailored its procedures and assessment templates to this economic approach to a larger degree than the Commission already.

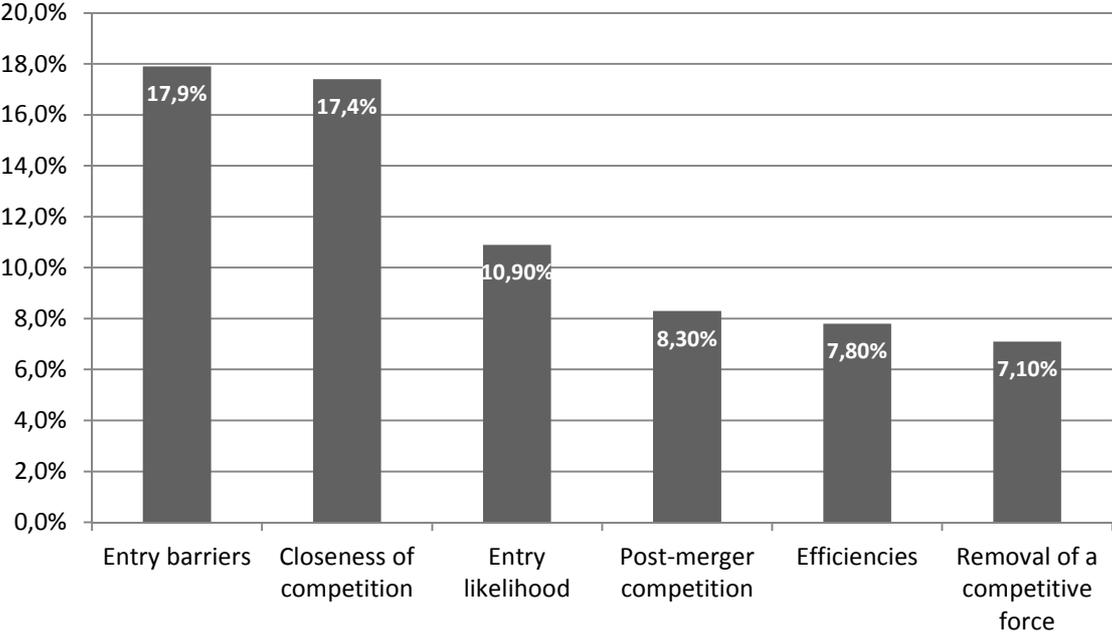
While the number of criteria assessed is higher during the US merger review process, the EC seems to have a more balanced approach in its merger review: For the markets, where the merger impedes effective competition, the Commission still finds pro- and anticompetitive effects in 17% of the markets. The US regime, on the contrary, only finds pro- and anticompetitive effects in 2% of its reviews. Again, the careful evaluation of pro- and anticompetitive effects speaks for a less standardized and more balanced approach on the Commission’s side: The balanced approach by the Commission necessitates a careful

consideration of the pro- and anti-competitive effects of the merger based on the tools (i.e. the assessment criteria) available, while the more standardized US approach can benefit from the standard consideration of more assessment criteria per case.

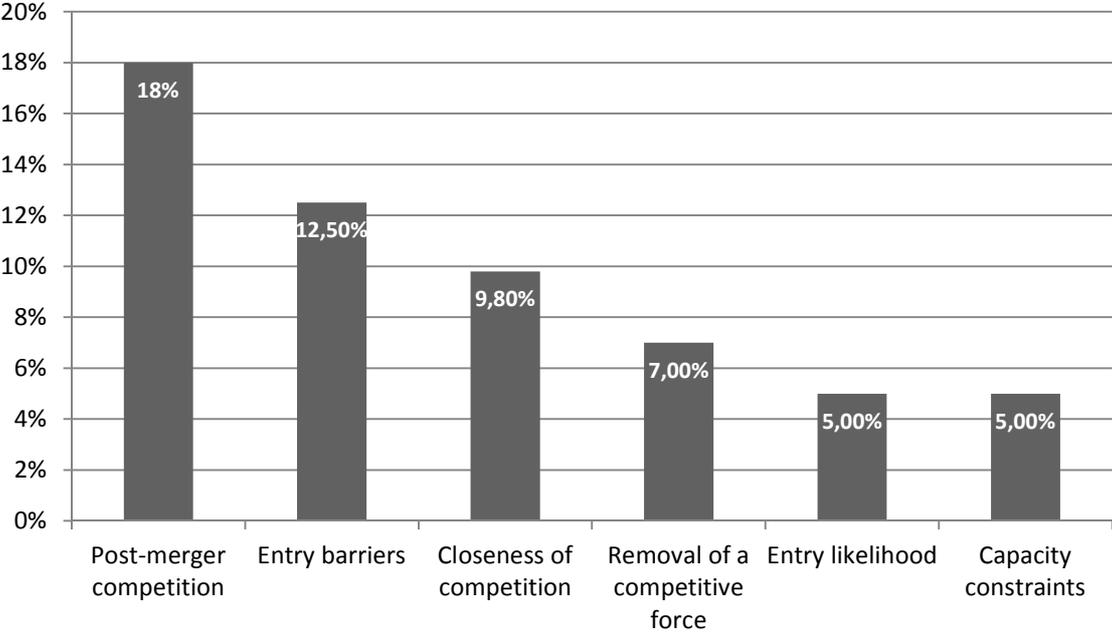
As indicated above, the US competition authorities found competition concerns in one low concentration case and in four moderate concentration cases. Unlike the Commission, which focuses on market share *levels* in its *prima facie* assessment, the US Merger Guidelines also consider the effects of an *increment* in the HHI to competition. In the four moderate cases considered and given the thresholds stipulated in the US Merger Guidelines, a *prima facie* indication of a potential rise of significant competitive concerns, which often warrant scrutiny, could be assessed in these cases. In the low concentration case, the post-merger market share would have been very high under EC terms, the low concentration was only present in one out of six markets, which had to be considered for the merger, and the DOJ used particular scrutiny in this case, considering ten assessment criteria, which were all found to have anti-competitive effects. As the EC regime, the US competition authorities appear to have consistently used the tools they have used in all their assessment also for these difficult-to-assess cases (e.g. HHI, number of assessment criteria assessed per market).

When comparing the assessment criteria referred to most often in the EC decisions and the US complaints, the top six criteria show a remarkable similarity: First, only one criterion in these top six criteria differs between the Commission's and the US assessments. The US includes efficiencies in these preferred criteria, while the Commission includes capacity constraints. However, as seen below, both criteria rank at the lower end of the top six. Second, the spread of using assessment criteria in the assessment is practically identical: As an example, the US top criterion, entry barriers, accounts for 17.9% of all assessed criteria. The EC top criterion, post-merger competition, similarly accounts for 18.0% of all assessed criteria.

**Figure 5 Top Assessment Criteria used in the US**



**Figure 6 Top Assessment Criteria used by the Commission**



One clear distinction between the US and the EC regime though lies in the assessment of the merger’s effect on the non-price competition (e.g. service level, innovation). The Commission

did not focus on the use of non-price competition criteria in its assessments for the time frame of this analysis, while the US uses qualitative arguments to assess the effect of the merger on non-price competition. In 62% of its reviews, the US competition authorities raise concerns against the merger's effect on non-price competition. In each case it considered the effect of the merger on non-price competition, the competition authorities found the effect to be anti-competitive, thereby strengthening the argumentation and affirming the view of why to conclude that an impediment to effective competition results from the notified merger.

There has been a long discussion on how to assess *prima facie market power*, which differs between the Commission's and the US regime. While the Commission has more prominently taken the view of market shares as outlined above, the US Merger Guidelines prefer to think in concentration levels and the increase in concentration from the merger. For this, they refer to the Herfindahl-Hirschman Index and the change in the Herfindahl-Hirschman Index brought about by the merger. Both regimes also take note of the number of remaining suppliers in the market and are more likely to challenge a merger with less suppliers left in the market: For example, four-to-three mergers are often cases, which are difficult to decide upon.<sup>65</sup> The question therefore becomes, which variable, market shares, concentration, change in concentration and/or number of remaining suppliers should have which weight in the assessment of the market power? While both regimes have thresholds to rely on, the correct weighting of each variable (and, whether the variable is to be considered at all) remains to be seen. However, the Commission gave rise to a suggestion through its decision in the *Johnson & Johnson/Synthes* merger, which it cleared with commitments (European Commission, 2012). In this decision, the Commission finds that no competition concerns arise, where at least two other competitors would remain post-transaction both (i) with a market share at least comparable to the increment or (ii) with a significant market share. How this rule of thumb will evolve over time in merger control decisions, remains to be seen.

Finally, with regards to vertical mergers, the US competition authorities assessed vertical effects for four mergers, including six markets. Similarly to the findings of the Commission, 50% of the cases (i.e. two mergers), the vertical effects were the only assessed effects in the

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<sup>65</sup> For example, Case COMP/M.3653, Case COMP/M.4919, Case COMP/M.6214, Case COMP/M.6471, Case COMP/M.6203, Case COMP/M.6497, Case COMP/M.6570, Case COMP/M.6992, Case COMP/M.7018.

merger review, while only in 50% of the mergers the vertical effects are supportive to the assessment of the horizontal effects.

## **6. Analysis of recent mergers in the small package delivery and the crop protection industry / Recent Significant cases and their assessment by the EC Merger Control**

Further to the broad range of merger control decisions analysed in Chapter 5, this Chapter focuses on the analysis of merger assessments in two industries, which have undergone particular merger activity in the last years: The small package delivery industry is characterised by the competition of four large integrators, *United Parcel Service* (“UPS”), *TNT Express* (“TNT”), *DHL*, and *FedEx Corporation* (“FedEx”). Six major corporations, *BASF*, *Dow*, *DuPont*, *Bayer*, *Monsanto* and *Syngenta*, competed in the crop protection industry prior to the recent consolidation wave.

The merger activities and in particular the motivation for the recent merger control decisions by the Commission and the US competition authorities in the small package delivery industry as well as the crop protection industry are analysed in the following sub-chapters.

### **6.1 Small package delivery industry**

The four large players in the small package delivery industry, UPS, TNT, DHL, and FedEx, which have been in the centre of the recent merger activities, are integrators, i.e. they possess full operational control over all transportation assets, a sufficient geographic coverage on a global level, a hub and spoke operating model, a proprietary IT network, and the reputation of reliably delivering small packages on time. The network element of the industry exposes the firms to significant economies of scale (e.g. pick-up and delivery costs, coverage at the origin and destination). Furthermore, the industry offers highly differentiated products depending on the speed of delivery (i.e. express vs standard delivery), the geography (i.e. from domestic to international extra-EEA<sup>66</sup>), and the quality of service (European Commission, 2016a).

Given the integrators’ network strength and spread across all EEA countries as well as their tight control over their network, non-integrated small package delivery providers generally exert a weak competitive constraint on integrators (European Commission, 2016a).

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<sup>66</sup> A domestic service takes place if packages are picked up and delivered in the same country, an international intra-EEA service is provided if the pick-up and the delivery are in two different EEA countries, and an international extra-EEA service is offered, when pick-up and delivery are in one EEA country and one non-EEA country.

The European Commission was notified of two proposed mergers in recent years, *United Parcel Service / TNT Express*<sup>67</sup> and *FedEx Corporation / TNT Express*<sup>68</sup>. Both mergers would at least have led to a 4-to-3 merger in the assessed markets. However, while the *United Parcel Service / TNT Express* merger was blocked by the Commission, the *FedEx Corporation / TNT Express* merger was approved. The following paragraphs summarize the competitive assessments by the Commission and particularly outline the reasons for the different conclusions reached by these competitive assessments.

#### *United Parcel Service / TNT Express*<sup>69</sup>

On June 15, 2012, UPS notified the Commission of its proposed acquisition of TNT. The motivation was to take benefit of TNT's European road freight network, while UPS' focus is on the North American market.

The Commission raised competition concerns in the market for *international intra-EEA small package delivery express*<sup>70</sup> services.

The Commission's competitive assessment found that neither the competitive constraints exerted by the non-integrators<sup>71</sup> nor the ones by the other operators<sup>72</sup> were sufficient to outweigh the anti-competitive effects induced by the merger in the defined market.

Furthermore, in most national markets, the merger would have been a 4-to-3 merger, in some even a 3-to-2 merger excluding FedEx. The closeness of competition between the market leader, DHL, and the merged entity also concerned the Commission as FedEx was deemed to be a distant substitute. This implies, even in markets where three integrators remained post-merger, the competitive constraint exerted by FedEx would have been minor, leading to a situation, where *de facto* only two integrators would have competed post-merger. Likely price increases revealed by a price concentration analysis as well as the inability of customers to switch suppliers increased the Commission's concerns. Given the network industry nature, high

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<sup>67</sup> Case COMP/M.6570.

<sup>68</sup> Case COMP/M.7630.

<sup>69</sup> This section is based on European Commission (2014).

<sup>70</sup> Express delivery services (with a next day delivery commitment) are regarded separate from the market of deferred/standard delivery services (with a longer time frame commitment).

<sup>71</sup> Non-integrators' coverage is lower, their air network, especially long-haul, and premium express services was assessed to be weaker.

<sup>72</sup> DHL is market leader, while FedEx is the weakest integrator (5-10% market share in most EEA countries), inferior coverage, a less developed network, and higher European pick-up and delivery costs (PUD). This means, FedEx exerts a weak competitive constraint to the parties on the market. Core activities of FedEx are the extra-EEA deliveries. FedEx plans to expand, but still lacks behind the competitors. Hence, post-merger the customers would thus face two very strong integrators: DHL and the merged entity.

investments (IT infrastructure, sorting infrastructure, and the air network) serve as barriers to entry and limit the possibility for a new entrant into the market as an integrator.

Based on this competitive assessment, the Commission declared the merger to be incompatible with the internal market and the EEA agreement on 30 January 2013.<sup>73</sup>

Table 3 offers an overview of the country-by-country analysis conducted by the Commission in its competitive assessment.

In the course of the proceedings, UPS had offered to divest TNT's subsidiaries in Bulgaria, the Czech Republic, Denmark, Estonia, Finland, Hungary, Latvia, Lithuania, Malta, the Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden, Spain, and Portugal and grant access to its intra-European air network to/from the countries with divested TNT subsidiaries.

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<sup>73</sup> Subsequently, the General Court of the European Union annulled the Commission's decision to refuse to authorise the merger on procedural grounds as the econometric analysis used by the Commission was based on an econometric model different from that which had been the subject of an exchange of views and arguments during the administrative procedure.

**Table 3 UPS / TNT Express: country-by-country analysis**

Country	Market shares	Net price effect	Competitive Constraint by FedEx
Bulgaria	U/T: 30-40% D: 50-60% F: 5-10%	0-10%	Limited (-)
Czech Republic	U/T: 50-60% D: 40-50% F: 5-10%	0-5%	Remain weak (-)
Denmark	U/T: 50-60% D: 40-50% F: 5-10%	-(0-5%), but merger would eliminate competitive force	Limited increase (0/+)
Estonia	U/T: 40-50% D: 50-60% F: 0-5%	0-5%	Remain weak (-)
Finland	U/T: 30-40% D: 60-70% F: 0-5%	0-5%	Very limited (--)
Hungary	U/T: 40-50% D: 30-40% F: 10-20%	-(5)-5%	Remain limited (-)
Latvia	U/T: 40-50% D: 40-50% F: 5-10%	0-10%	Remain limited (-)
Lithuania	U/T: 50-60% D: 40-50% F: 0-5%	0-10%	Remain limited (-)
Malta	U/T: 40-50% D: 50-60% F: 0-5%	5-10%	Remain weak (-)
The Netherlands	U/T: 50-60% D: 40-50% F: 5-10%*	-(5-0)%, but inconsistent data	Remain limited (-)
Poland	U/T: 40-50% D: 40-50% F: 5-10%	0-5%	Remain limited (-)
Romania	U/T: 40-50% D: 50-60% F: 0-5%	0-10%	Remain weak (-)
Slovakia	U/T: 40-50% D: 40-50% F: 5-10%	0-5%	Remain weak (-)
Slovenia	U/T: 30-40% D: 60-70% F: 0-5%	0-5%	Remain limited (-)
Sweden	U/T: 40-50% D: 50-60% F: 0-5%	0-5%	Remain weak (-)

Note: *Net price effect* after accounting for efficiencies; \* Likely exit of FedEx as an effective competitive constraint, leading to a 3-to-2 merger

Source: European Commission (2014)

### *FedEx Corporation / TNT Express*<sup>74</sup>

On 26 June 2015, FedEx notified the Commission of its proposed acquisition of TNT, which was cleared by the Commission on 8 January 2016.

The market was defined by the Commission as the market for small package delivery services (1) inside the EEA (intra-EEA) and (2) from the EEA to non-EEA destinations (extra-EEA).<sup>75</sup>

<sup>74</sup> This section is based on European Commission (2015; 2016a, 2016b, 2016c).

<sup>75</sup> Unlike for the intra-EEA market as in the *United Parcel Service / TNT Express* case, the Commission considered express and deferred services as segments of the same extra-EEA market, given that the integrators

(1) While the merger would be a 4-to-3 merger as in the case of *United Parcel Service / TNT Express*, the competitive assessment for the international *intra-EEA* services led to the conclusion that the proposed merger would lead to a market share of below 30% for the merged entity on an EEA level and the merged entity would be the weakest of the three remaining integrators. The parties were not particularly close competitors.<sup>76</sup> The merger would also not remove a competitive force given the high cost position of TNT, its history of no expansion, of not being an aggressive price setter, and of no significant investments. Furthermore, DHL and UPS as well as non-integrators with a large network would be in a position to exert a competitive constraint on the merged entity post-merger. A price concentration analysis did not indicate statistically significant post-merger price increases, while the merged entity would also be able to realize efficiency gains (efficiency defense). Hence, as analysed in Chapter 5.1 for the broader set of mergers, a countervailing factor analysis supported the Commission in determining, whether competition concerns existed in the market.

(2) The competitive assessment for the market for *extra-EEA* small package delivery services revealed moderate post-merger market shares<sup>77</sup>, but the market share would exceed 40% and the increment would be over 5% in Hungary, Estonia and Latvia for extra-EEA deliveries to the world, and a combined market share of more than 40 % and the increment would be over 5 % on ten national markets for extra-EEA deliveries to the major world lanes.<sup>78</sup>

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use the same network, the same supply chain steps and that the integrators directly compete, leading to price convergence.

<sup>76</sup> FedEx's focus is on customers with significant extra-EEA delivery needs and has limited ability to compete successfully for customers of stand-alone intra-EEA express services given its weaker network. TNT's focus is on customers with standalone international intra-EEA and domestic/deferred delivery needs, based on a substantial European road-based and more efficient air network presence in the EEA.

<sup>77</sup> Including most plausible markets for extra-EEA delivery services to the world and to the six main world trade lanes, on most 30 national markets to the world.

<sup>78</sup> Those markets correspond to extra-EEA deliveries from seven different EEA countries, namely Belgium, Bulgaria, Estonia, Latvia, Lithuania, Malta and Slovakia. For Belgium, Bulgaria, Estonia and Malta, those markets would be for extra-EEA deliveries to North America. For Latvia, it would be the markets for deliveries to North America, to Central and South America, to the Middle East and to Asia/Pacific. In the case of Lithuania and Slovakia, it would be the markets for deliveries to the Middle East. Finally, for Estonia, Hungary and Latvia it would also be the market for extra-EEA deliveries to the world.

In addition, the competitive assessment came to the conclusion that the parties were not particularly close competitors<sup>79</sup>, the merger would not remove a competitive force<sup>80</sup>, and DHL and UPS would be in a position to constrain the merged entity post-merger<sup>81</sup>.

As for the *United Parcel Service / TNT Express* merger assessment, the Commission also engaged in a country-by-country analysis for the assessment of the *FedEx Corporation / TNT Express* assessment<sup>82</sup>:

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<sup>79</sup> TNT is weaker among integrators on the total market for extra-EEA deliveries and on most possible sub-segmentations thereof given its focus on Europe; TNT owns a very limited air network in comparison to the other integrators; TNT appeared as a weaker competitor of FedEx for extra-EEA opportunities than DHL and UPS, given an analysis of bidding data.

<sup>80</sup> TNT has the weakest market position and its market share had not increased recently; TNT has no cost advantage and has not engaged in an aggressive pricing strategy.

<sup>81</sup> All are integrators with a global footprint; integrators can increase supply, customers can and would switch in the case of a post-merger price increase; non-integrators also exert some competitive force.

<sup>82</sup> The Commission analysed the markets with a moderate post-merger market share of the merged entity and where the third competitor would have a market share below 20 %. It also analysed the markets where the share of the third competitor would be smaller than the increment to the merged entity.

**Table 4 Country-by-country analysis of Extra-EEA services**

Country	Market	Market share of merged entity	Increment	DHL, UPS position
Austria	Extra-EEA to the Middle East	30-40%	n/a	D: 50-60% U: 10-20%
Belgium	Extra-EEA to North America	40-50%	5-10%	D: 30-40% U: 10-20%
Belgium	Extra-EEA to other main world lanes and world	30-40%	n/a	D: 40-60% U: 10-20%
Bulgaria	Extra-EEA to North America	40-50%	5-10%	D: 40-50% U: 10-20%
Bulgaria	Extra-EEA to the world, to Central and South America, and the Middle East	30-40%	n/a	D: 50-60% U: 5-20%
Bulgaria	Extra-EEA to Asia/Pacific	20-30%	n/a	D: 60-70% U: 5-10%
Croatia	Extra-EEA to Asia/Pacific	20-30%	5-10%	D: 50-70% U: 5-10%
Cyprus	Extra-EEA to the world, to Central and South America, Asia/Pacific, to Africa and the Middle East	30-40%	5-10%	D: 50-70% U: 0-10%
Cyprus	Extra-EEA to the world	20-30%	5-10%	D: 60-70% U: 5-10%
Czech Republic	Extra-EEA to the world and the Middle East	30-40%	n/a	D: 50-60% U: 10-20%
Czech Republic	Extra-EEA to Central and South America and to Asia/Pacific	20-30%	n/a	D: 60-70% U: 5-10%
Estonia	Extra-EEA to the world	40-50%	10-20%	D: 40-50% U: 10-20%
Estonia	Extra-EEA to North America	50-60%	5-10%	D: 20-30% U: 10-20%
Estonia	Extra-EEA to Asia/Pacific	30-40%	n/a	D: 50-60% U: 5-10%
France	Extra-EEA to Central and South America, to Asia/Pacific and to the Middle East	30-40%	n/a	D: 40-60% U: 10-20%
Hungary	Extra-EEA to the world	40-50%	5-10%	D: 40-50% U: 10-20%
Hungary	Extra-EEA to Central and South America, to Asia/Pacific, to the Middle East and to Africa	30-40%	n/a	D: 40-60% U: 10-20%
Ireland	Extra-EEA to the world and to Asia/Pacific	30-40%	5-10%	D: 40-60% U: 10-20%
Latvia	Extra-EEA to the world, to Central and South America, and to Asia/Pacific	40-50%	n/a	D: 30-50% U: 10-30%
Latvia	Extra-EEA to North America, and to the Middle East	50-60%	n/a	D: 20-40% U: 10-20%
Lithuania	Extra-EEA to the Middle East	40-50%	5-10%	D: 40-50% U: 10-20%
Luxembourg	Extra-EEA to the world, to Central and South America, and to the Middle East	20-30%	5-10%	D: 60-70% U: 5-10%
Luxembourg	Extra-EEA to North America	30-40%	n/a	D: 50-60% U: 10-20%
Malta	Extra-EEA to North America	40-50%	10-20%	D: 30-40% U: 20-30%
Poland	Extra-EEA to Central and South America, and to the Middle East	30-40%	n/a	D: 40-50% U: 10-20%
Slovakia	Extra-EEA to the Middle East	40-50%	n/a	D: 50-60% U: 0-5%
Slovakia	Extra-EEA to the world, Central and South America, and to Africa	30-40%	n/a	D: 50-60% U: 0-20%
Slovakia	Extra-EEA to Asia/Pacific	20-30%	n/a	D: 60-70% U: 5-10%

Note: U = UPS, D = DHL, n/a: not applicable

Source: European Commission (2016c)

*Why did the Commission clear one merger and block the other?*

In order to investigate, why the Commission cleared one merger and blocked the other, the qualitative assessment criteria as well as the detailed market-by-market analyses need to be compared.

The following table highlights the different conclusions of the qualitative assessment criteria applied by the Commission. It clearly indicates that the qualitative assessment of the *FedEx Corporation / TNT Express* merger is favourable for the clearance of the acquisition, while the assessment of the proposed *United Parcel Service / TNT Express* merge highlights the Commission’s concerns. In doing so, the Commission based its decision on a comprehensive application of the assessment criteria set forth in its 2004 Merger Regulation and particularly the Merger Guidelines. Furthermore, the assessment criteria most often used by the EC in the broader set of analysed mergers in Chapter 5.1 (cf. Figure 6) have also been applied in the assessment of these proposed mergers, which further strengthens the perception of a consistent implementation of the Merger Guidelines in EC merger control proceedings.

**Table 5 Comparison of EC evaluation of assessment criteria**

Assessment criterion	<i>United Parcel Service / TNT Express</i>	<i>FedEx Corporation / TNT Express</i>
Close competitors	Yes	No
Competitive force / Maverick	No	Yes
Constrain post-merger [other integrators]	No	Yes
Constrain post-merger [non-integrators]	No	Yes
Customers able to switch	No	Yes
Likely price increase post-merger	Yes	No
Efficiency defense	Partially	Yes
Barriers to entry	Yes	Yes

Source: European Commission (2014, 2016c)

The market-by-market analysis of the combined market shares and the market position of the merged entity leads to the following conclusions.

In Belgium<sup>83</sup>, Estonia, Latvia and Malta, the combined market shares of the merging parties were high (>40%) and the merged entity would be the market leader post-merger in the *FedEx*

<sup>83</sup> For extra-EEA to North America.

*Corporation / TNT Express* merger. Still, the Commission did not find competitive concerns for these markets. Conversely, in the proposed *United Parcel Service / TNT Express* merger, the Commission assessed impediments to effective competition in Bulgaria, Estonia, Malta, Romania, Slovenia, and Sweden, even though the merged entity would *not* have been market leader post-merger and in Bulgaria and Slovenia, the combined market shares would *not* have been above 40%. In the *FedEx Corporation / TNT Express* case, the Commission rebutted the *prima facie* evidence of potential competitive concerns by the post-merger market shares and market position of the merged entity through the outlined qualitative assessment criteria. In the *United Parcel Service / TNT Express* case, even though the *prima facie* evidence did not clearly indicate competition concerns for several markets, the assessment of the qualitative criteria allowed the Commission to identify competition concerns for these markets. This reinforces the comparable outcome in the analysis for the broad range of mergers with two mergers being challenged despite low post-merger market shares and eleven merger not being challenged despite very high post-merger market shares as presented in Chapter 5.1.

As also indicated in Chapter 5.1, the other qualitative assessment criteria applied by the Commission in these merger assessments (see Table 5) play a decisive role in deciding on such complex proposed acquisitions: In particular, the continued weak competitive constraint by FedEx<sup>84</sup> prompted the Commission to the conclusion that the merged entity would impede effective competition even in those countries, where it would not be market leader post-merger and would partially even have a market share below 40%. This would imply a *de facto* 3-to-2 merger, rather than a 4-to-3 merger, for the *United Parcel Service / TNT Express* merger, while the *FedEx Corporation / TNT Express* merged entity would always face a strong competitor, even in markets where it possesses a high market share and a market leading position post-merger. This reinforces the perception that the Commission bases its final merger ruling and the application of the assessment criteria on the actual and potential competition in the market, rather than dominance, as stipulated by the Merger Guidelines and as also found in Chapter 5.1. This holds particularly true for those mergers, where potential competition concerns stemming from the *prima facie* evidence of high or very high market shares could be rebutted through the use of the assessment criteria and vice versa by focusing on actual and potential competition as well as counterfactual factor analyses.

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<sup>84</sup> FedEx would have a market share of [0-5]% in Estonia, Malta, Romania, Slovenia, and Sweden.

## 6.2 Crop protection industry

Also the crop protection industry is currently undergoing a significant consolidation wave, leading to mergers and proposed mergers among the large players in the industry, the integrated R&D players.

Crop protection products are used for application in agricultural production in order to protect a crop from biological organisms (pests) that can negatively affect the crop development. The Commission categorizes crop protection products into three major types, including herbicides (to control weeds), insecticides (to control insects), fungicides (to control diseases triggered by fungi), as well as other products such as Plant Growth Regulators ("PGRs"). Also, these products can partially be applied on seeds ("seed treatment") (European Commission, 2017a).<sup>85</sup>

The market is composed of six integrated R&D players (Syngenta, Bayer Crop Science, BASF, Dow, DuPont, and Monsanto) as well as other players, mainly generic players. Integrated R&D players are involved in the discovery, the development, the formulation, as well as the distribution of crop protection products. Generic players do not or barely engage in the discovery of new Active Ingredients (European Commission, 2017a). *Adama* is the largest generic player and a subsidiary of ChemChina. ChemChina is a Chinese state-owned that had acquired the seventh largest crop protection company, Makhteshim Agan Industries, in 2011 (ETC Group, 2015).

The distinction between the capabilities of integrated R&D players and those of generic players has important implications for the competition in the crop protection industry. Generic players cannot use patent-protected Active Ingredients to produce new formulations that compete with those of the patent holder, mainly the integrated R&D players. Patent holders also heavily protect their patent-protected business (European Commission, 2017a).

The following table shows the top 10 players in the crop protection industry by revenue.

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<sup>85</sup> The global market size amounts to 56.6bn USD in 2014 The global market size amounts to 56.6bn USD in 2014. While most crop protection products are used in the agricultural industry, products applied in households and professional establishments are referred to as "Lawn and Garden" products. The global market for "Lawn and Garden" products amounted to 6.6bn USD in 2014 (European Commission, 2017a).

**Table 6 Top 10 Crop protection companies by revenue**

Company	Revenue 2014 (m USD)	Revenue 2013 (m USD)
Syngenta	11,847	11,413
Bayer Crop Science	11,142	10,418
BASF	7,232	6,942
Dow AgroSciences	5,686	5,523
Monsanto	4,897	4,804
Du Pont	3,690	3,558
Adama	3,029	2,876
Nufarm	2,322	2,297
FMC	2,174	2,146
Sumitomo Chemical	2,050	2,020

Source: European Commission (2017)

The crop protection industry is heavily segmented into different sectors, and even more so, into different types of crop applications. A further segmentation for the different crop protection markets is presented in Table 7.

**Table 7 Market shares by sector in the EEA, 2015**

Sector	Adama	Syngenta	Dow	DuPont	Bayer	Monsanto	BASF
Fungicides	[5-10]%	[10-20]%	[0-5]%	[0-5]%	[20-30]%	[0-5]%	[20-30]%
Insecticides	[5-10]%	[10-20]%	[5-10]%	[5-10]%	[10-20]%	[0-5]%	[0-5]%
Non-selective Herbicides	[5-10]%	[10-20]%	[5-10]%	[0-5]%	[10-20]%	[20-30]%	[0-5]%
Plant Growth Regulators	[5-10]%	[20-30]%	[0-5]%	[0-5]%	[5-10]%	[0-5]%	[20-30]%
Seed treatment	[0-5]%	[10-20]%	[0-5]%	[0-5]%	[40-50]%	[0-5]%	[5-10]%
Selective Herbicides	[5-10]%	[10-20]%	[10-20]%	[5-10]%	[20-30]%	[0-5]%	[10-20]%
<b>All Sectors</b>	[5-10]%	[10-20]%	[5-10]%	[5-10]%	[20-30]%	[0-5]%	[10-20]%

Source: European Commission (2017)

In recent years, three significant mergers in the crop protection industry were notified to the Commission:

- *Dow/DuPont*<sup>86</sup>
- *ChemChina/Syngenta*<sup>87</sup>
- *Bayer/Monsanto*<sup>88</sup>

The Commission cleared the *Dow/DuPont* merger in March 2017 (European Commission, 2017c) and the *ChemChina/Syngenta* merger in April 2017 (European Commission, 2017b).

<sup>86</sup> Case COMP/M.7932.

<sup>87</sup> Case COMP/M.7962.

<sup>88</sup> Case COMP/M.8084.

On 30 June 2017, Bayer filed its intent to merge with Monsanto (European Commission, 2017e). The question how the Commission will decide on *Bayer/Monsanto*, given the clearance of the *Dow/DuPont* and the *ChemChina/Syngenta* mergers will be evaluated in the course of this sub-chapter.

Furthermore, as the DOJ cleared the *Dow/DuPont* merger on 15 June 2017 (United States District Court for the District of Columbia, 2017c), a comparison between the EC and the US Merger Control decisions will be drawn for this specific merger assessment.

To conclude, the change in the EC's competitive assessment process and reasoning compared to the time of the *General Electric/Honeywell* ruling referred to in Chapter 1 will be investigated.

#### *How will the Commission decide on Bayer/Monsanto?*

Given the clearance of the *Dow/DuPont* and *ChemChina/Syngenta* mergers by the Commission, the question arises, whether the Commission will also clear the third major proposed merger in the crop protection industry, *Bayer/Monsanto*. The public has not only been critical towards the merger, but also questioned, whether the regulators will clear the merger<sup>89</sup>, citing e.g. a lower degree of innovation and farmers' future choice, political power, or dominance and market power of the merged entity as reasons to block the merger (Plumer, 2016a). On the other hand, the consolidation wave may even increase the competitive environment among the then remaining four integrators (Corridor Business Journal, 2017) and foster innovation, given the capital and assets required for further future R&D investments (Chazan & Weaver, 2017; Plumer, 2016b). Firms in concentrated may be more likely to invest in research as they can absorb more of the returns from an innovation and recover their investments as long as own products are not marginalized by their own research efforts (United States Department of Agriculture, 2017).

In order to predict any decision by the Commission for the ruling on the proposed *Bayer/Monsanto* merger, the competitive assessments of the *Dow/DuPont* and the

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<sup>89</sup> With the massive Bayer-Monsanto takeover bid finally official, the beleaguered agri-foods industry sees yet another megamerger in the face of bad weather, weak prices and strong competition, The Globe and Mail, September 15, 2016.

*ChemChina/Syngenta* mergers may provide indications of the process and the reasoning the Commission may use in its decision on the proposed *Bayer/Monsanto* merger (Kosman, 2017).

The Commission raised concerns that both mergers, *Dow/DuPont* and *ChemChina/Syngenta*, would reduce the competition in various markets.<sup>90</sup> These concerns were directly linked to “high combined market shares” (European Commission, 2017b) or even “very high combined market shares” (European Commission, 2017c) and “few other competitors” (European Commission, 2017b, 2017c).

The assessment process adopted by the Commission followed two steps: First, two sets of criteria were defined to provide *prima facie evidence* for or against competition concerns. If these criteria were fulfilled by the merging parties in the defined markets, the Commission believed that no competition concerns would arise from the merger. The criteria are based on the Herfindahl–Hirschman Index, market shares as outlined in the Merger Guidelines<sup>91</sup> and as discussed in Chapter 5.1 as well as a minimum number of significant competitors remaining post-merger (European Commission, 2017a). Conversely, if these criteria were not fulfilled in specific markets, this *prima facie* evidence of potential competition concerns, the Commission analysed the competitive situation in these markets in detail based on further assessment criteria stipulated in Table 1. Put differently, while the *prima facie* evidence based on dominance and market shares allowed to rule out competition concerns, other assessment criteria were actively used in order to assess, whether competition exerted sufficient competitive constraints on the merged entity post-merger. Ultimately, the merging parties committed to divest the product overlap they had in markets, for which the Commission finally assessed competition concerns as a result of this two-step process. These divestments cleared the Commission’s competition concerns in these product markets.

The *Dow/DuPont* and the *ChemChina/Syngenta* merger differed substantially in that Dow and DuPont (as well as Syngenta) are integrated R&D players, while ChemChina is a generic player. The Commission assessed that innovation is a driving force for competition and a *Dow/DuPont* merger would remove incentives to continue to pursue ongoing parallel innovation efforts and to develop and bring to market new crop protection products (European Commission, 2017c).

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<sup>90</sup> The Commission's competitive assessment has been focused on the narrowest segmentation for which data was available, that is, the Crop/Sector/Segment/Sub-segment level.

<sup>91</sup> ECHMG04 Art. 17f.

While competition innovation, along other non-price competition related assessment criteria, has been used in US merger control decisions in the past, the analysis of the importance of innovation competition for effective competition is novel to EC merger control decisions (cp. Chapter 5.2). On the other hand, the *ChemChina/Syngenta* merger was not found to impede innovation competition as Adama's production as a generic player is based on non-patented Active Ingredients and Adama is not active in the discovery of Active Ingredients. Ultimately, DuPont committed to divest its R&D organization in order preserve effective competition in the industry and clear the Commission's innovation competition concerns.

The *Dow/DuPont* and *ChemChina/Syngenta* assessments suggest that the Commission will likewise conduct its *Bayer/Monsanto* assessment based on the two-step process outlined above:

First, *prima facie* evidence based on market shares and the number of remaining competitors will shed light on the competitive situation in the markets based on the narrowest segmentation possible: Bayer and Monsanto argue that Bayer's geographic focus is on Europe and Asia-Pacific and Monsanto's focus is on the US and Latin America (Chazan et al., 2016). However, given combined market shares in the EEA, the number of competitors, and dominance criteria, competition concerns may be raised in the markets for non-selective herbicides, as well as potentially selective herbicides, seed treatments and fungicides according to Table 7. Detailed segmented data may lead to further or other potential competition concerns.

Once specific markets are found to possibly raise competition concerns based on the *prima facie* evidence of post-merger market shares and the number of remaining competitors, other assessment criteria may be applied to scrutinize the effective impediment to competition in these markets. As indicated above, non-herbicide products may be in the centre of the Commission's competition concerns. Monsanto's non-selective herbicide, *glyphosate* in Roundup products, and Bayer's non-selective herbicide, *glufosinate* in Liberty products, however, partially differ in their application (Agriculture, 2017) and are largely not patent-protected, which increases competition from generic players. As in the *Dow/DuPont* and the *ChemChina/Syngenta* mergers, an approval of the *Bayer/Monsanto* merger may still require the parties to divest their product overlap in markets, where competition concerns are raised.

As in the *Dow/DuPont* merger, Bayer as well as Monsanto are integrated R&D players. Bayer's intention to invest significantly in and accelerate R&D (Bayer, 2016; Chazan, Hornby, Luna,

& Lynch, 2016; Hart, 2017) directly addresses the Commission's concerns of lower research efforts post-merger. However, given the *Dow/DuPont* ruling, these communicated R&D intentions may not be sufficient to overcome potential competition concerns by the Commission without further commitments. This is, to ensure that future innovation in the industry is preserved, Bayer may have to commit to divest one party's R&D organization or to enter into licensing agreements with third parties.

On August 22, 2017, the Commission announced that it opens an in-depth investigation of the proposed *Bayer/Monsanto* merger indicating that its preliminary competition concerns related to, among others, the markets for *non-selective herbicide products* as well as *competition innovation*, i.e. the development of new Active Ingredients (European Commission, 2017d).<sup>92</sup>

*The Dow/DuPont merger clearance by the Commission: Comparison to General Electric/Honeywell and to the US Merger Control decision*

The following paragraphs set out the assessment criteria applied by the Commission in the *Dow/DuPont* merger and compare these to its assessment of the *General Electric/Honeywell* merger in 2001. Finally, the assessment criteria used by the Commission as well as the DOJ in the *Dow/DuPont* merger are compared.

The Commission's assessment of the *Dow/DuPont* merger strongly focuses on preserving actual and future effective competition as the merging parties are obliged to divest their product overlap as well as one party's R&D organization, thereby ensuring innovation competition going forward. As discussed above, the Commission directly linked innovation to competition<sup>93</sup> and the merger as notified would have removed the merged entity's incentives to develop and to continue to pursue innovation efforts (i.e. the lessening of innovation competition). Hence, the Commission targets to preserve the actual competitive constraint exerted by DuPont by

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<sup>92</sup> Other markets with competition concern relate to the seeds and the traits markets, which were not under in-depth investigation in the *Dow/DuPont* and the *ChemChina/Syngenta* mergers. Monsanto has a market-leading position on the global seeds market with 26%, while Bayer has a 3% market share (ETC Group, 2015).

<sup>93</sup> "Innovation, both to improve existing products and to develop new active ingredients, is a key element of competition between companies in the pest control industry (...)." (European Commission, 2017c).

conditioning the approval of the merger on the divestiture of DuPont's R&D organization.<sup>94</sup> Also, preserving the quality of products, another effect of non-price competition, was a focal point of the Commission's assessment.<sup>95</sup>

As outlined above, the Commission first analysed the merged entity's future market shares (rather than outright dominance)<sup>96</sup> as well as the number of remaining competitors post-merger as *prima facie* evidence of sufficient effective competition (e.g., 4-to-3 merger in the market for acid co-polymers). At the same time, it becomes apparent in the Commission's reasoning that it cleared the merger *despite* the high post-merger market shares of *Dow/DuPont* in some markets.<sup>97</sup> Hence, market shares were only used as a rebuttable *prima facie* evidence for or against impediments to effective competition. As found consistently throughout the merger assessments since 2004 in Chapter 5.1, the Commission also weighed pro- and anti-competitive effects in its *Dow/DuPont* merger assessment.

The Commission also addresses the closeness of competition in its assessment (and raises competition concerns given the low number of close competitors) as well as effectuates high barriers to entry as one competition concern.<sup>98</sup> However, the commitment to sell DuPont's R&D organization also lowers the entry barriers as "*the divestment package enables a buyer to sustainably replace DuPont's competitive effect in these markets and continue to innovate, for the benefit of European farmers and consumers.*"<sup>99</sup>

As a conclusion, despite the assessment that the merged entity would obtain a high post-merger market share and only few competitors were left post-merger, the Commission cleared the *Dow/DuPont* merger. To come to this conclusion, the Commission made use of qualitative assessment criteria, which focused on the state of actual and future competition. These criteria,

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<sup>94</sup> "The Commission concluded that the divestment package will enable a buyer to replace the competitive constraint exerted by DuPont." (European Commission, 2017c).

<sup>95</sup> Commissioner Vestager pointed out in indicating that "We need effective competition in this sector so companies are pushed to develop products that are ever safer for people and better for the environment." (European Commission 2017c).

<sup>96</sup> "The merged entity would have held very high combined market shares (...), with few other competitors remaining". (European Commission, 2017c).

<sup>97</sup> "(...) the Commission had concerns due to the high combined market shares of the two companies in the acid co-polymer market, where the number of competitors would be reduced from four to three." (European Commission, 2017c).

<sup>98</sup> "After the merger, only three global integrated players would remain to compete with the merged company, in an industry with very high barriers to entry. The number of players active in specific innovation areas would be even lower than at the overall industry level." (European Commission, 2017c).

<sup>99</sup> Also, "(t)he sale of the underpinning R&D organisation (...) will enable the buyer to become a global integrated R&D competitor." (European Commission, 2017c).

including post-merger competition, entry barriers, closeness of competition, are consistently used by the EC since the 2004 reform as indicated in Figure 6.

As indicated in Chapter 1, the Commission's assessment of the *General Electric/Honeywell* merger, particularly its lack to evaluate actual competition, to properly account for industry economics and to include pro-competitive effects from efficiencies, triggered the 2004 reform. The *General Electric/Honeywell* merger assessment focused on the future behaviour of the merging parties as well as their dominance, while the *Dow/DuPont* assessment focused on the actual or potential competition in the market.

The importance of *dominance* as an assessment criterion in *General Electric/Honeywell*, a critique addressed in the revision of the Merger Guidelines, is evidenced by the assessment that “[T]he dominance would have been created or strengthened as a result of horizontal overlaps in some markets as well as through the extension of GE’s financial power and vertical integration to Honeywell activities and of the combination of their respective complementary products. Such integration would enable the merged entity to leverage the respective market power of the two companies into the products of one another.” and the “key test for assessing mergers in Europe is whether they create or strengthen a dominant position” (European Commission, 2001).

On the other hand, the *Dow/DuPont* merger was cleared explicitly despite its high post-merger market shares and the fact that it was a 4-to-3 merger, on the merits that sufficient *future competition* was ensured through the divestment of DuPont’s R&D organization and the product overlap as well as the lowering of the entry barriers. Hence, the Commission applied further assessment criteria in addition to *prima facie* evidence of anticompetitive effects as suggested by e.g. high market shares. Furthermore, the Commission extended its analysis to take account of industry economics, e.g. by explicitly analysing the effect of innovation and quality on competition and conditioning the merger approval on commitments in this area (i.e. the divestment of DuPont’s R&D organization).

Comparing the Commission’s concluding remarks<sup>100</sup> also reflects the shift induced by the 2004 Merger Guidelines, as indicated in Chapter 1: While the focus of the *General*

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<sup>100</sup> “The merger between GE and Honeywell (...) would have (...) resulted ultimately in higher prices for customers (...)” (European Commission, 2001) vs. the merger as notified “would have reduced competition on price and choice (...). Furthermore, the merger would have reduced innovation.” (European Commission, 2017c).

*Electric/Honeywell* assessment was on the price effect only, the assessment of the *Dow/DuPont* merger focused on the actual and potential competition on price and choice, as well as innovation and the quality of the product (i.e. non-price competition).

The DOJ's evaluation of the *Dow/DuPont* merger (United States District Court for the District of Columbia, 2017a, 2017b) was based on the following process and assessment criteria.

Similarly to the two-step approach applied by the Commission, the DOJ also used high market shares as a *prima facie* evidence for impediments to effective competition.<sup>101</sup> The further assessment criteria used to either substantiate or to rebut this *prima facie* evidence in specific markets were applied consistently by both competition authorities<sup>102</sup>: Similarly to the Commission, the US competition authority highlights that the competition based on quality<sup>103</sup> and innovation as well as favourable contractual terms for the customer (i.e. non-price competition) form significant competitive constraints.<sup>104</sup> Actual and potential competition<sup>105</sup> and the absence of other competitors would almost lead to a monopoly in the acid copolymer and the ionomer market. Furthermore, the closeness of competition between Dow and DuPont exemplarily relates to the head-to-head competition in the market for acid copolymers and broadleaf herbicides for winter wheat. As the Commission, the DOJ also considers the significant barriers to entry stemming from lengthy development processes, high costs, and specialized know-how.<sup>106</sup>

Additional assessment criteria used by the US competition authority focus on evaluating customers' switching possibilities, which are assessed to be very low as customers would have

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<sup>101</sup> Broadleaf herbicides (>40%), insecticides for chewing pests (nearly 75%), acid copolymers (99%).

<sup>102</sup> Furthermore, the assessment criteria applied by the US competition authority in this case resemble the criteria most often used in general (cp. Figure 5).

<sup>103</sup> In addition to anti-competitive effects on innovation competition, the DOJ also mentions that the merger would may likely harm customers through reduced quality of customer service.

<sup>104</sup> "That competition has benefited farmers through lower prices, more effective solutions, and superior service. (...) spurred research, development (...). Customers also have benefited from the competition between Dow Chemical and DuPont by obtaining more favorable contractual terms (...). (...) assist customers with the development of new uses for existing copolymers (...). Customers have also benefited from the development of new acid copolymer products, which has been spurred on by competition between Dow Chemical and DuPont."

<sup>105</sup> "Additionally, Dow Chemical and DuPont's closest competitor sells competing products that are mixed with DuPont's Rynaxypyr, for which the competitor has a license."

<sup>106</sup> "Given the lengthy development cycle, the high hurdles and substantial cost of regulatory approval, entry of additional competitors (...) is not likely to be timely or sufficient (...).", "The cost associated with upgrading an existing ethylene derivative manufacturing operation (...) is estimated to be in the millions of dollars.", "Because of the specialized know-how and the likely foreclosure of access to a key ingredient (...)"

little or no alternative but to accept increased prices post-merger, as well as foreclosure possibilities as the merged entity would be able to foreclose ionomer producers of access to a key ingredient, acid copolymers.

The assessments undertaken by the DOJ (United States District Court for the District of Columbia, 2017a, 2017b) as well as the Commission (European Commission, 2017c) were remarkably similar, in terms of both, the applied process as well as the reached outcome, as shown in the following table.<sup>107</sup>

**Table 8 Convergence of EC and US Merger Control – Example: Dow/DuPont**

Phase	Assessment Criterion	EC Merger Control	US Merger Control
<b>Process</b>			
	Market shares	✓	✓
	Actual competition	✓	✓
	Innovation (future) competition	✓	✓
	Closeness of competition	✓	✓
	Entry barriers	✓	✓
	Quality of products	✓	✓
	Number of competitors	✓	✓
	Customers' switching possibilities		✓
	Foreclosure effects		✓
<b>Outcome</b>			
	Approval	✓	✓
	Commitment – sale of product overlap	✓	✓
	Commitment – sale of R&D	✓	✓

Note: The Commission's decision is not yet published.

Source: United States District Court for the District of Columbia (2017a, 2017b); European Commission (2017c)

To conclude, both competition authorities made use of similar assessment criteria and came to comparable conclusions, also on the individual assessment criteria. Furthermore, both competition authorities cleared the merger, despite high combined market shares of the merged entity in various markets, arguing that other assessment criteria indicated in Table 1 –and used by the Commission mainly since the 2004 reform- revealed that effective competition could be ensured, if the merging parties commit to selling their product overlap in markets with competition concerns as well as one party's R&D organization. Hence, the merger evaluation

<sup>107</sup> The Commission's decision has not yet been published and any assessment criteria applied to by the US competition authority, but not mentioned in the Commission's press release may therefore still have been taken into account in the not yet published decision of the Commission.

process by the EC and the US Merger Control strongly converged methodologically and procedurally, leading to the same conclusions for the assessment of merger cases. This in turn mitigates the risk of diverging merger assessment results as seen in the *General Electric/Honeywell* case.

### **6.3 Comparison of general and industry-specific EC and US Merger Control decisions**

Chapter 5 focused on the analysis of a broad range of merger control decisions following the 2004 merger reform, while Chapters 6.1 and 6.2 addressed mergers in two specific industries, the small package delivery industry and the crop protection industry. This Chapter evaluates the consistency of the merger control process applied by the Commission in general since 2004 (Chapter 5) and in specific industries (Chapter 6.1 and 6.2) as well as the convergence to the US merger control process.

Focusing on EC Merger Control decisions, both sets of analysed mergers, the across-industry range in Chapter 5 as well as the industry-specific mergers, lead to the conclusion that the Commission has made significant efforts in applying the economic assessment criteria stipulated in the Merger Guidelines focusing on actual and potential competition in its merger decisions. Also, while using market shares as *prima facie* evidence for competition concerns as indicated in the Merger Guidelines, the use of assessment criteria including closeness and number of competitors, entry barriers, competitive forces / mavericks, customers' switching possibilities, post-merger competition and countervailing factor analyses (e.g. efficiency defence) allowed the Commission to substantiate or rebut the effective competitive constraints suggested by the *prima facie* evidence. Particularly, it used these assessment criteria in order to specifically determine and justify different merger rulings among the large players in the small package delivery industry. As a further conclusion, the EC Merger Control process has also addressed the criticism it has received for the *General Electric/Honeywell* merger ruling (e.g. lack of a competition-based assessment and an efficiency defence) through the use of these assessment criteria. Finally, the mergers in the crop protection industry widened the range of the EC's assessment criteria by adding non-price competition more prominently to the set of applied assessment criteria.

The industry-specific analysis also comes to similar conclusions as the general analysis in Chapter 5 when comparing EC and US merger control decisions. The increasing use of similar

assessment criteria in the EU and the US converges the merger assessments, in terms of both process and outcome, which mitigates the risk of diverging merger control decisions between the EC and the US competition authorities.

## 7. Conclusion

The 2004 reform, which introduced Merger Guidelines for the first time in the European Union, set out a more economic approach to merger reviews. In this paper, I analysed the consistency of economic rationales used by the Commission in its review procedures following the 2004 reform and compared the economic rationales to those taken by US competition authorities. The analysis is based on two sets of mergers: First, I compared a broad range of mergers following the 2004 reform. Second, I pinpointed on two industries, which have undergone significant consolidation, and hence merger, activity in recent years, the small package delivery industry as well as the crop protection industry. Based on decisions taken by the Commission as well as complaints issued by the FTC and the DOJ, I find the following six results.

First, EC and US competition authorities use economic rationales focusing on actual competition as well as countervailing factors most often in their merger reviews, downgrading arguments around the potential future behaviour and reactions of customers, competitors, and other market players.

Second, with the introduction of the 2004 Merger Guidelines in the EU, the Commission could rely on assessment criteria, which it increasingly used in its assessments. The US, which has had merger guidelines in place since 1982, has even more so used its assessment criteria in merger reviews.

Third, the Commission takes a balanced approach to merger reviews. It considers both, pro- and anticompetitive effects thoroughly, finds markets with pro- and anti-competitive effects at the same time, where it then takes a merger control decision based on the tools and procedures it has in place. The countervailing factor analysis has supported this approach greatly.

Fourth, market shares (or, concentration indexes for the US) continue to provide a *prima facie* indication of market power. In their merger reviews, the competition authorities though make use of a detailed competitive assessment and, based on a consistent use of the assessment criteria available, can rebut a *prima facie* indication of high or low market power.

Fifth, the Commission as well as the US competition authorities largely make use of the same detailed and preferred assessment criteria, including closeness of competition, post-merger competition, removal of a competitive force, entry likelihood and barriers. Furthermore, especially for the industry-specific analysis, the merger decisions converge in both, process and

outcome, leading to less diverging merger control decisions between these competition authorities.

Finally, the objectives of the 2004 reform were to provide a consistent and effective merger review procedure, stakeholders could rely on. These objectives are largely met, also by eliminating potential errors of clearing anti-competitive mergers as well as prohibiting pro-competitive mergers. When looking at specific industries, the 2004 reform specifically allowed the EC Merger Control to rule differently on two proposed mergers among the large players in the industry. At the same time, the approach taken by the Commission is now more competition-focused, thereby also addressing the criticism made when EC merger decisions were overruled prior to the 2004 reform.

## Conclusion

This dissertation has investigated previous gaps in analytical and empirical merger literature. On the analytical side, the objective was to investigate whether introducing more realistic assumptions into horizontal merger models would yield results which mirrored reality more closely, explaining the growing merger activity. On the empirical side, the objective was to analyze the effects of the 2004 reform on merger control decisions by the European Commission and their international alignment with merger control procedures in the US.

For Cournot competition, I find that merger profitability has been underestimated by the traditional horizontal merger literature as risk aversion, uncertainty and efficiency gains can raise the incentives to merge. Furthermore, unlike in previous literature, I find that if risk aversion is taken into account, insiders have incentives to conceal their private information from the outsiders as well as the competition authority. From a regulatory point of view, horizontal mergers in risk-averse industries benefit consumers.

These findings imply that risk aversion, uncertainty and efficiency gains may help to explain the increased merger activity given their effect on merger profitability for the merging firms. Finally, competition authorities should underline the importance of not only the insiders' efficiency gains, but also uncertainty and risk aversion in their guidelines as both can lead to an increasing consumer surplus.

For Bertrand competition, while literature has proclaimed that industry prices increase post-merger and that mergers are privately profitable for the insiders (e.g. Deneckere & Davidson, 1985), I find that risk aversion and uncertain efficiency gains even increase merger incentives for the insiders by softening competition, which motivates insiders to share private information: Efficiency gains lead to lower costs and higher price-cost margins for the insiders, while the overall risk aversion also leads to higher price-cost margins due to the upward pricing pressure.

Merging firms should understand that e.g. industry-wide caution and crisis mood have an influence on their optimal pricing and production strategy and thereby on the incentives to share or conceal information related to their merger-induced cost efficiencies.

From a consumer point of view, while the standard Bertrand analysis asserted that consumers are worse off upon a merger due to increasing industry prices, I find that this may not necessarily be the case once risk aversion and efficiency gains are considered: The outsiders in particular may have the incentives to lower their prices leading to a decrease in the average industry price depending on the level of risk aversion as well as the size of the efficiency gains. Competition authorities should therefore take into account that under the outlined industry characteristics a merger in a Bertrand industry does not necessarily harm the consumers and that the effect on consumers strongly depends on the outsiders' pricing behaviour. Such behaviour is influenced by the intensity of prevailing risk aversion and efficiency gains.

On the empirical side, the 2004 reform introduced Merger Guidelines for the first time in the European Union, proclaiming a more economics-based approach to merger reviews. I analysed the consistency of the economic rationales used by the Commission in its review procedures following the 2004 reform and compared the economic rationales to those taken by US competition authorities for specific industries as well as a broader set of conducted merger assessments since 2004. Both research questions have been confirmed by my analysis: The European Commission increasingly applied a balanced, economics-based approach as stipulated by the Merger Guidelines, focusing on actual competition as well as countervailing factor analyses. This process is largely shared with the assessments undertaken by the US competition authorities. Also, as the competition authorities now make largely use of the same detailed and preferred assessment criteria, their proceedings have been further aligned through the 2004 reform from both, a process as well as a results perspective. While *prima facie* indications of market power still play a role in merger assessments by the European Commission, the detailed economics-based approach allows the competition authorities to rebut a *prima facie* indication of high or low market power on sound grounds. This has also helped eliminating potential errors of clearing anti-competitive mergers as well as prohibiting pro-competitive mergers.

Future research could focus on the empirical aspects of the merger profitability implications introduced through risk aversion, information sharing, and efficiency gains mechanisms. The empirical aspects could include whether industries prone to these mechanisms have performed differently in terms of merger activity and profitability than others. Additionally, it could be analysed, whether an empirical relation between merger profitability and, for example, the type

of competition, merger- (e.g. efficiency gains) and industry-specific characteristics (e.g. risk aversion, size, homogeneity) exists. Finally, empirical evidence on insiders' information sharing strategy is scarce and could benefit from further research: Research on their sharing strategy in comparison to actual synergy outcome and merger profitability could shed light on whether a consistent sharing mechanism exists and whether it has had any effect on merger profitability. From an analytical standpoint, the extension of the analysis of risk aversion, information sharing, and efficiency gains to other forms of competition (e.g. Stackelberg competition) may close research gaps and provide further insights into explaining merger activities in industries prone to the respective form of competition.

Also, the effects of the 2004 reform could benefit from further analysis. In addition to receiving further evidence on the effects of the 2004 reform on merger decisions over time (i.e. as more merger assessments are undertaken), a comparison to other jurisdictions' merger control procedures (e.g. Japan, China) could prove useful for a broader assessment on the internal alignment of merger control proceedings. Finally, the application of additional assessment criteria (e.g. non-price competition such as innovation) by the European Commission should be followed closely in order to investigate the further alignment with the US merger control procedures.

Finally, research on the interrelation between the analytical and the empirical analyses undertaken in this dissertation could provide further insights. Specifically, the competition authorities' increasing focus on the efficiency defence as well as possible extensions to assessment criteria on risk aversion and uncertainty should be scrutinized. Also, an analysis of the ex-post effect of mergers on industry price levels could provide insights into when mergers may lead to beneficial outcomes for consumers. This in turn may lead to the development of further assessment criteria, which can be used to assess the likely effect of the merger on industry price levels and thereby on consumer surplus prior to the merger.

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