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Mergers in two-sided media markets: Pricing- and welfare implications

by

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Abstract

This paper discusses the pricing- and welfare implications of mergers in two-sided media markets. Media firms typically rely on revenues from two very different, but inextricably linked, customer groups: consumers and advertisers. As a result, the pricing decisions of media firms are more complex than those of firms operating in regular single-sided industries. We develop two theoretical models in order to investigate the effects of a merger between competing duopolists. In the first model, the only way for media firms to stimulate demand is by lowering content prices, whereas firms in the second model also can attract consumers by increasing the inherent quality of their product. As we abstract from the existence of efficiency gains, the merger should, in accordance with classic merger theory, inevitably be detrimental to prices and welfare. We find that content prices could decrease while welfare could increase as a result of a merger. Moreover, the merger could be welfare enhancing, even with higher content prices, if consumers are sufficiently compensated by virtue of higher quality products.

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1. INTRODUCTION

Few industries impact as many people's lives on a daily basis as the ever-evolving chaos that is the media industry. While media markets for many years were confined mainly to the printed media and radio- and television broadcasts, a wave of tremendously innovative and user-friendly media forms have emerged over the last decade, captivating a worldwide audience on their way. The media industry is undergoing profound changes, on a scale never seen before, and the traditional media are finding their market shares threatened – both amongst audiences and advertisers. As a result, many media firms have identified the need to consolidate their operations and take advantage of the benefits that come with being a larger player in today's increasingly competitive market place.

These trends are global. Even in the small country of Norway, we have witnessed a series of large mergers in recent years, involving some of the biggest, most powerful media firms in the region. In 2006, Orkla Media – at the time controlling a portfolio of 31 local newspapers – was acquired by the international media giant Mecom. Two years later, in 2008, four of Norway's largest regional newspapers – Aftenposten, Bergens Tidende, Stavanger Aftenblad and Fædrelandsvennen – joined forces to form Media Norge. Moreover, only since the turn of 2011, we have seen Media Norge integrated into Schibsted, and in the most recent of events, on the 26th of May 2011, news surfaced that A-Pressen and Dagbladet were holding talks to discuss the possibility of merging the two entities.

With this backdrop in mind, we pose the question of how such mergers affect the strategic incentives of media firms with regard to their choice of product prices and advertising space. Moreover, how does the combining of media firms – merging to form more powerful entities– affect overall welfare for society? These questions are warranted because, as we aim to demonstrate in this paper, conventional anti-trust rationale might not apply. To arrive at this realization, we need to understand the special characteristics that constitute media markets.

In the last few years, a string of interesting papers have given clear indications that media markets are indeed governed by mechanisms which can sometimes give rise to surprising – even unprecedented – results. For instance, in a paper on the effects of imposing an added-value tax on newspapers[1], Kind, Schjelderup and Stähler (2009) find that prices could

[1] Many western countries today provide tax-exemptions for newspapers in order to soften competition and preserve plurality of opinions. In Norway, for instance, newspapers are completely exempted from the added-value tax.

decrease while journalistic quality could *increase* as a consequence of such a regulation. These are quite staggering results by the face of it, completely at odds with popular belief and common economic intuition. Such findings suggest that media markets are truly unique, meriting thorough examination. Furthermore, it underlines how important it is for those charged with supervising these markets to be aware that they function in ways not easily reconcilable with economic theory. A failure to do so could lead to policies which end up decreasing consumer – and indeed overall – welfare.

What is it then, that makes media markets special? In short, it is because they are two-sided. While most markets would appear to have two sides, namely buyers and sellers, the term "two-sided market" refers to a specific type of market. Media firms are typical examples as they compete for business on two sides: they require a base of media users to use their product, the attention of which they can sell on to advertisers. This means that there are network externalities between the two sides which could influence the strategic decisions of media firms, leading them to act very differently than firms operating in traditional single-sided industries.

In light of the special features of media markets, we are somewhat puzzled to find that little or no work has been done on mergers specifically related to such markets. This is particularly surprising considering recent trends, with mergers and acquisitions commonplace in today's media industry. Our work therefore contributes to the literature on both mergers and two-sided markets in a number of ways.

First, we build a comprehensive model of media markets, accounting explicitly for their two-sided nature, enabling us to investigate how mergers affect the pricing policies of media firms in two-sided markets. We find that a monopolist could indeed find it optimal to set lower content prices than competing duopolists. This result is very much contrary to popular opinion and at odds with traditional anti-trust rationale. The intuition is that the merged media firm can leverage its increased market power to extract a higher margin from advertisers. Because the monopolist can make higher profits from the sale of ads, his incentives to underprice content in order to boost demand increases.

Secondly, we extend the analysis to accommodate endogenous quality investments. This allows us to investigate how media firms' incentives to invest in quality are affected by a merger. We find that quality investments could indeed be higher if the competing duopolists

merge to form a monopoly. As far as we know, we are the first to study how a merger in a two-sided market affects incentives to invest in quality.

Our third, and main contribution, is that we are able to demonstrate how a merger can be welfare enhancing – even in the absence of efficiency gains – for consumers and society as a whole if the market is two-sided. Moreover, our results show that welfare can increase, even with higher prices on the consumer side, if consumers are sufficiently compensated through higher product quality. We believe these to be important results as welfare gains arise specifically due to the two-sided nature of media markets. To our knowledge, we are the first to explicitly analyze potential welfare gains of mergers in two-sided media markets. We therefore see this paper as an important contribution both to the long line of work related to mergers, and to the burgeoning literature on two-sided markets.

Before moving on to the technicalities of our modeling approach, we provide a survey of the existing literature on two-sided markets, mergers, and – specifically – on mergers in two sided markets. At the very outset, however, we find it feasible to define some key concepts which will be central throughout this paper.

1.1 Two-sided markets

The theory on two-sided markets first emerged around the beginning of the new millennium with the pioneering work often accredited to Rochet and Tirole (2002) and Caillaud and Jullien (2001, 2003). While the theory was first developed in relation to payment cards, it was quickly extended to a number of other markets such as those for newspapers, video games, computer operating systems – even dating clubs!

Although one might initially struggle to see the similarities between an operating system and a dating club, they are in fact characterized by the same properties in that the platform – in this particular example, the operating system or the dating club – must get both sides "on board" for there to even be a market. Both sides, in this case, refer to users and software developers for the operating system, and men and women for the dating club. An operating system relies on the development of software programs in order to get users, and, conversely, there need to be users for the operating system to attract software developers. Likewise, a dating club needs female customers in order to attract male customers, and vice versa. For

platforms in such markets then, clearly, a "chicken-and-egg problem"[2] exists, with the solution crucially relying on the design of a viable pricing strategy.

The two above-mentioned examples should give a good understanding of what constitutes a two-sided market, but in spite of this, scholars have yet to agree on a common definition. Several suggestions have been proposed, but we find a definition from Anderson and Coate (2005) to be particularly attractive:

"A two-sided market is one where the participants on at least one side care directly about the number of participants on the other […] where the two sides are intermediated by a platform, or platforms, which typically competes for business from both sides"

Although simple, this sentence perfectly epitomizes the unique nature of two-sided markets. These markets are characterized by two distinct groups of customers which may respond differently to changes in the level of consumption on the other side, where a platform is needed to facilitate the transaction between the two groups. As noted by Kind, Nilssen and Sørgård (2009), this is unlike the standard theory of complementary goods in consumption where there, conversely, are not two distinct groups of consumers.

1.2 Mergers

Put simply, a merger occurs when two companies become one. The term "merger" however, encompasses numerous types of arrangements that differ by the relationship between the targeted and the acquiring firm, and by the method of compensation involved in the transaction[3]. If the acquiring firm is buying or selling to the targeted firm, it is classified as a vertical merger, whereas a merger between companies in unrelated industries is called a conglomerate merger. This paper however, deals exclusively with a third kind of merger, that of a horizontal nature, which we define as:

"An economic arrangement between two or more companies performing similar functions in the production or sales of comparable products or services, i.e. competitors, involving the combining of the business entities into one, where the result is the elimination of whatever competition existed between the companies prior to the consolidation"

[2] Bernard Caillaud and Bruno Julien (2003) were the first to use the analogy of the chicken and the egg to illustrate the problem faced by two-sided platforms.
[3] The latter relates to whether shareholders of the targeted firm receive stock or cash as payment for target shares, a distinction irrelevant to this paper.

Although the great majority of mergers are legal[4], mergers involving firms of a certain size could be subject to investigation and litigation by competition authorities if deemed potentially detrimental to prices – either directly, as a result of eliminated competition between the merging parties, or indirectly by inducing coordination in the industry. This paper is only concerned with the former – the pure market power effect of mergers – and does not address matters of tacit collusion. We will nevertheless provide a brief discussion also of the latter in the next section as we survey the classic literature on mergers. Here, we will also discuss the role of efficiency gains, although we abstract from the presence of such effects in our model.

1.3 Economic welfare

At the very center of this paper is the question of how mergers in two-sided markets impact economic welfare. Economic welfare is a measure of how an industry performs, aggregating the welfare of all consumers and producers in the economy. In our case, this refers to media firms, advertisers and users of media products (consumers). The welfare (or surplus) of an individual consumer is given by the difference between his or her valuation of a good and the price he or she must pay to purchase it. The welfare of a producer is equal to the profit he makes from selling the good. The total consumer surplus can therefore be found by adding up the surpluses of all consumers, while total producer surplus is given by summarizing the profits of all producers in the industry.

An ongoing debate relates to whether equal weight should be given to the consumer- and the producer surplus, and what should be the ultimate objective of anti-trust authorities – to maximize consumer welfare or total welfare. While most of the scholarly literature argues that the welfare of consumers and producers should be given equal weight, the wording of anti-trust legislation in both the EU and in the US seem to indicate that authorities are indeed leaning towards a consumer objective (Motta, 2004)[5].

One argument in favor of the latter view is that authorities could have an important role in rebalancing the relative lobbying positions of consumers and producers. Because consumers

[4] Motta (2004) reports that of 1500 reported merger cases between 1990 and 2000, only 13 were blocked by the European Commission.

[5] For instance, regarding efficiency gains: "the Agencies consider whether cognizable efficiencies likely would be sufficient to reverse the merger's potential to harm customers in the relevant market, e.g., by preventing price increases in that market" (US Merger Guidelines, 2010:30)

usually are much more dispersed than producers, they are less able to oppose, say, an unwanted regulation which causes prices to rise. Producers, by coordinating their efforts, could be in a strong position to lobby in favor of the regulation, while a diverse mass of consumers will find it difficult to speak with one voice. A second argument is that, because of information asymmetries between producers and authorities, especially in the case of evaluating efficiency gains from mergers, more weight should be given to consumer welfare in order to counter-balance any potential biases due to the superior information of producers. A third, and slightly more prosaic, argument argues that a sole focus on consumer welfare is feasible as it greatly simplifies the task of anti-trust authorities as they can limit themselves to studying the effects on prices and avoid the difficult task of evaluating effects on profits (Motta, 2004).

A number of compelling arguments can be made against anti-trust authorities taking such a view however. For one thing, by definition, gains to producers will not be accounted for, which might ultimately hurt consumers as the many consumers that hold stocks in companies, either directly or through pension- or investment funds, would suffer from lower profits. Another important argument is that a sole focus on consumer welfare would be unreasonably harsh on producers, eventually leading to products being priced at marginal cost and thereby depriving companies of any prospect of innovation and investments in new products and technologies. In this paper, we follow the consensus in the literature by ascribing equal weight to the surpluses of consumers and producers, meaning we consider the effects of mergers on total welfare.

There is also another debate, concerning media markets specifically, pertaining to whether the welfare of advertisers should be included in total welfare or if advertisers' profit should be regarded a mere transfer from the users of the media product. The crux of the matter is whether ads should be considered informative or persuasive towards consumers. We follow Anderson and Coate (2005) and Anderson and Gabszewicz (2005) in assuming that ads provide consumers with valuable information about the characteristics of new products. This implies that advertiser welfare is treated as part of total welfare.

The rest of this paper is organized as follows. In section 2 we provide a thorough review of the relevant literature in order to place our work in the larger context. Section 3 is devoted to the first of our two models, where quality is given exogenously. We start by outlining the characteristics of all market participants, before solving and comparing equilibrium outcomes

for duopoly and monopoly, respectively. We then calculate welfare under each scenario, before finally comparing them to outline the conditions under which a merger can be welfare enhancing. Section 4 continues in the same vein as the preceding section, but our framework is here extended to also accommodate endogenous quality investments. Section 5 discusses the possible limitations of our model and points to future research directions, section 6 relates our findings to empirical work, before we finally summarize and draw our conclusions in section 7.

2. LITERATURE REVIEW

While mergers have interested economists for centuries, resulting in a comprehensive literature integral to the daily workings of anti-trust agencies all over the world, little or no attention was given to two-sided markets before the new millennia. Notwithstanding its brief history however, interest in two-sided markets has been mounting over the last few years, inducing an influential and rapidly evolving branch of economic literature. Although there is now a relatively large body of work available on two-sided markets, we are somewhat surprised to find that very little of the existing research deals with mergers specifically.

In this review, we start out by surveying the seminal literature on two-sided markets, where we give special attention to media markets – a unique species of two-sided markets – as this is the most relevant to our analysis. We then proceed to survey the classic literature on mergers, before finally investigating to which extent the existing literature has addressed the implications of two-sidedness for anti-trust analysis in general, and mergers in particular.

2.1 Two-sided markets

As the last in a number of survey articles, Rochet and Tirole (2006) summarized what had been done in the mere four years since the first paper explicitly referring to "two-sided markets" was published in 2002. Rochet and Tirole conceptualized their ideas on two-sided markets with a paper on the determination of interchange fees in payment card associations, but it soon became clear that their results applied more widely and that the same framework could be used to describe a variety of interesting markets. Much of the literature which emerged after Rochet and Tirole (2002) however, was focused on media markets.

Media markets are two-sided because platforms – newspapers, television- or radio channels – match advertisers to audiences by selling their content to users and access to those users to advertisers. What sets media markets apart from most other two-sided markets is that while network externalities between the two customer groups usually are positive for most two-sided markets – as in the opening case of the dating club and the operating system – this is not necessarily the case for media markets. While advertisers certainly want as many consumers as possible to use the platform, so that they can reach a bigger audience with their ads, consumers tend not to show the same regard for the advertisers. Whether advertisers exert a positive or negative effect on consumers is an empirical question which has been found to

differ between different media industries[6]. The consensus opinion seems to be that the direction of the externality is ambiguous, maybe positive, in the case of newspaper readers, while it is most likely negative for television viewers (Anderson & Coate, 2005). We will revisit this issue later when we discuss the setup of our model. Media markets had long been the subject of considerable research, but early work overlooked problems related to pricing structure and so failed to explain how platforms design their pricing strategy so as to accommodate both sides of the market[7]. Rochet and Tirole (2002) provided the building blocks for a more realistic description of media markets and paved the way for a string of influential publications in this area.

The pricing structure prevailing in a two-sided market will often differ quite significantly from that observed in a single-sided market. It is for instance not uncommon for a platform in a two-sided market to sell a product with a considerable discount on one side in order to earn a margin on the other. This is particularly evident in many media markets where the content side tends to be heavily subsidized while the platform raises most of its revenue from advertisers[8]. The by now well-established explanation for such a skewed pricing structure is the presence of network externalities between the two sides of the market, which the platforms must take into account when making their pricing decisions on either side[9]. Rochet and Tirole (2006) note that also the presence of marquee buyers and captive customers, as well as the extent to which customers are multi-homing, meaning they use several platforms, could influence the price structure. Marquee buyers on one side, which participants on the other side consider to be extremely valuable, can allow the platform to raise prices on the selling side, and, similarly, higher prices could be charged to captive customers that for whatever reason are considered unlikely to leave the platform, for instance because they would incur non-negligible switching costs.

In the scholarly literature on media markets, one of three frameworks is usually deployed: the Hotelling model, the Salop model or the model of the representative consumer. These three frameworks have different features and therefore suit different purposes. In order to facilitate the upcoming discussion, we provide a short description of each of them.

[6] For a few recent empirical studies of the nuisance effect, we refer to Kaizer and Wright (2006) and Kaiser and Song (2009) who find a positive impact of advertising on readership demand for magazines in Germany. Argentesi and Filistrucchi (2007) and Fan (2010) find demand for newspapers in Italy to be unaffected by advertising.
[7] See for instance Katz (1985, 1986) and Tirole (1988).
[8] Godes et al (2009) refer to this as the "underpricing effect".
[9] This is well documented in the series of seminal articles by Rochet and Tirole and Caillaud and Jullien (2003).

The Hotelling framework – named after its architect Harold Hotelling – has been used extensively in the literature ever since first publicized in 1929. The standard model allows for a study of a duopoly situation where two firms choose their location on a horizontal line. The framework could be adapted to accommodate multiple firms. The line can be interpreted either as a geographical line, for instance showing the physical location of two firms in a city, or in an intangible manner as illustrating two newspapers' affiliations in the political spectrum[10]. Consumers of the two goods are uniformly distributed along the line and incur transport costs when "travelling" to consume a product. Travelling could be literally travelling through the city to get to the store, or travelling in the sense that the consumer must sometimes consume a product that is not identical to his or her preferences[11]. The standard Hotelling framework assumes that consumers on both sides are single-homing, meaning that they are using one – and only one – platform, and that the market is covered, implying that demand is perfectly inelastic. The latter assumption is tantamount to the standard Hotelling framework being unsuitable for the type of analysis we are doing in this paper as demand would be unaffected by a merger. It should be noted however that it is possible to circumvent this problem by using some modified version of the Hotelling framework. One such example can be found in Leonello (2010) – a paper we will revisit later in this section.

The Salop framework, unlike Hotelling, does not allow for endogenous differentiation by media firms as they are evenly distributed around a "circular city". The features of the Salop model however make it the ideal tool for a study of entry and the optimal number of firms in an industry. For obvious reasons this cannot be addressed in a Hotelling framework as the number of firms are fixed. A couple of interesting applications of the Salop framework can be found in Choi (2006) and Crampes, Haritchabalet and Jullien (2009).

The third framework – which will form the basis for the model we build in this paper – is that of the representative consumer. Here the demand of one individual is scaled up so as to derive the total market demand for the platform. We follow Kind et al. (2009a) and Godes et al. (2009) in normalizing the population size to one, meaning we can interpret the consumption of a media product such as a television channel as the amount of time the consumer spends watching the particular television channel, or as the number of viewers of the given television channel. One important limitation of this model is highlighted in Godes et al. (2009); when

[10] One interesting application of the Hotelling framework can be found in Kind, Schjelderup and Stähler (2009).
[11] For a detailed discussion on the Hotelling framework,we refer to Hotelling (1929) and d'Aspremont, C., Gabszewicz, J.J, Jaskold, J. and J.F. Thisse (1979).

assuming that all consumers have the exact same preferences we admittedly overlook heterogeneity amongst users of the media product. This could be important because advertisers often are interested in targeting specific groups of customers. In response to this critique, however, the authors argue that it makes sense if one sees the analysis as taking place at the segment level rather than the aggregated market level. Although this framework is now used extensively in the literature, it is nevertheless important to be aware of this limitation.

Godes et al. (2009) argue that the literature on media markets can be roughly separated into two groups depending on whether media firms are assumed to be able to charge a price for their content or not. The latter was a widespread assumption in most early work on broadcasting markets which typically dealt with how media firms choose to differentiate their content, how they decide on the level of advertising on the platform, and whether advertising is over- or underprovided in the competitive equilibrium compared to in the social optimum. As pointed out by Godes et al. (2009) however, these models did not account for the impact of competition on the marginal profit in each market, and so failed to address how companies might decide to lower the price on one side in order to make a margin on the other. The other branch of the literature then, is that which assumes that media firms can charge their users for access to content, as well as charge advertisers for access to those users.

Peitz and Valetti (2008) is an interesting article in this respect, as they analyze how differences in media platforms' ability to charge their viewers affect advertising intensity and program content. Two differing scenarios are compared: the first being a "free-to-air" regime where media platforms are unable to charge their viewers and so must rely solely on income from advertisers, whereas in the opposite case of a "pay-tv" regime, media platforms are also able to charge their viewers – meaning they have two sources of revenue. The principle objective of the paper is to investigate which of these market structures gives rise to the market equilibrium closer to the social optimum; the authors are in other words performing a welfare analysis.

A model is constructed using the standard Hotelling framework, and as customary in the literature when addressing the television market, a parameter measuring the nuisance felt by consumers when encountering ads is included. Higher values of this parameter translate into strong distaste for ads, while lower values imply that viewers are somewhat indifferent with regard to the amount of advertising on the television channel. Viewers are modeled as single-homing, meaning they watch one, and only one, television channel – an assumption not easily

reconcilable with what we observe in real-life as most viewers presumably tune in to more than one channel[12]. The authors circumvent this problem by stating that they are considering competition for a given time-slot rather than competition between two television channels. Advertisers, on the other hand, have the option of advertising on none, one, or both platforms. Informative advertising is assumed, implying that ads carry valuable information to consumers about product characteristics of new products.

By not restricting prices to be positive – implying that platforms can subsidize viewers – Peitz and Valetti (2008) obtain the somewhat special result that equilibrium profit under a "pay-tv" regime is independent of the size of the advertising market[13]. In their model, the increased revenues from advertising will be exactly offset by the lost income due to lower content prices. The authors show that the standard Hotelling result of maximum differentiation then emerges where platforms always choose to differentiate their content to the extreme. This result is independent of the nuisance parameter and the size of the advertising market. Platforms under "pay-tv" set the level of advertising which equates the marginal revenue per viewer to the marginal cost of advertising – where the latter is given by the nuisance parameter. This means that for very high levels of the nuisance parameter, platforms will shut down the advertising market entirely as the disutility of viewers will exceed any profit which could be made from advertising. As long as platforms find it profitable to operate a market for advertising however – implying that the nuisance effect is not too high – there is an under-provision of advertising under "pay-tv". This is because platforms do not account for the surplus of advertisers when setting their ad levels.

In the opposite case of "free-to-air" we would expect platforms to provide more advertising as they are not able to raise revenues from consumer payments. However, by relying solely on advertising income, the only way for platforms to make themselves more attractive to viewers is to decrease the amount of advertising. Peitz and Valetti (2008) show that while content will always be differentiated to the extreme under a "pay-tv" regime, differentiation under "free-to-air" depends positively on the nuisance parameter so that maximal differentiation only occurs for very high levels of nuisance. Differentiation also depends negatively on transport cost. In general, they find differentiation to be less pronounced under a "free-to-air" regime. The level of advertising decreases with the size of the nuisance parameter, but is also affected

[12] Single-homing is more representative of the newspaper market where readers in many cases subscribe exclusively to one newspaper.
[13] While this assumption appears to be somewhat ad-hoc, the authors maintain that imposing prices to be positive will not impact their welfare results in a meaningful way.

by the size of transport costs and the extent to which platforms are differentiated. If viewers are indifferent toward ads, platforms will – as under "pay-tv" – provide the monopoly level of advertising. As long as viewers are somewhat disliking ads, however, the ad level will be strictly lower than the monopoly level. A move towards a more central location on the Hotelling line or lower transport costs similarly puts downward pressure on the ad level. The result of profit neutrality does not persist under "free-to-air", as profits decline with the level of the nuisance parameter.

When comparing the welfare properties of the two payment regimes, Peitz and Valetti (2008) find – perhaps not surprisingly – that neither "free-to-air" nor "pay-tv" end up producing an equilibrium equal to the social optimum. The key finding from the paper is that too little advertising is provided and content is too differentiated compared to the social optimum under a "pay-tv" regime, whereas results for "free-to-air" are ambiguous as they depend on the size of transport costs and the extent to which viewers find ads to be a nuisance. Ergo, which of the two payment regimes is better from a welfare perspective is ultimately also dependent on the size of these two parameters. In general, Peitz and Valetti (2008) conclude that a move from "free-to-air" to "pay-tv" will be welfare enhancing if competition in the market in question is sufficiently intense and the nuisance parameter is not too high.

This article by Peitz and Valetti (2008) illustrates well how welfare assessments in media markets are complicated by the competitive pressure in the media market in question and, in particular, media users' attitudes towards advertising. In a related exercise, Anderson and Coate (2005) investigate the nature of market failures in the television market by analyzing whether platforms offer the socially desirable number of channels and to which extent they offer advertising compared to social optimum. Like Peitz and Valetti (2008), they find that the level of advertising offered under a "pay-tv" regime will be below the social optimal level, but in addition they conclude that the subjective cost for viewers will be higher in the case of "pay-tv" than in the case where television channels raise all their revenue from advertising. Again, as in the analysis of Peitz and Valetti (2008), a crucial role is played by the nuisance parameter. There are, however, even more factors that can complicate such studies of media markets. One particularly important consideration is how media firms' incentives to invest in quality might differ under the different payment regimes.

In fact, once we account for the fact that media firms can invest in quality in order to attract viewers, the latter result from Anderson and Coate (2005) might not hold. Too see this, think

of what happens if quality investments are higher under "pay-tv". A higher inherent quality of the product is generally thought to increase a consumers' utility from consuming the product, and a media firm could thereby increase demand by increasing quality investments. Moreover, if firms have stronger incentives to invest in quality under "pay-tv", the increased utility consumers get from watching higher quality channels could outweigh the adverse price effect. When accounting for quality investments then, the result from Anderson and Coate (2005) that the subjective cost is higher under "pay-tv" might not persist. One of the main contributions of our paper is that we investigate whether such incentives to invest in quality changes as a result of a merger.

The two aforementioned articles were built on the Hotelling framework, where the number of firms was fixed to two. In reality however, media firms will often have many competitors which compete for both users and advertisers. Intuitively, we would expect also the number of competitors and the extent to which products are substitutable for one another to have considerable impacts on the strategic decisions of media firms. These matters are also likely to be of great importance to our analysis as we examine the welfare implications of a media merger.

Kind et al. (2009a) provide key insights in this context as they investigate how competitive pressures in an industry impact media firms' choice of whether to raise revenue from advertisers or users. Their analysis can be considered somewhat complementary to Godes et al. (2009) which we will discuss in detail later when we turn to the literature on mergers in two-sided markets. Both articles build models in the mold of the representative consumer. The key trait of Kind et al. (2009a) is that they make an explicit distinction between increased competitive pressures due to (1) higher content substitutability and (2) there being more media firms in the industry. To the contrary, Godes et al. (2009) have only one parameter for competitive pressure, and are as such unable to separate the effects of increased content substitutability and increased number of media firms as sources of intensified competition. Kind et al. (2009), however, argues that this distinction is paramount, as the two sources of competition have very different implications for how media firms raise revenues.

Kind et al. (2009a) show that if competitive pressure rises by virtue of higher content substitutability, advertising levels and –profits will increase, while content profits decline. If, on the other hand, competition increases because of there being more media firms in the industry, both advertising- and content revenues will decline. The intuition is that media firms

will find it hard to charge consumers for access to a content which is not significantly different from its competitors, and they will so choose to bundle more ads the more similar the content. This is why, for instance, many internet sites offering similar content, in most cases must rely solely on revenues from advertising. Kind et al. (2009a) also show that when moving from a monopoly to a duopoly, the advertising market becomes more important, while any move towards more media firms will lead to higher importance of content payments. This is because, as the number of media firms approach infinity, they will have no market power in advertising targeted at their own consumers. They do, however, still have some market power in the sale of content to consumers if it is somewhat differentiated.

There are two key findings from Kind et al. (2009a). First, a media firm's ability to raise revenue from users will depend on whether close content substitutes are offered by rivaling firms. The less differentiated the content, the less revenue the media firm will be able to raise from user payment, and so the platform becomes more reliant on income from advertising. Secondly, advertising revenues, on the other hand, are dependent on how many rival firms there are competing for the same advertisers. Kind et al. (2009a) concludes that, in light of these results, we should expect to see increased importance of user payments the more competing media firms there are in the industry. Kind et al. (2009a) is an important contribution to the literature as they show how the revenue strategies of media firms are dictated by the competitive environment.

2.2 Mergers in single-sided markets

A comprehensive body of research exists on mergers, and their potential detrimental implications for competition and welfare are well-established. As a result, most developed countries today have adopted some form of anti-trust legislation calling for competition authorities to canvass mergers. In the US, the central anti-trust provisions are found in the Sherman Act, the Clayton Act and the Federal Trade Commission Act. These provisions are enforced by the FTC (Federal Trade Commission) together with the Anti-trust Division of the Justice Department. The techniques, practices, and rules by which they evaluate potential merger effects are outlined in the Merger Guidelines – the latest edition of which were released in 2010. The overriding objective of competition policy with regard to mergers is to prevent any merger that might "create, reinforce or entrench market power" (US Merger

Guidelines, 2010:2). The key statutory provision can be found in section 7 of the Clayton Act of 1914 which states that a merger is to be prohibited if:

"[…] in any line of commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be substantially to lessen competition, or to tend to create a monopoly"[14]

While there are many ways in which a merger could lead to reduced competition, the literature generally distinguishes between mergers with unilateral and coordinated effects (Motta, 2004). The former refers to mergers which by simply eliminating competition between the merging parties allows the merged firm to *unilaterally* exercise market power, whereas mergers of the latter kind reduce competition by facilitating collusion in the industry. Motta (2004) notes that whether a merger might lead to a collusive outcome or not in practice will depend on a number of factors, such as the presence of structural linkages between firms, frequency of market interactions and information exchange amongst firms. As noted, however, such effects are not the focus of this paper and as such will be abstracted from in the following.

In this paper we develop a model which allows us to examine the pricing- and welfare effects of a merger between two firms competing in a duopoly fashion. This means that the merger results in a monopoly and the corresponding unilateral effects are therefore particularly strong as the merger eliminates all competition, allowing the merged firm to charge monopoly prices. The scenario where two firms merge to form a monopoly, however, is admittedly a special one. In the more typical scenario where there are several independent firms left in the industry post-merger, unilateral effects will be less pronounced but could still have a significant impact on competition. Unilateral effects are typically manifested in higher prices or reduced output, but can also be utilized in ways that hurt consumers by virtue of reduced product quality, reduced product variety or diminished investments in research and development. The extent to which the increased market power can be leveraged is dependent on constraining factors on both the demand- and supply side (Motta, 2004). Such constraining

[14] Although phrased in a slightly different manner, these sentiments are echoed by anti-trust legislation in the EU. The EC Merger Regulation Act of 2004 (Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings) states that: *"it should be ensured that the process of reorganization does not result in lasting damage to competition; Community law must therefore include provisions governing those concentrations which may significantly impede effective competition in the common market or in a substantial part of it".* For an in-depth comparison of the two merger policies, we refer to Bergman, Coate, Jakobsson and Ulrick (2006).

factors on the supply side are small market shares of the merging firms, high threat from potential new entrants and excess capacity amongst rival firms. Factors on the demand side relate to whether demand is elastic or whether the firm is dealing with concentrated buyers possessing bargaining power.

As a general rule however, in the absence of efficiency gains, mergers with unilaterally effects reduce consumer surplus and total welfare (Motta, 2004). Moreover, profits will increase not only for the merged firms, but also for the other firms operating in the same industry. The reason why also competitors benefit from a merger is that they can "free-ride" by following the merged firms in charging higher prices, thereby earning higher profits (Motta, 2004). It should be noted that this latter result might not persist if firms are assumed to set quantities rather than prices. If it indeed is the case that firms compete in quantities as opposed to prices, competitors will respond to a reduced quantum – entailing a price increase– by the merged firm, with an increase of their own production, resulting in lower prices on their products. Motta (2004) notes that although this might even result in the merged firm losing from the merger, the overall effect of the merger will still be detrimental to consumer surplus[15].

While the pure market power effect of mergers will be harmful to competition and welfare, efficiency gains could mitigate their potential harmful effects. As Williamson (1968) was the first to point out, efficiency gains could indeed neutralize – and even outweigh – the adverse effects of a merger[16]. In fact, with efficiency gains of sufficient size, a merger could allow the merging parties to rationalize their activities, making it profitable for the merged firm to lower its prices. Although competing producers will suffer from tougher competition, welfare and consumer surplus will increase with sufficiently large efficiency gains (Motta, 2004). The most common source of efficiency gains are economies of scale and of scope. Economies of scale arise because of falling average cost of production as the scale of output is increased. By rationalizing and reorganizing production, the merged firms can reduce their cost of production. Efficiency gains could also present themselves through economics of scope which involves the bundling of marketing and sales or synergies in research and development.

[15] For models with Bertrand- and Cournot competition, respectively, we refer to Davidson and Deneckere (1985) and Salant, Switzer and Reynolds (1983).
[16] A formal argument of this result is given in Williamson (1968). Motta (2004) points to Farrell and Shapiro (1990) for an even richer model of the effects of efficiency gains.

One important note concerning efficiency gains relates to the difficulty competition authorities face in estimating the size and extent to which they are present. In any particular case where the size of the efficiency gains will be crucial to the outcome, the merging parties have a clear incentive to overstate their size (Motta, 2004). At the same time they are in a much better position to evaluate how efficiency gains might be achieved than the competition authorities. Finally, Motta (2004) emphasizes that competition authorities should regard cost savings targeted at fixed costs as inferior to cost savings in variable cost. This is because cost savings in fixed costs will have no impact on price, and as such, no impact on consumer surplus. Moreover, costs savings should only be considered if they could not have been achieved without the merger taking place. Cost savings must be a direct result of the merger. Farrell and Shapiro (2001) argue that anti-trust agencies should value synergies, i.e. efficiencies achieved through the "intimate integration of the parties' unique, hard-to-trade assets", more than simple cost saving gains, as these are more likely to be obtainable without a merger.

As should be evident from the preceding discussion, the traditional literature on mergers is mainly concerned with whether a merger creates or reinforces a dominant position which could be detrimental to competition and welfare, and if so, whether possible efficiency gains could offset the negative consequences arising from the abuse of market power. There is no mention of the term "two-sided markets", nor are the important anti-trust implications stemming from the unique features of such markets addressed in any way[17]. Evans and Schamalansee (2008), who offer a qualitative discussion of anti-trust implications in two-sided markets, argue that this might not be a problem in all cases as it often is a question of *degree* of two-sidedness. Following a review of recent anti-trust cases involving two-sided platforms in the EU and in the US, they conclude that, in some cases, the two-sided aspects of a market were so small that they had no real impact on the courts assessment. In other cases, two-sidedness represented an interesting consideration but was not ultimately determinative. Finally, they also identified cases where the two-sided features of a market were absolutely crucial to the analysis. These findings illustrate well that care must be taken by competition

[17] A recent report written jointly by the Law and Economics Center at Tilburg University notes that some competition agencies actually have started referring to two-sided terminology, but still, the authors argue, the economic principles underlying the concept of two-sided markets and their policy implications have yet to be taken fully into account in their decisions. This report, which was commissioned by the Dutch Competition Authority (NMa), provides a comprehensive survey of anti-trust cases in the EU and the US. Notable examples where courts referred explicitly to two-sided terminology are the Google/DoubleClick and Travelport/Worldspan cases. In the report, they also attempt to build a model of merger simulation which is applied to Dutch newspaper market. This section is basically an earlier version of Filistrucchi et al. (2010), one of the main authors of the NMa report.

authorities when assessing mergers in markets that are characterized by a two-sided nature as a conventional approach can sometimes lead to outcomes which end up decreasing welfare.

2.3 Mergers in two-sided markets

When investigating how research on two-sided markets have dealt with mergers, we find that little or no work has been done in this particular area. A handful of qualitative papers point out that the implications for anti-trust policy are likely to be significant in most two-sided markets, but as it stands, very few have attempted to develop theoretical models like we do in this paper[18]. In fact, to our knowledge, there are only two articles that specifically deal with mergers in this manner: Leonello (2010) and Chandra and Collard-Wexler (2009). We also find the previously mentioned article by Godes et al. (2009) to be useful as they compare a duopoly- to a monopoly scenario – an analysis which is analogous to the case of a merger between duopoly firms in an industry. Before reviewing each of these articles in detail however, we present an example from Evans (2003) as it is particularly illustrative of the shortcomings of the conventional single-sided approach in the assessments of mergers in two-sided markets[19].

Consider again the opening case of the dating club, what would be the welfare effects if it was to merge with a second dating club? It could certainly be the case that the new and bigger dating club might exploit its increased market power by charging its clients higher prices. If we were to rely on the one-sided anti-trust approach, we would look upon a price increase as detrimental to welfare and perhaps seek to prevent the merger from being approved. However, because this is a two-sided market, there is one important effect which is left unaccounted for, namely that the visitors to the dating club get increased utility because there are more potential partners to meet! It is perfectly plausible that the increased value visitors get from having a bigger pool of partners to choose from, could neutralize – even outweigh – the lost utility due to the price increase. As a result, the merger could actually be welfare enhancing rather than welfare detrimental. This is very much contrary to what we would conclude if we applied the conventional one-sided terminology, where a price increase always will have a

[18] It is also interesting to note that although a new edition of the US Merger Guidelines was released in 2010, replacing the previous Guidelines from 1992, there was no mention of two-sided markets.

[19] In a more comprehensive study, Evans and Noel (2008) analyze the Google/DoubleClick case and show that the traditional Lerner-index is invalidated. They conclude that relying on a conventional approach would have produced a significantly different outcome than a correct assessment conducted with a modified Lerner-index.

detrimental effect on consumer welfare. In two-sided markets, in contrast, additional utility due to network effects could outweigh the negative effect of the price increase.

Judging from this example, the anti-trust implications for mergers in two-sided markets are obvious. Even in the absence of efficiency gains, increased prices can result in enhanced welfare because of the higher value users get from joining the platform. It is however by no means certain that prices will increase when two firms in a two-sided market merge, and as some recent papers have argued, prices could even decrease on at least one side of the market.

Chandra and Collard-Wexler (2009) is, to our knowledge, the first paper to specifically study mergers in two-sided markets with the use of a theoretical model. They deploy a modified Hotelling framework where consumers are assumed to be single-homing – consistent with the newspaper market – whereas advertisers have the option of advertising in several newspapers. The key finding from their paper is that increased concentration might not lead to higher prices on either side. More specifically, they show that a monopolist could choose to set lower prices than two firms competing in a duopoly fashion. While the fact that such a result can arise is interesting in itself, their model has certain peculiar characteristics which merit further discussion.

In particular, the results from Chandra and Collard-Wexler (2009) are conditioned on pricing below marginal cost on the reader side. If newspapers sell their content at a price below marginal cost, additional readers are only valuable to the extent that the revenues which could be made by selling their attention to advertisers are greater than the subsidy. How much advertising revenue can be made from the additional reader, however, depends on how attractive his attention is to advertisers.

Chandra and Collard-Wexler (2009) analyze a scenario where there are two competing newspapers, and two advertisers – each located at the extremes of the Hotelling line, in 0 and 1, respectively. Readers are distributed uniformly across the line. A newspaper reader has a relative taste for the two newspapers, but also an idiosyncratic taste for newspapers in general. No assumptions are imposed on a reader's attitudes towards advertising. There are two sets of readers: "switchers" and "stoppers". The former refers to readers that are indifferent between the two newspapers, and will respond to a price increase of one newspaper by switching to the other. Each newspaper also has a base of loyal readers that have a very strong preference for the particular product and would rather stop reading newspapers altogether than switch to the competing product. These readers are referred to as "stoppers".

Chandra and Collard-Wexler (2009) assume readers and advertisers to have almost perfectly correlated preferences[20]. This implies that advertisers place a higher value on readers located closer to them. A newspaper will therefore be able to raise more advertising revenues from "stoppers" than "switchers" as the former have a much stronger preference for the paper – and thereby a higher probability of buying the advertiser's product. There are two alternative explanations for this. If taken geographically, the Hotelling line can be seen as possible locations within a city. An advertiser located in 0, at the outskirts of the city, place more value on readers that are located close by, as they are more likely to visit his store. An alternative explanation is that more dedicated readers presumably spend more time with the newspaper and are more likely to see the ad. This makes them more valuable to advertisers.

Ultimately then, the key consideration in Chandra and Collard-Wexler (2009) is how advertisers value the "switching" consumer. If advertisers are not willing to pay an advertising price which exceeds the loss that the newspaper incurred when selling him a paper below marginal cost, the "switcher" is representing negative value for the newspaper. The authors show that, for certain parameter values, a newspaper will not find it profitable to reduce its price because the additional profit from more "stoppers" purchasing the paper could be outweighed by the adverse effect from gaining unprofitable "switchers". There is, however, an indirect effect on the profit of the other newspaper. As the other newspaper will have fewer "switchers", its profit will increase. A monopolist will take this positive effect into account, and could choose to set a lower price level than if the two newspapers were competing.

Chandra and Collard-Wexler (2009) goes on to test their predictions on data from the Canadian newspaper market which underwent a wave of mergers in the late 1990s. They find that prices were largely unaffected by increased concentration, thereby corroborating their results. They do, however, note that there are several shortcomings related to their empirical analysis. It is perfectly possible that some mergers were accompanied by efficiency gains, which by virtue of lower costs for the merged parties allowed prices to remain unchanged. It could also be that some mergers were driven by motives other than increased market power, such as for instance empire-building or political motives (Anderson & McLaren, 2008).

[20] But not perfectly, as this would allow newspapers to "screen" readers, i.e. charge the exact price so that they only attract the profitable readers.

Leonello (2010) performs a similar analysis as she evaluates the welfare implications of a merger in a scenario where a merger between two competing firms results in a monopoly. Although her model does not address one specific type of media market, she notes that it is best understood in the context of the newspaper market. This is because she assumes consumer demand to be unaffected by the level of advertising. The novelty of Leonello (2010) is that, after the merger, the monopolist offers advertisers in one paper the opportunity to advertise also in the other newspaper as part of the deal. For a single price, the advertiser can now reach twice as many consumers as before. She refers to this as "interoperability". Leonello (2010) goes on to show that the introduction of advertising bundling by the monopolist increases incentives to keep prices low on at least one side of the market. This is because interoperability increases the margin which the newspaper can charge on advertising, and it thereby becomes profitable to reduce prices on the consumer side in order to stimulate demand. Overall, welfare could increase following a merger. This is an important result as it is obtained absent efficiency gains.

It should be noted, however, that the result from Leonello (2010) only holds with network externalities of a certain size. When network externalities are sufficiently small, the traditional merger analysis will apply and the result will be higher prices on both sides and decreased overall welfare. This is consistent with Evans and Schmalansee (2008) who argued that the importance of a markets two-sidedness for anti-trust analysis will depend on the degree of two-sidedness, i.e. the size of the network externalities. If these are found to be sufficiently small, a conventional approach might yet yield satisfactory results.

Godes et al. (2009) provide key insights into the particular merger case we are analyzing in this paper. Although they do not perform a merger analysis per se, their paper is similar to ours in that they too compare equilibrium outcomes from monopoly and duopoly competition. Their paper is also closely related to Kind et al. (2009a) as both papers investigate how competition affects media firms' choice of revenue strategy with regard to how much advertising they choose to bundle and the relative importance of advertising- and consumer payments. Recall that Kind et al. (2009a) were able to distinguish between increased competitive pressures due to (1) products being closer substitutes, and, (2) there being more competing firms in the market in question. Godes et al. (2009), in contrast, have only one parameter for competitive pressure as they keep the number of firms fixed. While Kind et al. (2009a) consider one media industry in isolation, Godes et al. (2009) was pioneering in that it considered competition for advertising also from media firms belonging to a different media

industry. This part of their analysis is particularly important considering later trends in media markets where media firms face tougher competition for advertising, and increasingly so from media firms belonging to other media industries.

Godes et al. (2009) build their model on the framework of the representative consumer. They include a parameter measuring users' disutility of ads and a substitution parameter measuring how the representative consumer perceives a media products' content to be substitutable with that offered by the rival firm. Similarly, advertisers can see the different media outlets as substitutable to a lesser or higher degree. The authors first analyze the case of a monopolist media firm who faces no competition for users and advertisers. Their first important finding is that which they call the "underpricing effect". Media firms have incentives to charge lower content prices, relative to other industries, in order to boost demand, as they can earn a margin on them by selling their attention to advertisers. This thereby corroborates the intuition based on casual observations from media markets where the content side tends to be subsidized.

Moreover, Godes et al. (2009) find that, as consumers are more disliking of advertising, the less advertising will be bundled and the less revenue can be raised from advertising. This is not surprising as a higher ad level would reduce demand on the consumer side. Consumer prices and profits, however, follow a U-shaped pattern. Initially, as nuisance increases, the most profitable option for the firm is to lower content prices so that it can make a relatively healthy margin of advertising on the other side. This is "cheaper" when nuisance is moderate as the firm would have to drastically cut the number of ads to attract more consumers. However, when nuisance is very strong, the firm must severely limit consumers' ad exposure in order to preserve demand. The importance of consumer payments then increases, and the market approaches a regular single-sided one.

Godes et al. (2009) goes on to analyze the case of within-media competition. A media firm now faces competition for both users and advertisers from another firm belonging to the same media industry. They show that duopolists will bundle less advertising with content, but that the overall level of advertising increases. This implies that advertising rates are unequivocally lower in duopoly than in monopoly. Content prices, on the other hand, can increase or decrease depending on how substitutable the content of the two media firms is for one another. Two forces impact the pricing of content: (1) a traditional downward effect as increased competition reduces the benefits of increasing prices, and, (2) an upward effect as increased competition diminishes incentives to underprice content because of a lower ad

margin. The central finding is that with low substitutability, the latter effect dominates and content prices could be higher in duopoly. This is an important result which strengthens findings from Leonello (2010) and Chandra and Collard-Wexler (2009).

The novelty of Godes et al. (2009) is that they consider across media competition for advertising. They analyze a scenario where a monopolist media firm encounters competition for advertising from two other media firms belonging to a different media industry. Consumers see the media firms belonging to different media industries as completely unrelated. Godes et al. (2009) find that the more the two media industries are substitutable for one another, in the eyes of advertisers, the less advertising will the monopolist choose to bundle with content. The intuition is that competition from another medium reduces the margin which can be made of advertising, and so the monopolist will instead shift his focus to the content market where he still has monopoly power. Recall that it was assumed that the two media industries were completely unrelated. In the event that advertisers see the different media industries as perfect substitutes for advertising, the monopolist will leave the advertising market entirely. This illustrates that once we account for competition for advertising across different types of media, the merged media firm's ability to generate revenues from advertising might be restricted. In contrast, if advertisers see advertising on different media as complements, Godes et al. (2009) show that the monopolist bundles more ads and sets lower content prices than competing duopolists. This is because the margin on ads increases, further increasing the monopolists' incentives to underprice content.

In sum, a review of the existing literature on mergers in two-sided markets, while scarce, give clear indications that the existence of network externalities could indeed lead to lower prices being charged post-merger on at least one side of the market. We have however seen that none of the aforementioned articles explicitly discuss the accompanying welfare implications. In our paper, we evaluate the welfare properties of monopoly and duopolistic competition by adding up the surpluses of media firms, advertisers and consumers. As far as we know, we are the first to perform such an analysis, specifically addressing mergers in two-sided markets.

Recall from the preceding discussion that qualitative papers such as Evans (2003) also provided the intuition for how a merger could be welfare enhancing, even if prices increase on the consumer side. In the celebrated example of the dating club, where there are positive externalities between the two customer groups, the value of joining the platform increases with the number of participants on the other side. In such a scenario, a merger could certainly

increase welfare. In a media market, in contrast, the utility of media users do not necessarily increase with the number of participating advertisers on the other side. This does not mean, however, that a merger in a media market cannot be beneficial for consumers even if content prices increase. Chandra and Collard-Wexler (2009) noted that a merger could bring about a change in the quality of media products. This is an important consideration as increased quality investments could compensate consumers for a higher price, thereby making a merger welfare enhancing even with higher content prices. We have, however, not been able to identify papers which analyzes, in a theoretical setting, how incentives to invest in quality could change following a merger. In the second of our two models we investigate precisely this aspect. As we evaluate a merger's effect on quality investments and overall welfare, we see our paper as an important contribution both to the literature on mergers and two-sided markets in general.

3. MODEL 1 – EXOGENOUS QUALITY

In this section we aim to illustrate, through a theoretical model, pricing- and welfare implications of mergers in media industries characterized by a two-sided nature. There are a total of two media firms, each offering a single media product. Each firm can rely on two different sources of income, they sell their content to viewers (readers), and they can sell the attention of these viewers to advertisers. At first we consider a scenario where the media firms compete in a classic duopoly setting. We then consider a setting where the two firms merge into a monopoly, where actions are taken collectively in order to maximize combined profits. In Model 1 we assume that each media firm cannot engage in demand expanding activities besides those of lowering prices. The quality level of the two media products is thereby fixed outside the model. We will alter this assumption in model 2.

This section is organized as follows. We first outline the basic ingredients of the market participants: consumers, advertisers and media platforms. We then report our equilibrium outcomes, both for the duopoly- and the monopoly case. Finally we solve for society's wealth level in equilibrium outcomes.

3.1 Model setup

3.1.1 The consumer

Consumer preferences are assumed to be given by the following quadratic utility function due to Kind et al. (2009a) with the number of media products fixed to two:

$$U = \sum_{i=1}^{2} C_i - \left[(1-s)\left(\sum_{i=1}^{2} C_i^2 \right) + \frac{s}{2}\left(\sum_{i=1}^{2} C_i \right)^2 \right], \quad i = 1, 2 \tag{1.1}$$

$C_i > 0$ measures consumption of media product i. The consumption constraint ensures participation of both media platforms in the market. $s \in [0, 1)$ is a parameter, given exogenously, measuring the substitutability of the media products' content, from consumers' perspective. $s = 0$ implies that products are unrelated, with the following result that media firms have monopoly power in the supply of content to consumers. In the limit where $s \to 1$, products are viewed as perfect substitutes. By normalizing the population size to one we can interpret C_i as each individual's consumption of product i, or as the number of consumers of the good.

The specification in (1.1) is a modified version of the quadratic utility function proposed by Shubik and Levitan (1980). Our motivation for preferring this specification over a standard quadratic utility function (SQU), as used by Godes et al. (2009), relates to its appealing features regarding comparative statistics[21]. Under SQU the aggregate market demand changes with respect to both the substitutability between the products and the number of products. Problems posed by changes in the number of products are irrelevant to our analysis as we fix the number of products (and firms) to two. Problems do however appear when doing comparative statistics with respect to the differentiation parameter because the aggregate market size decreases with increased product substitutability, holding prices fixed. Substitutability is a good measure for competitiveness in a given industry, as price increases intuitively are constrained by consumers' option to consume similar goods offered by other producers. Under SQU a change in parameter s implies an increased competitive pressure, as well as a decrease in aggregate demand. Both of these effects are believed to decrease firm profits, but we will not be able to isolate the effects from each other. These problems are eliminated by employing the specification in (1.1), where aggregate demand is unaffected by changes in s, holding prices fixed.

When deciding how much of a good to consume consumers consider prices in addition to utility. We assume that consumers maximize consumer surplus given by the following function:

$$CS = U - \sum_{i=1}^{2} p_i C_i , \quad i = 1, 2 \tag{1.2}$$

The formulation in (1.2) implies that the subjective cost that consumers pay when consuming a media product only contains the explicit prices of the product. In particular we have disregarded any disutility that consumers experience with advertisements. The main result is that consumers are indifferent about the number of participants on the other side of the two-sided market, the advertisers. This implies, in our model, that only consumers exert an external effect on the advertisers, not the other way around.

We impose the assumption of a nuisance parameter equal to zero mainly because it greatly simplifies algebra as we later characterize complex equilibrium conditions regarding the social welfare level. However, there are two alternative arguments for why this assumption is

[21] See Motta (2004) for a general discussion on the properties of the Shubik-Levitan utility function.

not too distant from reality. The first relates to consumers' own ability to avoid ads. It can be argued the nuisance effect is negligible in the case of newspapers and magazines as readers can easily flip pages containing ads. Empirical observations by Filistrucchi et al. (2010) support this argument. Their findings from the Dutch newspaper market suggest no clear-cut relation between circulation and the amount of advertising. The same argument does, however, not hold for TV channels as commercials interrupt and lengthen programs, resulting in "zipping" and "zapping" by viewers (Bellamy & Walker, 1996)[22]. The alternative argument for why consumers do not view ads as a nuisance concerns the benefit they receive from being informed about product characteristics and/or prices they previously were unaware of. We could expect a positive consumer surplus following trades inspired by the advertisements. If this surplus equals the disutility effect there would be no net disutility, just as our modeling of consumer surplus suggests. Anderson and Coate (2005) and Peitz and Valletti (2008), who both impose disutility from consuming goods with advertisements, circumvents this surplus problem by assuming that the price of each advertised good equals the willingness to pay for all consumers. In our model we assume that any surplus which consumers receive from purchasing advertised goods is already contained in specification (1.2).

The choice of disregarding the nuisance effect seems consistent with literature modeling the two-sided nature of the newspaper- and magazine industry. Gabszewicz et. al (2001) and Kind et. al (2009b), who build endogenous differentiation models in a Hotelling setting, both assume no disutility from ads. However, seminal articles modeling the two-sidedness of the television industry introduce a nuisance parameter in the consumer utility function. This includes the before mentioned articles of Anderson and Coate (2005) and Peitz and Valletti (2008), as well as Godes et. al (2009), the latter building a model similar to ours. Kind et. al (2009a) stresses the important implication that competition in advertising prices, in their model, are strategic substitutes when including an ad nuisance parameter.

3.1.2 Advertisers

Producers of media products receive the attention of viewers (readers) by selling content. This attention can be resold to advertisers, who use advertisements to inform consumers about the characteristics, quality and/or price of their product. We follow Anderson and Coate (2005)

[22] "Zipping" refers to fast-forwarding of pre-recorded programs, while "zapping" refers to changing channels when commercials are aired. Wilbur (2008), using data on the American viewer population, identifies a negative correlation between the duration of commercials during a program and program audience size, indicating that viewers avoid commercials.

and Anderson and Gabszewicz (2005) in their modeling of the advertisement market. They regard advertising as informative because it communicates the existence of new goods and its' characteristics to prospective consumers. Informative advertising is easily amendable to welfare analysis as it unambiguously creates surplus distributed to consumers, producers or a combination of the two. The surplus effect is harder to define if advertising works in a persuasive manner, where the intention is to enhance consumer taste for a specific product[23].

We assume that all advertisers are producers of independent new goods, and that they have monopoly power in production. We further assume that these goods differ only in the probability that consumers find interest in their products. Consumers of different media products are identical from advertisers' perspective, implying that there is no targeted advertisement. Advertisers can choose to place ads in either of the media products, or in both. These assumptions are sufficient in order to rank advertisers by the expected benefit they receive from communicating with consumers. They also imply that the price for contacting a viewer (reader), i.e. the price per ad per viewer, is all that matters to advertisers. We can from this derive a downward sloping demand function for advertising per viewer in the advertisement price.

The question then arises of how to define the market for ads. We assume that advertisers regard advertisements in different media products, within the same media industry, as homogenous goods. The motivation for this assumption is that each advertiser can reach identical consumers through either of the media products. If we interpret consumption, C_i, as each consumer's consumption of media product i, then advertisers can reach each consumer through both advertising alternatives. Wilbur (2008) estimates the price elasticity in the market for advertisements on each US broadcast network to be -2.9, a substantial increase from similar estimates found in the 1970s, a period with a more concentrated broadcasting industry[24]. This implies an increase in the competition for advertisements, which further supports our initial assumption, that advertisers view different media products as closely linked substitutes. In our model, we circumvent the aspect of alternative advertising channels, such as direct advertising, by assuming that the advertising market is restricted to only the two

[23] See Dixit and Norman (1978) for a seminal paper on persuasive advertising and Butters (1977) for one on informative advertising.
[24] Wilbur (2008) reports that Crandall in 1972 estimated the price elasticity of ads to be -0.45.

presented media platforms[25]. By imposing advertising demand to be linear the inverse demand function for ads per viewer (reader) can be written as

$$r = \alpha - \beta(a_i + a_j), \quad i, j = 1, 2 \quad i \neq j \tag{1.3}$$

where r is the advertising unit price per consumer in any media product, a_i is product i's advertising level, and a_j is that of its' rival. α and β are both non-negative measures of the size of the ad market. An increase in α is interpreted as an increased willingness to pay for advertisements, while a decrease in the parameter β implies that the number of advertisers has increased.

3.1.3 Media platforms

Each media firm can, by bundling content with ads, capture revenue from both the sale of content to end-users and from producers advertising their products. Media firm i's total profit is thus the sum of its profits from the sale of content $\pi_{co,i}$, and profits from the sale of advertisements $\pi_{ad,i}$, minus any fixed production costs. The fixed production costs, which include those for printing facilities (for newspapers), studios (for radio- and television channels), and the exogenously given quality level, are irrelevant for the models equilibrium conditions; hence any fixed cost can be normalized to zero.

Content price $p_i \in [0, \infty)$ is chosen by media platform i, yielding consumer demand C_i. Marginal production costs are the same for each firm, and fixed to c[26]. The constraint of non-negative prices implies that consumers cannot engage in arbitrage purchasing, i.e. the purchasing of a product only to receive economic benefit. We do, however, allow for prices to be in the interval of $p_i \in [0, c)$, suggesting that content could be sold at a per unit loss. Content profits per media platform i is

$$\pi_{co,i} = (p_i - c)C_i, \quad i = 1, 2 \tag{1.4}$$

Advertising profits $\pi_{ad,i}$ depends on the advertising level a_i, the advertising price per consumer r, and the number of consumers C_i. Any variable costs in placing ads in the media platform are normalized to zero. We follow Godes et. al (2009) in assuming that each firm chooses how many ads a_i will be included in the product, with the advertising price per

[25] See Godes et. al (2009) for a discussion concerning advertising competition between firms in different media industries.

[26] While marginal production costs are likely to be negligible in the radio- and television industry, this is not the case for the magazine and newspaper industry. A marginal increase in circulation implies more printed copies.

consumer endogenously determined through equation (1.3). This suggests that competition on advertising levels is a Cournot game, something that merits further discussion.

We find that, in our model, advertising levels are strategic substitutes. If ad prices were the strategic decision variable instead of quantities we would, in equilibrium, end up with the classic Bertrand paradox where advertisement price equals marginal cost, for this case zero. This result seems inconsistent with both current and historic examples from media industries. Traditionally, in the television broadcasting industry there were no mechanism for charging viewers, meaning that television channels had to rely solely on ad revenues. This is also the case for purely advertisement financed newspapers and magazines. The media platforms would, for both presented cases, not be able to finance their content under the Bertrand paradox.

Kind et. al (2009a) argues that media platforms have a per se incentive to set advertising prices rather than quantities. This is because, in their model setup, advertising prices are strategic substitutes while ad levels are complements. It is well known that competition in strategic substitutes is a softer competition form than that of strategic complements (Vives, 1999). This argument does, however, not hold for our model as media platforms have incentives to set ad levels instead of prices to avoid ending up in a Bertrand paradox. If media platforms can credibly commit to advertising levels before choosing prices we will, following the seminal article by Kreps and Scheinkman (1983), end up with the original Cournot equilibrium. It can be argued that this is the case for television broadcasters and radio channels as advertising levels are an important feature of their long-term commercial profile[27]. The argument is not easily applicable to newspapers and magazines in general, as separate leaflets can be added to increase space for ads. However, capacity constraints do exist on prime locations, such as for front-page ads, and newspapers are here likely to make long-term strategic decisions on how much space to allocate to advertisements[28].

[27] One example of this is Clear Channel Communications who in December 2004 decided to cut the number of commercial minutes per hour in order to stem ad pricing weakness for its radio stations (Wilkerson, 2005).

[28] An alternative explanation for why competition on advertisements is able to avoid the Bertrand paradox, with the real market equilibrium being closer to that of Cournot competition, is that advertisers have a per se preference for spreading ads across different advertising channels. The motivation for this practice is an increased customer recollection of the advertised product. In this case, media platforms carrying the ad would not be able to easily attract advertisers of the rival platform, as they would be offering an inferior good; hence the market avoids the Bertrand paradox. This is not consistent with the straightforward demand specification in (1.3) where it is implied that advertisers are indifferent as to whether or not they spread their ads between platforms. To allow for this effect we would have to introduce a more complex advertisement demand function. In our paper, we have refrained from going further with this particular issue.

With advertisement unit price per consumer of r, an ad level of a_i and C_i consumers platform i will have

$$\pi_{ad,i} = ra_iC_i\,, \;\; i = 1,2 \tag{1.5}$$

in advertisement profits. Total profit for media firm i becomes

$$\prod_i = \pi_{co,i} + \pi_{ad,i} = (p_i - c + ra_i)C_i\,, \;\; i = 1,2 \tag{1.6}$$

If the two platforms merge they will have the following combined monopoly profits:

$$\prod_m = \prod_1 + \prod_2 \tag{1.7}$$

Specification (1.7) implies that there are no efficiency gains or losses resulting from a merger between the platforms since the variable and fixed costs have not been altered. The merger has thereby only a market power effect on the media market.

3.2 Equilibrium – duopoly case

We consider a sequential game in two stages. Media platforms set user prices (p_i) and advertising levels (a_i) non-cooperatively at the first stage, while consumers decide on consumption (C_i) at the final stage. The sequencing of the game implies that media platforms do not commit to setting ad levels before prices, or vice versa. That the consumption decision is made at the final stage is quite intuitive when addressing media products as newspaper- and magazine purchases, both single time purchases and long time subscriptions, are decided on the basis of given prices and product characteristics. We solve the model through backwards induction.

3.2.1 Stage 2 – Consumer demand

Consumers maximize consumer surplus given by specification (1.2) with respect to the consumption level of each media product. Setting $\partial CS/\partial C_i = 0$ yields consumer demand for media product i[29],

$$C_i = \frac{1}{2}\left(1 - \frac{p_i - s\bar{p}}{1-s}\right)\,, \;\; i = 1,2 \tag{1.8}$$

[29] The second order condition is satisfied with $s \in [0,1)$.

where $\bar{p} = \frac{1}{2}\sum_{j=1}^{2} p_j$ is the average price of both media products. From (1.8) we see that demand for product i is decreasing in its own price, and increasing in that of its rival if the products are related, i.e. $s > 0$.

3.2.2 Stage 1 – Platforms set advertisement levels and content prices

At stage 1 each media platform maximize individual profits, given by equation (1.6), with respect to own consumer price p_i and advertisement level a_i. The maximization problem gives rise to four first-order conditions when the number of media firms is fixed to two. Equilibrium conditions are derived by solving these first-order conditions simultaneously. The first order conditions are given by

$$\frac{\partial \prod_i}{\partial p_i} \leq 0\,, \;\; p_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_i}{\partial a_i} \leq 0\,, \;\; a_i \geq 0\,, \;\; i = 1,2$$

with complementary slackness for each specification. The complementary slackness conditions ensure that content prices and ad levels are non-negative.

By differentiating media platform i's first-order conditions for consumer price p_i and ad level a_i with respect to the rivals actions, p_j and a_j respectively, we can infer that competition on content prices are strategic complements if content is related, while competition on ad levels are strategic substitutes.

$$\frac{\partial^2 \prod_i}{\partial p_i \partial p_j} = \frac{s}{4(1-s)} > 0 \;\; if \; s > 0$$

$$\frac{\partial^2 \prod_i}{\partial a_i \partial a_j} = -\beta C_i < 0$$

The result is consistent with both microeconomic intuition and classical literature on imperfect competition. Increased rival content price p_j will, if products are related, increase demand for product i's own product, which in turn entails a price increase. If the rival increases ad level a_j the price for advertising will, through specification (1.3), decrease. With a lower advertising price it will be optimal for media platform i to decrease its ad level.

The interior equilibrium conditions for content prices and advertising levels, which are symmetric, are found by solving $\partial\prod_i/\partial p_i = \partial\prod_i/\partial a_i = 0$, subject to (1.3) and (1.8), simultaneously for the media platforms. The equilibrium conditions are[30]

$$p_d^* = \underbrace{\frac{2(1-s)}{4-3s}}_{l} + \underbrace{\frac{c(2-s)}{4-3s}}_{ll} - \underbrace{\frac{\alpha^2(2-s)}{9\beta(4-3s)}}_{lll} \tag{1.9}$$

$$a_d^* = \frac{\alpha}{3\beta} \tag{1.10}$$

Subscript d denotes the symmetric equilibrium conditions in duopoly competition. Content prices are constrained to zero under the following condition:

$$\frac{\alpha^2}{9\beta} - c > \frac{2(1-s)}{2-s} \quad \rightarrow \quad p_d^* = 0$$

Content is sold at a loss $(p_d - c < 0)$ if

$$\frac{\alpha^2}{9\beta} > \frac{2(1-c)(1-s)}{2-s}$$

Focusing on the interior solution given in specification (1.9) we see that the equilibrium price consists of three distinct elements, *l*, *ll* and *lll*. We refer to the first element, *l*, as the *market power factor*. This non-negative factor measures to what amount a platform price its content, when disregarding the advertisement market, above marginal cost. It depends entirely on a platform's market power in the content market through the substitutability parameter s. This is, as earlier emphasized, a measure for the industry's competitive pressure. There can be no markup if the media products are perceived as perfect substitutes $(s \rightarrow 1)$. The *market power factor* increases as the products become more differentiated, and reaches its maximum at $s = 0$ where each firm has monopoly power in the sale of content to consumers.

Element *ll* is referred to as the *cost factor*, and measures how marginal production costs of content are internalized in content prices. Any increase in marginal production costs will, in accordance with this effect, lead to higher equilibrium prices. That the *cost factor* is increasing in s implies that any changes in costs will have a larger internalization effect on

[30] The second-order conditions are satisfied as $\frac{\partial^2\prod_i}{\partial p_i^2} = -\frac{(2-s)}{2(1-s)} < 0, \frac{\partial^2\prod_i}{\partial a_i^2} = -2\beta C_i < 0$ and $\frac{\partial^2\prod_i}{\partial p_i \partial a_i} = 0$ for the interior solution.

content prices the larger the competitive pressure in the market. This is because full internalization will, for firms with market power in the sale of content, lead to unprofitable large fluctuations in consumption.

We follow Godes et. al (2009) in referring to element *lll* as the *underpricing effect*. It is this effect that captures how the equilibrium pricing structure is affected by the two-sided nature of the model. Consider, hypothetically, a media industry where there is no ad market, i.e. $\alpha = 0$. Media platforms would then be selling only content to consumers, and the industry would be a regular one-sided one. The equilibrium price in such an industry would contain only the two first terms in specification (1.9). From this we can infer that the existence of the ad market makes the media firm price its content strictly lower than what it would do otherwise. The incentive to underprice content emerges from the industry's positive bilateral network externalities, i.e. that advertisers are willing to pay more for ads the more consumers use media product i, which in turn increases media firm i's ad profits through specification (1.5). Media firms thus have an additional incentive to expand own demand C_i by lowering content prices. The *underpricing effect* increases in the size of the ad market (higher α or lower β) due to higher margin per consumer, which in turn makes the firm more inclined to generate additional demand.

We can also see the intuition behind the *underpricing effect* quantitatively by looking at platform i's first-order condition with respect to its content price ($\partial \prod_i / \partial p_i = 0$):

$$C_i = (p_i - c)\left(-\frac{\partial C_i}{\partial p_i}\right) + ra_i\left(-\frac{\partial C_i}{\partial p_i}\right), \quad i = 1, 2 \tag{1.11}$$

By marginally increasing content price a media firm will benefit due to a one unit increase in the price of consumption, which is the left-hand side of specification (1.11). A marginal price increase will, however, also reduce demand, and the losses associated are captured by the right-hand side. The losses due to contracting demand are comprised in margin loss from the content- and advertising market respectively. The margin loss through advertising captures that raising prices is more expensive if the market is two-sided, i.e. $ra_i > 0$. Changes in the ad margin per consumer are internalized further by firms operating in competitive industries, which is consistent with that of the *cost factor*.

If consumers view the media products as perfect substitutes ($s \to 1$) the equilibrium prices given by specification (1.9) will constitute a special case of the Bertrand paradox. Content

will, conditioned on the existence of an advertisement market, be sold at a loss, and content prices will equal marginal cost minus advertisement profits per consumer, ra_i. If prices where set in accordance with the standard Bertrand paradox, where prices equal marginal production costs, the firms would make zero content profits and positive advertisement profits. Media firms would then have an incentive to undercut the content price of their rival in order to increase their profits stemming from the sale of ads. The only Nash equilibrium in content prices will be that where ad profits per consumer (ra_i) are exactly offset by the loss of content sales per consumer $(c - p_i)$. From specification (1.9) we can also identify a general property regarding content prices p_d: they are falling in the competitive pressure, i.e. $\partial p_d^*/\partial s < 0$. The proof is given in appendix A1.

From specification (1.10) we can infer two central properties regarding the advertising level; that it is increasing in the size of the advertising market $(\partial a_d^*/\partial \alpha > 0,\ \partial a_d^*/\partial \beta < 0)$, which is expected, and that it is unaffected by the substitutability parameter s $(\partial a_d^*/\partial s = 0)$, which is a measure for the competitive pressure in the content market. The latter is consistent with the findings of Godes et. al (2009) but inconsistent with those of Kind et. al (2009a).

Summarizing we have:

Proposition 1 *Competing media platforms price their content lower with a larger advertisement market and increased competitive pressure* $(\partial p_d^*/\partial \alpha < 0,\ \partial p_d^*/\partial s < 0)$. *They choose to bundle more ads with content the larger the advertisement market, while the bundling decision is unaffected by the competitive pressure* $(\partial a_d^*/\partial \alpha > 0,\ \partial a_d^*/\partial s = 0)$.

3.3 Equilibrium – merger case

The basics of the model are not altered when going from a duopoly state to monopoly through a merger. In particular we consider the same sequencing of the game, i.e. media platforms set user prices p_i and advertising levels a_i at the first stage, while consumers decide on consumption C_i at the final stage. The merger case differs from the duopoly one as user prices and advertising levels now are set cooperatively by the platforms.

3.3.1 Stage 2 – Consumer demand

Consumers do not take the particular ownership structure between media platforms into consideration when deciding on consumption, and consumer demand for media product i is thus given by equation (1.8).

3.3.2 Stage 1 – Platforms set advertisement levels and content prices cooperatively

In stage 1 each media platform maximize combined profits, given by equation (1.7), with respect to content price p_i and advertisement level a_i. The maximization problem gives rise to the following four first-order conditions:

$$\frac{\partial \prod_m}{\partial p_i} \leq 0\,, \;\; p_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_m}{\partial a_i} \leq 0\,, \;\; a_i \geq 0\,, \;\; i = 1,2$$

with complementary slackness for each condition.

We choose to focus on the symmetric solution of the proposed maximization problem i.e. content prices and advertising levels are set equal between the platforms. There are, however, conditions in which the merged platform will find it profitable to choose asymmetric content prices and ad levels. We refrain from going further with an equilibrium analysis on this particular matter, but do nevertheless provide a discussion of when it is, and when it is not, optimal for the merged platforms to choose an asymmetric solution.

First consider what happens to combined content profits if content prices are set asymmetrically. Aggregate demand for content $\left(C_1 + C_2 = 1 - \frac{p_1+p_2}{2}\right)$ is only dependent on the aggregate price level $(p_1 + p_2)$, hence any asymmetries in content prices will only have a demand shifting effect through substitution, from one platform to the other. Consumers will respond to asymmetric prices by consuming more of the cheaper good and less of the expensive good if content is related $(s > 0)$. This will shift consumption away from the relatively profitable good and towards the relatively unprofitable one, causing a decrease in content profits for the merged platform. Sale of content therefore creates a disincentive to set prices asymmetrically.

While the merged platform should set symmetric content prices to maximize content profits the same argument does not apply to advertisement profits. If content prices are set

asymmetrically consumers would, as previously emphasized, consume more of the cheaper good and correspondingly less of the expensive one. This will in turn increase the value of placing an ad in the platform where consumption has increased, and decrease the value of advertisements in the other platform. The platform can benefit from this by placing more ads in the platform where consumption is the highest, while at the same time keeping aggregate ad level $(a_1 + a_2)$ fixed. This argument can also be seen by observing the equation for combined advertisement profits $\left(\pi_{ad,m} = r(a_1 C_1 + a_2 C_2)\right)$, which is maximized by directing consumption and ad levels to only one of the two platforms.

The advertisement market does therefore create an incentive to set asymmetric content prices, which should be weighed against the loss encountered in content profits. Two factors are crucial in deciding which of these factors dominate. The first is the relative importance of the advertisement market to the content market, measured by the advertisement parameters α and β. The second is the substitutability parameter s. This parameter is crucial in deciding how much loss in content profits one will have to endure to create a sufficient shift in demand. The loss will be relatively large if consumers are not prone to substitute between platforms $(s \to 0)$. None of the reported incentives for symmetric, or asymmetric, content prices are present if platform content is entirely unrelated $(s = 0)$, as there is no demand shifting effect.

Assuming that it will be optimal for the merged platform to set symmetric content prices $(p_1 = p_2 = p_m)$ yields the result that ad levels can arbitrarily be set equal between the platforms $(a_1 = a_2 = a_m)$. Maximizing combined platform profits, given by (1.7), subject to (1.3), (1.6), (1.8) and the symmetry restrictions, yields the following derived first order conditions:

$$\frac{\partial \prod_{m,sy}}{\partial p_m} \leq 0\,, \quad p_m \geq 0$$

$$\frac{\partial \prod_{m,sy}}{\partial a_m} \leq 0\,, \quad a_m \geq 0$$

with complementary slackness for both conditions. Subscript sy denotes that symmetry in content prices and advertisement levels has been imposed. By setting the first-order conditions equal to zero $\left(\partial \prod_{m,sy}/\partial p_m = \partial \prod_{m,sy}/\partial a_m = 0\right)$ we characterize the interior

solution for optimal pricing and advertisement level for merged platforms. Solving them simultaneously yields the following equilibrium outcome[31]:

$$p_m^* = \underbrace{\frac{1}{2}}_{l} + \underbrace{\frac{c}{2}}_{ll} - \underbrace{\frac{\alpha^2}{16\beta}}_{lll} \tag{1.12}$$

$$a_m^* = \frac{\alpha}{4\beta} \tag{1.13}$$

Subscript m symbolizes merged platforms. Content price p_m^* is constrained to zero if

$$\frac{\alpha^2}{8\beta} - c > 1 \quad \rightarrow \quad p_m^* = 0$$

while content is sold at a loss ($p_m^* - c < 0$) if

$$\frac{\alpha^2}{8\beta} + c > 1$$

Equation (1.12) shows that the interior equilibrium price for content set by the merged platforms also can be divided in three distinct elements, *l*, *ll* and *lll*. The elements are, respectively, referred to as the *market power factor*, the *cost factor* and the *underpricing effect*, just as for the content price under duopoly competition. The *market power factor* is a price premium stemming from the merged platforms exerting their monopoly power in the content market. The *cost factor* represents how marginal production costs are accounted for in the pricing of content. Element *lll* is the *underpricing effect* which captures the two-sided nature of our media market modeling, in particular that platforms have an incentive to underprice their content due to the existence of the market for advertisements. A larger ad market (higher α or lower β) will lead to increased underpricing.

Notice that content prices set by merged platforms is unaffected by the competitive pressure in the content market, measured by the parameter s. This is natural as the merger creates a monopoly that eliminates all rivalry between platforms. This result would, however, not persist if we employed a standard quadratic utility function, instead of the modified

[31] The second-order conditions are satisfied as the Hessian matrix becomes negative definite with $\frac{\partial^2 \prod_{m,sy}}{\partial p_m^2} = -2 < 0, \frac{\partial^2 \prod_{m,sy}}{\partial a_m^2} = -4\beta(C_1 + C_2) < 0$ and $\frac{\partial^2 \prod_i}{\partial p_i \partial a_i} = 0$ if symmetry is imposed.

specification due to Shubik & Levitan (1980), as changes in s would affect the aggregate market size.

The merged platform sets advertisement levels per platform given by specification (1.13). From this we can infer that the advertising level is increasing in the size of the ad market ($\partial a_m^*/\partial\alpha > 0,\ \partial a_m^*/\partial\beta < 0$).

Summing up we have:

Proposition 2 *Merged media platforms price their content lower with a larger advertisement market* ($\partial p_m^*/\partial\alpha < 0$)*, and choose to bundle more ads with content the larger the advertisement market* ($\partial a_m^*/\partial\alpha > 0$).

3.4 Equilibrium outcomes – duopoly vs. merger

We will in this section compare the equilibrium outcomes of the non-cooperative and cooperative cases. We first focus on the decision of advertising level before turning to the content pricing decision.

A platform engaging in duopoly competition sets advertising level $a_d^* = \frac{\alpha}{3\beta}$ in equilibrium, while merged platforms maximize combined profits by setting ad level $a_m^* = \frac{\alpha}{4\beta}$. From this we can infer that firms choose to bundle less advertisement with content if they cooperatively set advertising level. If platforms set advertising levels non-cooperatively they will increase ad level until their own marginal revenue equals marginal cost of advertisements. The firms do not take into consideration that increased ad level in their platform creates a negative externality on the other platform's advertisement income through a lower advertisement price r. Platforms who combine their actions take this externality into account by lowering their ad level. This results in a higher advertisement price r through specification (1.3), and a higher advertisement revenue per consumer $\left(ra_m^* = \frac{\alpha^2}{8\beta} > \frac{\alpha^2}{9\beta} = ra_d^*\right)$.

We consider the three elements of the content price separately when comparing the content prices charged by platforms engaging in duopoly competition and by platforms coordinating their efforts. The *market power factor* for a duopoly firm equals $\frac{2(1-s)}{4-3s}$, which is decreasing in competitive pressure s and ranges in the interval $\left(0, \frac{1}{2}\right]$. Merged platforms have a

corresponding factor equaling $\frac{1}{2}$. From this we can infer that duopoly platforms have a lower *market power factor* in the sale of content, except for the case where content is unrelated $(s = 0)$.

The *cost factor* equals $\frac{c(2-s)}{4-3s}$ for the duopoly platform and $\frac{c}{2}$ for the merged platforms. The *cost factor* for the duopoly platform is increasing in s and ranges in the interval $\left[\frac{c}{2}, c\right)$. This shows that marginal production costs have a greater influence on a duopoly platform's content price than for a merged platform, apart from in the case where content is unrelated.

Comparing the *underpricing effect* in the two scenarios yields some particularly interesting insights. While the effect for the merged platform is fixed at $\frac{\alpha^2}{16\beta}$, the effect for duopoly platforms, which equals $\frac{\alpha^2(2-s)}{9\beta(4-3s)}$, ranges in the interval $\left[\frac{\alpha^2}{18\beta}, \frac{\alpha^2}{9\beta}\right)$. The *underpricing effect* is increasing in s for a duopoly platform. We see that the merged platforms have a larger underprizing effect than duopoly platforms that face no competition in the content market $(s = 0)$. This is because the merged platforms have monopoly power in the advertising market, and they capitalize on this to raise ad margin per consumer. Because merged platforms have higher supplementary revenues per consumer they have a larger incentive to expand demand by lowering content prices. However, we also noted that the underpricing effect is increasing in the competitive pressure in the content market under duopoly competition. $s = \frac{4}{11}$ is the unique parameter value for which the monopoly power effect in the ad market is neutralized by the increased underprizing effect accredited higher competitive pressure. The *underpricing effect* for merged platforms will, in this state, equal that of the duopoly platforms.

Summing up the differences in content prices we see that the *market power factor* for merged platforms is greater than, or equal to, that of duopoly platforms. The *cost factor* for the duopoly platforms is greater, or equal to, that of the merged platforms, while we cannot determine which of the two scenarios has the larger *underpricing effect* unless we make assumptions on the content substitutability parameter s[32]. It is not clear, when combining the three factors, if the content pricing level is higher for the merged platform or the ones

[32] Some assumptions on the parameter values α, β and c must be made to have strictly positive consumption of content in the merger and duopoly case. We assume that the parameter values are such that $1 - c + \frac{\alpha^2}{9\beta} > 0$.

engaging in duopoly competition. It should, however, be noted that when content substitutability is low $(s \to 0)$ the only content price factor that separates the merged platforms from the duopoly ones is the underpricing one, which is larger for the merger case. The result is that platforms that merge set lower content prices, in spite of increased market power, a result counterintuitive to traditional theory on one-sided markets[33]. Figure 1 displays content prices for the merged platforms and duopoly platforms with the substitutability parameter s on the horizontal axis[34].

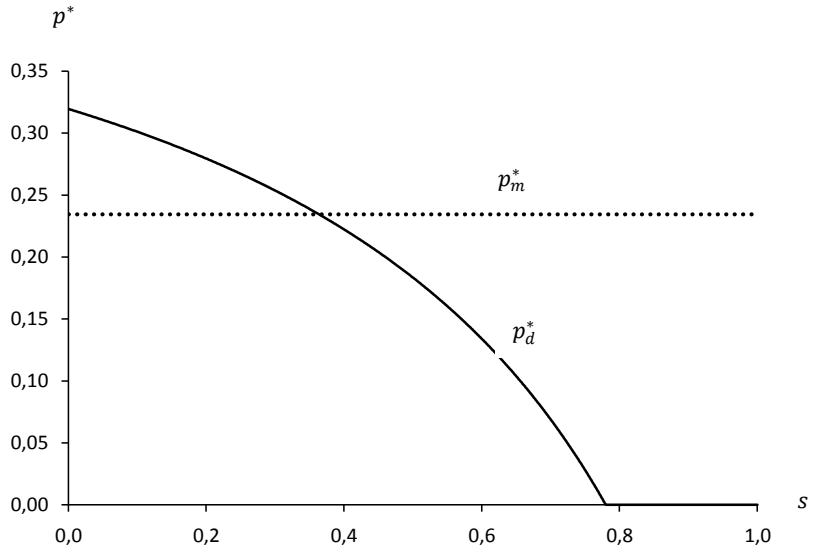


Figure 1 – Equilibrium Prices for Content

Figure 1 illustrates that the merged platforms set lower content prices if products are sufficiently differentiated. This is a general result, conditioned on the existence of the advertising market, and the proof is given in appendix A2. The illustration shows that content prices charged by duopoly platforms are lower than that of merged platforms for sufficiently high substitutability of content. However, this is not a general result, and a proof is given in appendix A3.

Summarizing we have:

Proposition 3 *Merged platforms charge lower content prices than duopoly platforms if the products are sufficiently differentiated. The merged platforms bundle less ads with content than duopoly platforms.*

[33] See Motta (2004) for analysis on the price implications of horizontal mergers in one-sided markets.
[34] Chosen parameter values are $\alpha = 3.5$, $\beta = 1$ and $c = 1$.

3.5 Welfare

In this section we explicitly solve for society surplus of our model for both equilibrium scenarios; the merger case and duopoly competition. Following earlier discussion on economic welfare we choose to ascribe equal weight to consumer- and producer surplus. The question then emerges of how to define consumers and producers in a two-sided media market. We define consumers of content as one type of consumers and the media platforms as the producers. Advertisers, who by definition also are producers of goods, are defined as another type of consumers as they purchase a service, the attention of potential buyers, from the platforms. While the literature is adamant that the existence of advertising does affect welfare level via platform profits, there is no clear consensus as to how one should include surplus stemming explicitly from trade in goods inspired by ads (Anderson and Gabszewicz, 2005). As noted earlier, we follow Anderson and Coate (2005) in their modeling of the advertisement market, in particular by assuming that advertising works in an informative manner. Producer profits stemming from trades inspired by advertisements are then defined as the advertisement surplus, and the surplus is included in the aggregate welfare level. We first consider the three surplus elements separately under the two equilibrium scenarios; consumer surplus, advertising surplus and platform profits, before combining the elements to examine aggregate welfare level.

It is important to highlight that we use interior equilibrium content prices when calculating welfare measures. Consequently, we assume that parameters are such that platforms do not find it optimal to have a negative pricing level of content.

3.5.1 Consumer surplus

Equilibrium consumer demand is found by solving equation (1.8) subject to equilibrium content prices, which are given by specifications (1.9) and (1.12) for the duopoly and merger case, respectively. This yields the following equilibrium consumption levels for each media platform:

$$C_d^* = \frac{2-s}{2(4-3s)}\left(1-c+\frac{\alpha^2}{9\beta}\right) \tag{1.14}$$

$$C_m^* = \frac{1}{4}\left(1-c+\frac{\alpha^2}{8\beta}\right) \tag{1.15}$$

By inserting equilibrium consumption and content pricing levels into the consumer surplus equation in (1.2) we solve explicitly for consumer surplus.

$$CS_d^* = \frac{(2-s)^2}{2(4-3s)^2}\left(1-c+\frac{\alpha^2}{9\beta}\right)^2 \tag{1.16}$$

$$CS_m^* = \frac{1}{8}\left(1-c+\frac{\alpha^2}{8\beta}\right)^2 \tag{1.17}$$

Consumer surplus hinges entirely on the content price level under symmetry, in which it is decreasing $\left(CS_{sy} = \frac{1}{2}\left(1-p_{sy}^*\right)^2\right)$. We can thus, following the discussion on equilibrium prices, not determine which competition scenario is better for consumers. A horizontal merger in a two-sided market, which works to create monopoly power in the market, may thus be welfare enhancing for the consumers of content. The result is profoundly inconsistent with traditional literature on horizontal mergers, where loss to consumers is expected to more than offsets increased firm profits, absent efficiency gains (Motta, 2004). It is the market's two-sided nature that produces the surprising result, in particular, that an increased underprizing effect potentially can result in lower content prices. While inconsistent with conventional economic theory, these findings are in line with conclusions made by Leonello (2010) on two-sided markets.

3.5.2 Advertising surplus

Equilibrium advertising price per ad per consumer r^* is found by solving equation (1.3) subject to equilibrium ad levels, given by (1.10) and (1.13). The equilibrium advertising price is $r_d^* = \frac{\alpha}{3}$ under duopoly competition and $r_m^* = \frac{\alpha}{2}$ for the platform merger case. Advertising surplus per ad per consumer can be found by subtracting the equilibrium advertising price from the advertisers' willingness to pay for the ad. Summarizing this surplus across all ads in both platforms $(a_1 + a_2)$ yields total advertising surplus with a symmetric consumption level of each platform equal to one. We adjust for the consumption level by multiplying this surplus with the symmetric consumption level of the platforms. Advertising surplus is given by

$$AS_d^* = C_d^* \int_0^{2a_d^*} (r - r_d^*)d(a_1 + a_2) = \frac{(2-s)}{(4-3s)}\left(1-c+\frac{\alpha^2}{9\beta}\right)\frac{\alpha^2}{9\beta} \tag{1.18}$$

$$AS_m^* = C_m^* \int_0^{2a_m^*} (r - r_m^*) d(a_1 + a_2) = \left(1 - c + \frac{\alpha^2}{8\beta}\right)\frac{\alpha^2}{32\beta} \tag{1.19}$$

The expressions for advertising surplus (AS_d^* and AS_m^*) captures that producers of new goods benefit from a lower advertising price r and higher consumption level C^*. While a lower advertising price makes it cheaper to reach each consumer, higher consumption will increase the expected number of trades inspired by an advertisement.

It becomes evident by comparing equations (1.18) and (1.19) that we cannot infer under which scenario advertisers are better-off. Advertisers will, in particular, benefit from a merger in a two-sided market if parameter values are such that the second factor of (1.18) becomes very small. In this case, the adverse effect of increased advertisement price will be dominated by the favorable effect of increased consumption.

3.5.3 Producer surplus

Producer surplus equals the combined profits of the two media platforms in equilibrium. Equilibrium profit for duopoly platforms is found by solving equation (1.6) subject to equilibrium content prices, advertising levels and consumption. Platform profits in the merger case is found by solving the expression for combined profits, given by equation (1.7), subject to equilibrium conditions. Producer surplus in equilibrium is given by

$$PS_d^* = 2\prod_d^* = \frac{2(1-s)(2-s)}{(4-3s)^2}\left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 \tag{1.20}$$

$$PS_m^* = \prod_m^* = \frac{1}{4}\left(1 - c + \frac{\alpha^2}{8\beta}\right)^2 \tag{1.21}$$

Two central properties concerning producer surplus in duopoly are established through equation (1.20). The first is that it is decreasing in the substitutability parameter s[35]. Platform profits are thereby minimized when content is completely undifferentiated ($s \to 1$), and it is from this we derive the second property. If content is perfectly substitutable we will, as stressed during the equilibrium content price section, obtain the special case of the Bertrand paradox where ad profits are exactly offset by the loss incurred from the sale of content. In this case, each platform makes zero equilibrium profits.

[35] $\frac{\partial PS_d^*}{\partial s} = -\frac{2s}{(4-3s)^3}\left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 \leq 0$ for $s \in [0, 1)$.

By comparing equations (1.20) and (1.21) we are able to conclude that producer surplus under duopoly is strictly below that of the merger case, if the market is two-sided. This ensures that duopoly platforms always have a profit incentive to merge. The proof is given in appendix A4.

3.5.4 Aggregate welfare level

The model's aggregate welfare level is found by adding together consumer surplus, advertising surplus and producer surplus ($W = CS + AS + PS$). The equilibrium welfare level is

$$W_d^* = \frac{2-s}{2(4-3s)^2}\left(1-c+\frac{\alpha^2}{9\beta}\right)\left((6-5s)\left(1-c+\frac{\alpha^2}{9\beta}\right)+(8-6s)\frac{\alpha^2}{9\beta}\right) \qquad (1.22)$$

$$W_m^* = \frac{1}{16}\left(1-c+\frac{\alpha^2}{8\beta}\right)\left(6\left(1-c+\frac{\alpha^2}{8\beta}\right)+\frac{\alpha^2}{2\beta}\right) \qquad (1.23)$$

From equations (1.22) and (1.23) we can infer some central characteristics of the aggregate welfare level. A larger advertising market (higher α or lower β) yields a positive shift in welfare under both scenarios. The opposite is true if marginal productions costs of content increase (higher c). The welfare level increases with higher competitive pressure in duopoly[36], whereas it is independent of s under the merger case. The former shows that, in a duopoly market setting, the benefit to consumers and advertisers from higher competitive pressure outweighs the profit loss of platforms. This supports the classic anti-trust account that competition benefits society as a whole.

Does this imply that a merger between media platforms, which has an unfavorable impact on the industry's competitive conditions, will harm society? By examining equations (*1.22*) and (*1.23*) together, we are able to conclude that this is not necessarily the case. There are parameter values such that the welfare level under the merger case exceeds that of duopoly competition. In appendix A5 we show, for unrelated content ($s = 0$), the circumstances under which society will be better off with a merger than duopoly competition. Figure 2, which

[36] $\frac{\partial W_d^*}{\partial s} = \frac{2}{(4-3s)^3}\left(1-c+\frac{\alpha^2}{9\beta}\right)\left(2(1-s)\left(1-c+\frac{\alpha^2}{9\beta}\right)+(4-3s)\frac{\alpha^2}{9\beta}\right) > 0.$

measures wealth level on the vertical axis and s on the horizontal axis, illustrates a scenario where the welfare level with merged platforms exceeds that of duopoly competition[37].

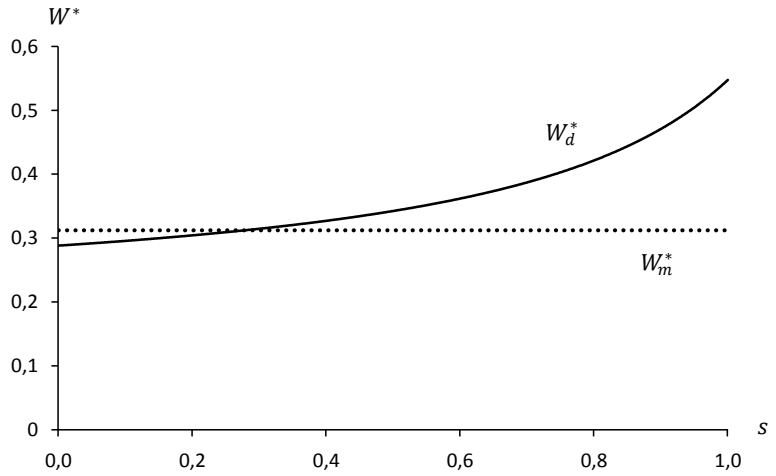


Figure 2 – Aggregate Welfare Level

Figure 2 illustrates, together with the preceding discussion, that a horizontal merger in a two-sided market can indeed enhance society surplus, even in the absence of efficiency gains. This result, however, will not persist if we exclude the advertisement market from the model, i.e. considering merely a one-sided media market. The proof of this is given in appendix A6. In this case, the move to a monopoly will impose a loss to the consumers of content that dominates the beneficial effect of increased platform profits. From this we can infer that it is the two-sided nature of the model that enables a welfare enhancing horizontal merger. In particular, platforms will utilize their increased market power by raising ad margin per consumer. Consumers can benefit from lower content prices through an increased *underpricing effect*, while advertisers will benefit if increased consumption outweighs the adverse effect of higher advertising prices. This, combined with higher platform profits, illustrates how a merger in a two-sided market can benefit society as a whole.

Summing up we have:

Proposition 4 *A horizontal merger between duopoly platforms can be welfare enhancing if the media market is two-sided.*

[37] Chosen parameter values are $\alpha = 3.6$, $\beta = 1$ and $c = 2.1$.

4. MODEL 2 – ENDOGENOUS QUALITY

Recall from Model 1 that lowering content prices was the only way in which a platform could expand consumer demand. In this section we alter this assumption, specifically by allowing platforms to make quality investments, i.e. investments that increase their product's attractiveness among the consumer audience. The chief example of quality investments in media industries is that of improvements in journalism. The basic ingredients of Model 1 are not altered when introducing endogenously chosen quality levels. We still consider two media platforms that first compete in a duopoly setting, and then maximize combined profits following a merger. In addition to choosing content prices and ad levels, the platforms must now decide on quality levels.

The section is organized as follows. We first explicate how the market participants (consumers, advertisers and media platforms) are affected by the introduction of endogenous quality levels. We then report our equilibrium outcomes in content prices, advertising levels and quality levels before finally solving for welfare levels.

Before proceeding with the model specifics we find it appropriate to elaborate on how content quality is understood in the context of our model. We define quality as a process to increase willingness to pay among consumers. All consumers agree on the preferred mix of characteristics of products with different quality, and, consequently, there exists a natural ranking at equal prices. As consumers are in agreement regarding the associated positive utility effects, quality improvements are easily accommodated in the representative consumer's preferences.

4.1 Model setup

4.1.1 The consumer

Consumer preferences are given by the quadratic utility function in equation (1.1) but with an additional quality term. The adapted utility function is given by

$$U = \sum_{i=1}^{2} C_i(1+q_i) - \left[(1-s)\left(\sum_{i=1}^{2} C_i^2\right) + \frac{s}{2}\left(\sum_{i=1}^{2} C_i\right)^2\right], \quad i = 1,2 \qquad (2.1)$$

where q_i denotes the quality level of platform i. The quality modeling in (2.1) follows that of Eika and Solheimsnes (2010), and captures that the marginal utility of consumption increases with higher product quality. In model 1, q_i was fixed to zero.

Consumers maximize consumer surplus given by the following function:

$$CS = U - \sum_{i=1}^{2} p_i C_i , \quad i = 1, 2 \tag{2.2}$$

where utility level U is given by equation (2.1). Equation (2.2) reveals that advertisement is assumed not to be a nuisance for consumers, a model characteristic highlighted in the setup of Model 1.

4.1.2 Advertisers

Advertisers are assumed not to care directly about the quality levels of the platforms, indicating that no additional value is assigned for ads bundled with higher quality content. The assumption is consistent with earlier modeling, in particular that consumers are identical in advertisers' perspective. This allows us to use the same modeling of the ad market as Model 1, where the inverse demand function for ads per viewer (reader) was

$$r = \alpha - \beta(a_i + a_j) , \quad i, j = 1, 2 \quad i \neq j \tag{2.3}$$

r is the unit advertising price per consumer, and $a_i + a_j$ is the aggregate advertisement level. Although advertisers do not assign explicit value to content quality, they are indirectly affected as quality improvements affect consumption levels. If platforms with higher quality have higher consumption levels, then ads placed in this platform will have a higher inherent value. This is because the number of expected trades in goods inspired by the ad is higher.

4.1.3 Media Platforms

Each media platform has two revenue sources: the sale of content to consumers, and the sale of consumers' attention to producers advertising their new goods. Content quality is, in addition to content prices and advertisement levels, chosen by media platforms in order to maximize platform profits. Specifically, if higher quality increases demand, there will be higher ad revenues following quality improvements. Increased consumer demand will also result in increased content profits if content is sold with a positive margin ($p_i > c$), and decreased profits if it is sold at a loss ($p_i < c$).

Quality improvements, for example through investments in journalism, have associated costs. We capture this by including a variable investment cost given by $\frac{1}{2}\varphi q_i^2$. $\varphi > 0$ is a parameter measuring the cost of investing in quality, which is assumed to be sufficiently large to fulfill all second-order conditions. The convexity of the investment cost captures that quality improvements are more expensive the higher the initial quality level, a realistic characteristic of media industries. We do not alter other assumptions given in Model 1, and total profit for media firm i then becomes

$$\prod_i = (p_i - c + ra_i)C_i - \frac{1}{2}\varphi q_i^2 , \;\; i = 1, 2 \tag{2.4}$$

Combined platform profits are

$$\prod_m = \prod_1 + \prod_2 \tag{2.5}$$

implying that there are no efficiency gains in the cost of quality investments following a merger. As for Model 1, the merger has thereby only a pure market power effect on the media market.

4.2 Equilibrium – duopoly case

The sequencing of the game is as follows: in the first stage, platforms choose quality levels simultaneously with advertising levels and content prices, before consumers decide on consumption at the final stage. The sequencing implies that media platforms do not commit to a fixed quality level before deciding on content prices and ad levels, or vice versa. Consumption of content is chosen on the basis of given platform price- and quality characteristics. The model is solved through backward induction.

4.2.1 Stage 2 – Consumer demand

At the final stage consumers maximize consumer surplus, given by equation (2.2), with respect to consumption level of each platform. Setting $\partial CS/C_i = 0$ yields two first-order conditions that are solved simultaneously to derive consumer demand for media product i[38]:

$$C_i = \frac{1}{2}\left(1 - \frac{p_i - s\bar{p}}{1 - s} + \frac{q_i - s\bar{q}}{1 - s}\right) , \;\; i = 1, 2 \tag{2.6}$$

[38] The S.O.C. for the consumer is satisfied with $s \in [0, 1)$.

where $\bar{p} = \frac{1}{2}\sum_{j=1}^{2} p_j$ and $\bar{q} = \frac{1}{2}\sum_{j=1}^{2} q_j$ denotes the average price- and quality levels, respectively. Equation (2.6) reveals that demand for media product i is decreasing in its own price and increasing in quality level. Substitution effects arise if products are somewhat related ($s > 0$). In this case, consumption of product i, C_i, decreases if the rival firm increases its good's attractiveness, either by lowering content prices or by raising the inherent quality of the good through quality investments.

4.2.2 Stage 1 – Platforms set price-, advertisement- and quality levels

Media platform i maximizes individual profits given by equation (2.4), subject to (2.3) and (2.6), with respect to content price p_i, advertising level a_i and quality level q_i. The maximization problem gives rise to the following six first-order conditions:

$$\frac{\partial \prod_i}{\partial p_i} \leq 0\,, \;\; p_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_i}{\partial a_i} \leq 0\,, \;\; a_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_i}{\partial q_i} = 0\,, \;\; i = 1,2$$

with complementary slackness for the conditions on content price and ad level. Quality levels are, as strategic actions between platforms, unrelated $\left(\frac{\partial^2 \prod_i}{\partial q_i \partial q_j} = 0\right)$. Solving $\partial \prod_i / \partial p_i = \partial \prod_i / \partial a_i = \partial \prod_i / \partial q_i = 0$ simultaneously for the two media platforms gives rise to the following interior, symmetric equilibrium in content prices, advertising levels and quality investments:

$$p_d^* = \underbrace{\frac{4\varphi(1-s)}{2\varphi(4-3s)-(2-s)}}_{I} + \underbrace{\frac{c(2\varphi-1)(2-s)}{2\varphi(4-3s)-(2-s)}}_{II} - \underbrace{\frac{\alpha^2(2\varphi-1)(2-s)}{9\beta\left(2\varphi(4-3s)-(2-s)\right)}}_{III} \tag{2.7}$$

$$a_d^* = \frac{\alpha}{3\beta} \tag{2.8}$$

$$q_d^* = \frac{2-s}{2\varphi(4-3s)-(2-s)}\left(1 - c + \frac{\alpha^2}{9\beta}\right) \tag{2.9}$$

Subscript d denotes that platforms here engage in duopoly competition. Content prices are set equal to zero, due to the non-negativity constraint, if the parameter values are such that

$$\frac{2\varphi-1}{4\varphi}\left(\frac{\alpha^2}{9\beta}-c\right)>\frac{1-s}{2-s} \quad \rightarrow \quad p_d^*=0$$

while equilibrium advertisement levels, given by equation (2.8), are always non-negative. All second-order conditions for profit maximization are satisfied with $\varphi>\varphi_{d,cri}^*=\frac{2-s}{8(1-s)}$, which we assume always to be the case[39]. By imposing $\varphi>\varphi_{d,cri}^*$ we obtain the result that the common denominator factor in p_d^* and q_d^*, $2\varphi(4-3s)-(2-s)$, is strictly positive.

Equilibrium advertisement level a_d^*, given by equation (2.8), is increasing in the size of the ad market ($\partial a_d^*/\partial\alpha>0,\ \partial a_d^*/\partial\beta<0$), and independent of the competitive pressure in the content market ($\partial a_d^*/\partial s=0$). These findings are consistent with those found in Model 1.

From equation (2.9) we can infer some central properties regarding equilibrium quality level, q_d^*; it is increasing in the competitive pressure ($\partial q_d^*/\partial s>0$) and falling in the quality investment cost parameter ($\partial q_d^*/\partial\varphi<0$)[40]. The latter is expected as higher φ increases the marginal cost of quality investments. The former result captures that the demand expanding effect of quality improvements is larger if content is less differentiated. This is because more consumers are prone to switch between platforms if switching is "cheap". Equation (2.9) also captures that equilibrium quality level is decreasing in marginal production costs of content ($\partial q_d^*/\partial c<0$), and increasing in the size of the advertisement market ($\partial q_d^*/\partial\alpha>0$). A higher c will increase a platform's costs in sale of content, making it less profitable to increase demand. A larger ad market will, on the other hand, increase a platform's revenue per consumer, which in turn increases the marginal benefit of investments in quality.

[39] The Hessian matrix, $\begin{pmatrix}\frac{\partial^2\Pi_i}{\partial p_i^2} & \frac{\partial^2\Pi_i}{\partial p_i\partial a_i} & \frac{\partial^2\Pi_i}{\partial p_i\partial q_i}\\ \frac{\partial^2\Pi_i}{\partial a_i\partial p_i} & \frac{\partial^2\Pi_i}{\partial a_i^2} & \frac{\partial^2\Pi_i}{\partial a_i\partial q_i}\\ \frac{\partial^2\Pi_i}{\partial q_i\partial p_i} & \frac{\partial^2\Pi_i}{\partial q_i\partial a_i} & \frac{\partial^2\Pi_i}{\partial q_i^2}\end{pmatrix}=\begin{pmatrix}-\frac{2-s}{2(1-s)} & 0 & \frac{2-s}{4(1-s)}\\ 0 & -2\beta C_i & 0\\ \frac{2-s}{4(1-s)} & 0 & -\varphi\end{pmatrix}$, is negative definite with $\varphi>\frac{2-s}{8(1-s)}$ and $C_i>0$.

[40] $\frac{\partial q_d^*}{\partial s}=\frac{4\varphi}{(2\varphi(4-3s)-(2-s))^2}\left(1-c+\frac{\alpha^2}{9\beta}\right)>0$. We assume that $1-c+\frac{\alpha^2}{9\beta}>0$ to ensure that consumption, $C_d^*=\frac{\varphi(2-s)}{2\varphi(4-3s)-(2-s)}\left(1-c+\frac{\alpha^2}{9\beta}\right)$, is strictly positive.

As in model 1, we separate content prices in duopoly, given by equation (2.7), into three distinct elements, *l*, *ll* and *lll*, respectively. Element *l* is referred to as the *market power factor* and measures the amount to which a platform prices its content above marginal cost when disregarding the advertising market. Platforms that offer undifferentiated content ($s \to 1$) in a duopoly setting do not price content above marginal production costs. However, it cannot be inferred that the *market power factor* is decreasing in the substitutability parameter s. The intuition for this is that a

higher s results in a higher quality level ($\partial q_d^*/\partial s > 0$) which in turn raises consumers' willingness to pay for the good. This effect is especially large for low levels of φ, and if $\varphi < \frac{1}{2}$ the quality effect will dominate the adverse competition effect. It can be identified that the *market power factor* is decreasing in φ. The intuition is that a lower quality level decreases consumer's willingness to pay for content.

Element *ll* is refered to as the *cost factor* and measures how marginal production costs are internalized in the pricing of content. The *cost factor* is, in absolute terms, increasing in s. This implies that changes in marginal costs are further internalized in the content price of platforms that face harder competitive pressure.

While we through assumptions on the investment cost parameter φ can infer that the denominator of *ll* is strictly positive, the same cannot be concluded for the numerator. Specifically, the *cost factor* will be negative if $\varphi \in \left(\varphi_{d,cri}^*, \frac{1}{2}\right)$ and positive if $\varphi \in \left(\frac{1}{2}, \infty\right)$. A negative *cost factor* ($\partial p_d^*/\partial c < 0$) indicates that increased marginal production costs results in lower equilibrium content prices, a fairly counterintuitive result that merits further discussion. The result stems from the introduction of endogenous quality levels. We can separate the pricing impact of changes in marginal production costs, c, in two isolated parts, a direct effect and an indirect quality effect. The direct effect captures that an increase in c results in a higher optimal content price. Increased marginal production costs do, however, also weaken a platform's incentive to invest in quality. The result of this is lower content prices, as lower content quality reduces consumers' willingness to pay for the good. This indirect quality effect will dominate the direct one if changes in c results in a large enough alteration of quality level. Specifically, this is the case when quality investments are sufficiently "cheap" $\left(\varphi < \frac{1}{2}\right)$. The direct effect dominates if $\varphi > \frac{1}{2}$, and they offset each other perfectly at $\varphi = \frac{1}{2}$ with the result that content prices, p_d^*, are independent of marginal

production costs, c. Figure 3 encapsulates at what values the *cost effect* is negative (the grey shaded area), and when it is positive. Recall that φ is assumed to be strictly above $\varphi^*_{d,cri}$.

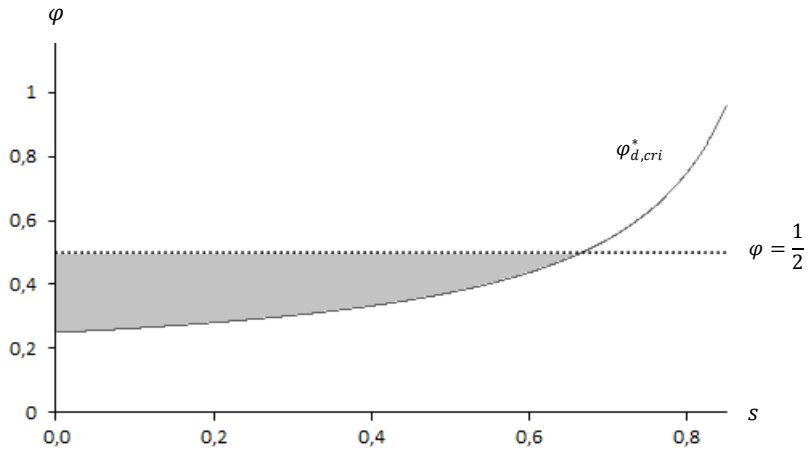


Figure 3 – Positive vs. Negative Cost Effect

Element *lll* captures how the unique relationship between advertisers and consumers in the two-sided model affects equilibrium content prices. The element is referred to as the *underpricing effect*. The effect is increasing, in absolute value, in the substitutability parameter s.

Under model 1 we highlighted a platforms' incentive to expand demand by lowering content prices as advertising income raises revenue per consumer. While this direct effect persists when introducing endogenous advertising levels, the advertising market now also impacts equilibrium content prices indirectly. Increased advertisement revenue per consumer raises a platform's incentive to expand demand through quality improvements. Higher content quality will, in itself, raise consumers' willingness to pay for the good, resulting in higher equilibrium content prices. The indirect quality effect dominates the direct one if $\varphi \in \left(\varphi^*_{d,cri}, \frac{1}{2}\right)$. The existence of the advertisement market will, in this case, lead to higher equilibrium content prices, a somewhat surprising result that can be related directly to a negative *cost effect*. It is, however, important to emphasize that consumers are not necessarily hurt by the existence of the ad market, even though content prices would be lower without it. The advertisement market will, following equation (2.9), lead to higher quality level of content, which is, by itself, positive for consumers.

Comparative statistics concerning equation (2.7) yield somewhat surprising results. In particular, we are not able to infer that equilibrium content prices, p_d^*, is decreasing in the competitive pressure of the content market, s. Content pricing level is increasing in s if $\varphi \in \left(\varphi_{d,cri}^*, \frac{1}{2}\right)$[41]. The intuition behind this is that higher content substitutability results in a positive shift in quality level, which in turn increases consumers' willingness to pay for the good by an amount that more than offsets the adverse price effect of increased competition. Equilibrium content price is decreasing in the quality investment cost parameter $(\partial p_d^*/\partial \varphi < 0)$[42]. This is expected as higher investment costs will lower quality level, weakening consumers' willingness to pay for content.

Summarizing yields:

Proposition 5 *Competing media platforms invest more in quality with a larger advertisement market and increased competitive pressure* $(\partial q_d^*/\partial\, \alpha > 0, \partial q_d^*/\partial\, s > 0)$. *Larger advertisement market or increased competitive pressure can result in both lower and higher content prices, depending on the quality investment cost parameter,* φ.

4.3 Equilibrium – duopoly case

We now consider the case where the two media platforms maximize profits cooperatively following a merger. The basics of the model are not altered, i.e. media platforms set content prices p_i, advertising levels a_i and quality levels q_i at the first stage, while consumers decide on consumption C_i at the final stage.

4.3.1 Stage 2 – Consumer demand

Consumers maximize consumer surplus, given by equation (2.2), on the basis of given content characteristics and prices. Consumer demand for media product i, C_i, is then given by equation (2.6).

[41] $\frac{\partial p_i^*}{\partial s} = \frac{-4\varphi(2\varphi-1)}{\left(2\varphi(4-3s)-(2-s)\right)^2}\left(1-c+\frac{\alpha^2}{9\beta}\right)$

[42] $\frac{\partial p_i^*}{\partial \varphi} = \frac{-4(2-s)(1-s)}{\left(2\varphi(4-3s)-(2-s)\right)^2}\left(1-c+\frac{\alpha^2}{9\beta}\right) < 0$

4.3.2 Stage 1 – Platforms set price-, advertisement- and quality levels cooperatively

At the first stage, each media platform maximize combined profits, given by equation (2.5), with respect to content price p_i, advertising level a_i and investments in content quality q_i. This gives rise to the following six first-order conditions,

$$\frac{\partial \prod_m}{\partial p_i} \leq 0\,, \;\; p_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_m}{\partial a_i} \leq 0\,, \;\; a_i \geq 0\,, \;\; i = 1,2$$

$$\frac{\partial \prod_m}{\partial q_i} = 0\,, \;\; i = 1,2$$

with complementary slackness for the conditions concerning content prices and advertising levels.

Under model 1 we highlighted the merged platforms incentives in setting symmetric or asymmetric content prices and advertising levels. It was concluded that content profits form an incentive to set symmetric content prices, while the opposite was true for advertisement profits. While these results persist when introducing endogenous quality levels, we now also have to consider whether quality levels should be set symmetrically or asymmetrically. Though choosing to focus on the symmetric equilibrium when explicitly solving the maximization problem, we will first provide a discussion around the platforms' decision of quality investments.

Asymmetric quality levels constitute an alternative to content prices in generating asymmetric consumption with the aim of increasing combined ad profits $\left(\pi_{ad,m} = r(a_1 C_1 + a_2 C_2)\right)$. While the losses encountered with asymmetric content prices arose from increased relative consumption of the good with lowest content profit margin, the losses encountered in quality levels have a somewhat different source. Asymmetric quality levels have higher combined investment costs than symmetric ones, which is due to the convexity of the quality investment cost function $\left(\frac{1}{2}\varphi q_i^2\right)$. The convexity implies that additional quality improvements for a high quality product are costly, and this investment cost will not be fully compensated by a symmetric quality drop for the inferior product. The magnitude of the increase in combined investment costs depends crucially on the parameters φ and s. Higher quality investment

costs will increase the associated cost of asymmetric quality. Increased substitutability between goods will, on the other hand, reduce the associated cost as a lower asymmetry in quality will be required to create an adequate shift in demand.

Another question to consider for the merged firm is whether to keep both media platforms in its product portfolio. This question was not relevant under Model 1 as none of the goods had associated retrievable fixed costs. In particular, the merged platforms can now reduce their quality investment costs by removing one of the media platforms from the market. This practice will, on the other hand, result in decreased consumption as consumers may not wish to substitute towards the alternative platform. The decreased consumption effect reduces platform revenue, and is particularly large if content is completely differentiated ($s = 0$). The effect is negligible if goods are perceived as perfect substitutes ($s \to 1$).

We assume that parameters are such that it will be optimal to keep both goods in the product portfolio, and to set symmetric content prices ($p_1 = p_2 = p_m$) and quality levels ($q_1 = q_2 = q_m$). Advertising levels can then, arbitrarily, be set equal between the platforms ($a_1 = a_2 = a_m$). Maximizing combined platform profits, subject to (2.3), (2.4), (2.6) and the symmetry restrictions, yields the following three first-order conditions:

$$\frac{\partial \prod_{m,sy}}{\partial p_m} \leq 0\,, \;\; p_m \geq 0$$

$$\frac{\partial \prod_{m,sy}}{\partial a_m} \leq 0\,, \;\; a_m \geq 0$$

$$\frac{\partial \prod_{m,sy}}{\partial q_m} = 0$$

with complementary slackness for the two first conditions. Solving $\partial \prod_{m,sy}/\partial p_m = \partial \prod_{m,sy}/\partial a_m = \partial \prod_{m,sy}/\partial q_m = 0$ simultaneously yields the succeeding unique, interior equilibrium:

$$p_m^* = \underbrace{\frac{2\varphi}{4\varphi - 1}}_{I} + \underbrace{\frac{c(2\varphi - 1)}{4\varphi - 1}}_{II} - \underbrace{\frac{\alpha^2(2\varphi - 1)}{8\beta(4\varphi - 1)}}_{III} \tag{2.10}$$

$$a_m^* = \frac{\alpha}{4\beta} \tag{2.11}$$

$$q_m^* = \frac{1}{4\varphi - 1}\left(1 - c + \frac{\alpha^2}{8\beta}\right) \tag{2.12}$$

Prices are, due to the non-negativity constraint, restricted to zero if

$$\frac{2\varphi - 1}{2\varphi}\left(\frac{\alpha^2}{8\beta} - c\right) > 1 \quad \rightarrow \quad p_m^* = 0$$

while equilibrium advertising levels are always non-negative. The second-order conditions for profit maximization are satisfied with $\varphi > \varphi_{m,cri}^* = \frac{1}{4}$, which we assume to be the case[43]. This assumption also ensures that the common denominator factor in equilibrium content price and quality level, $4\varphi - 1$, is strictly positive.

The merged platforms set quality level optimally in accordance with equation (2.12). Equilibrium quality level is decreasing in marginal production costs of content ($\partial q_m^*/\partial c < 0$). This is expected as higher costs will decrease profits per consumer, making demand expanding quality investments less profitable. Conversely, a larger ad market will increase profits per consumer, resulting in higher quality investments ($\partial q_m^*/\partial \alpha > 0$). Furthermore, equilibrium quality level is decreasing in the cost of quality improvements ($\partial q_m^*/\partial \varphi < 0$).

Equilibrium content price for merged platforms, given by equation (2.10), is as for the duopoly case, divided in three distinct elements. Element *l*, referred to as the *market power factor*, is a monopoly platform's price premium in the sale of content. The factor is decreasing in φ, and the explanation is that a lower quality level decreases consumers' willingness to pay for the product. Element *ll* and *lll*, referred to as the *cost factor* and the *underpricing effect,* respectively, displays how marginal production costs and advertising profits per consumer are internalized in the prizing of content. Element *ll* and *lll* will change signs if $\varphi \in \left(\varphi_{m,cri}^*, \frac{1}{2}\right)$ implying that lower marginal production costs, or a larger advertisement market, will result in a higher equilibrium content price. This counterintuitive result, the rationale for which we explained under the duopoly section, stems from a large quality level internalization that in

[43] The Hessian matrix, $\begin{pmatrix} \frac{\partial^2 \Pi_{m,sy}}{\partial p_m^2} & \frac{\partial^2 \Pi_{m,sy}}{\partial p_m \partial a_m} & \frac{\partial^2 \Pi_{m,sy}}{\partial p_m \partial q_m} \\ \frac{\partial^2 \Pi_{m,sy}}{\partial a_m \partial p_m} & \frac{\partial^2 \Pi_{m,sy}}{\partial a_m^2} & \frac{\partial^2 \Pi_{m,sy}}{\partial a_m \partial q_m} \\ \frac{\partial^2 \Pi_{m,sy}}{\partial q_m \partial p_m} & \frac{\partial^2 \Pi_{m,sy}}{\partial q_m \partial a_m} & \frac{\partial^2 \Pi_{m,sy}}{\partial q_m^2} \end{pmatrix} = \begin{pmatrix} -2 & 0 & 1 \\ 0 & -4\beta C_m & 0 \\ 1 & 0 & -2\varphi \end{pmatrix}$, is negative definite with $\varphi > \frac{1}{4}$ and $C_m > 0$. This fulfills all second-order conditions after symmetry has been imposed.

turn raises consumers' willingness to pay for the product sufficiently to create an opposite pricing effect.

Equilibrium pricing level of content is, for the merger case, decreasing in the quality investment cost parameter $(\partial p_m^*/\partial \varphi < 0)$[44]. This is an indirect effect accredited to lower willingness to pay for a product of lesser quality. Equation (2.10) also demonstrates that the content pricing level in the merger case is unaffected by the competitive pressure in the content market, measured by the substitutability parameter s. The result can be accredited to a competition-eliminating merger and the use of a utility function where the market size is unaffected by changes in s.

By summing up we get:

Proposition 6 *Merged platforms invest more in quality with a larger advertisement market* $(\partial q_m^*/\partial\, \alpha > 0)$. *A larger advertisement market can, however, result in both lower and higher content prices, depending on the quality investment cost parameter,* φ.

4.4 Equilibrium outcomes – duopoly vs. merger

In this section, we compare equilibrium outcomes for the non-cooperative duopoly case and the cooperative merger case. We start by focusing on advertising level, before attending to quality levels. Finally we discuss the differences in platforms' pricing of content.

Merged platforms set advertising levels strictly lower than platforms engaging in duopoly competition $\left(a_m^* = \frac{\alpha}{4\beta} < \frac{\alpha}{3\beta} = a_d^*\right)$. The intuition for this is that platforms who maximize profits cooperatively take into account that increased advertising level reduces the other platform's advertisement profits, due to a lower advertising price per consumer, r. This outcome, consistent with findings from Model 1, results in higher ad profits per consumer for merged platforms than for duopoly platforms.

Equilibrium quality levels are given by equations (2.9) and (2.12) for the duopoly- and merger case, respectively. If we disregard any substitution effects between platforms by setting $s = 0$, it becomes evident that merged platforms invests more in quality improvements than duopoly ones. The result stems from a higher ad margin per consumer that raises the

[44] $\frac{\partial p_m^*}{\partial \varphi} = \frac{-2}{(4\varphi-1)^2}\left(1 - c + \frac{\alpha^2}{8\beta}\right) < 0$

marginal benefit of demand expanding quality investments. Duopoly platforms do, however, have an additional incentive to invest in quality if content is somewhat related $(s > 0)$. This incentive is accredited business stealing, i.e. the capturing of consumers from the rival platform. Platforms that invest in quality cooperatively have no incentive to engage in business stealing, as it does not matter for combined profits which product consumers decide to purchase. Figure 4 displays equilibrium quality levels for the two competition scenarios with the content differentiation parameter s on the horizontal axis[45].

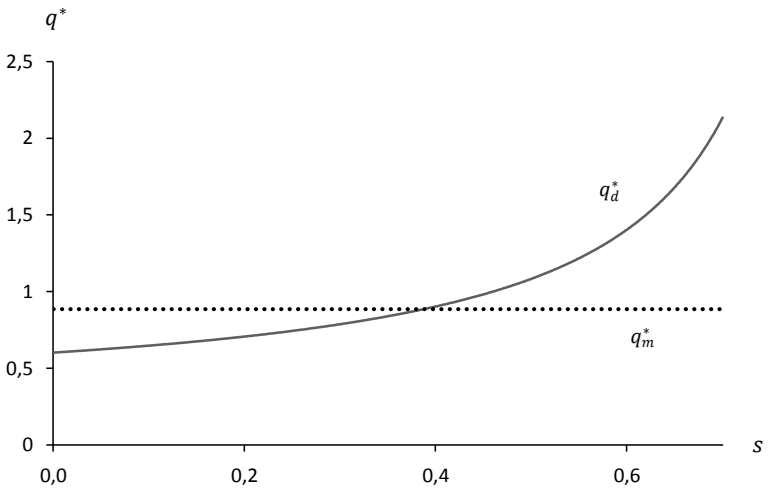


Figure 4 – Equilibrium Quality Levels

The figure demonstrates that merged platforms set higher quality levels for sufficiently undifferentiated content, a general result proven in appendix B1. The illustration also shows that quality investments amongst duopoly platforms will exceed that of merged firms if content is sufficiently substitutable. This is, however, not a general result.

We once again discern the content price into three distinct elements in order to compare them separately. The *market power factor* for a duopoly platform equals that of merged platforms when $s = 0$. Recalling an increasing duopoly price in s if $\varphi < \frac{1}{2}$ yields the result that duopoly platforms will weakly price their content more above marginal cost than merged ones, disregarding the advertising market. Merged platforms will in the case of $\varphi > \frac{1}{2}$ have a weakly larger pricing factor.

The *cost factor* is, in absolute value, increasing in s for duopoly platforms, thus reaching its minimum at $s = 0$. At this point the *cost factor* is equal in the two competition scenarios.

[45] Chosen parameter values are $\alpha = 3.5$, $\beta = 1$, $c = 2$ and $\varphi = 0.4$.

Recall that we were unable to infer the sign of the cost factor unless we made assumptions on the parameter φ. If the sign is positive $\left(\varphi > \frac{1}{2}\right)$, duopoly platforms will price its content, due to marginal production costs of content, weakly above ones that have merged. On the other hand, if the sign is negative $\left(\varphi < \frac{1}{2}\right)$, the result will be the opposite, with a lower, or equal, content price effect in duopoly. In the special case of $\varphi = \frac{1}{2}$, neither duopoly- nor merged platforms take marginal production costs into account in their pricing of content.

The last element to consider is the *underpricing effect*. There are two distinct factors to reflect on in the difference of underpricing between duopoly- and merged platforms. The first factor is that the effect is increasing, in absolute value, in the parameter s for duopoly platforms. Merged platforms do, because of monopoly power in the advertisement market, have higher ad profits per consumer, and this is the second factor. This factor results in higher incentives to expand demand, which can be achieved by lowering content prices, increasing quality investments, or a combination of the two. Furthermore, these practices will lead to a higher *underpricing effect* in absolute value. The effect is equal for the two equilibrium scenarios if $s = s_{equal} = \frac{2(4\varphi-1)}{22\varphi-1}$. Merged platforms will, because of ad market, price their content lower than duopoly platforms if the sign of the *underpricing effect* is negative $\left(\varphi > \frac{1}{2}\right)$ and $s < s_{equal}$, or if the effect is positive $\left(\varphi < \frac{1}{2}\right)$ and $s > s_{equal}$. Correspondingly, a merged platform price its content higher than duopoly ones if $\varphi > \frac{1}{2}$ and $s > s_{equal}$, or if $\varphi < \frac{1}{2}$ and $s < s_{equal}$.

It is not possible to infer in which direction each of the three elements impact the content pricing level in equilibrium without making assumptions on the parameter φ. Figure 1 captures two distinct content pricing scenarios. In scenario 1 content prices of duopoly platforms will exceed that of merged platforms only if s is sufficiently high. The opposite is true for scenario 2 where content prices in duopoly are higher only if s is sufficiently low[46].

[46] Chosen parameter values are $\alpha = 2$, $\beta = 1$, $c = 1.4$, $\varphi = 0.4$ for $p_{d_1}^*$ and $p_{m_1}^*$, and $\alpha = 2$, $\beta = 1$, $c = 1.3$, $\varphi = 0.6$ for $p_{d_2}^*$ and $p_{m_2}^*$.

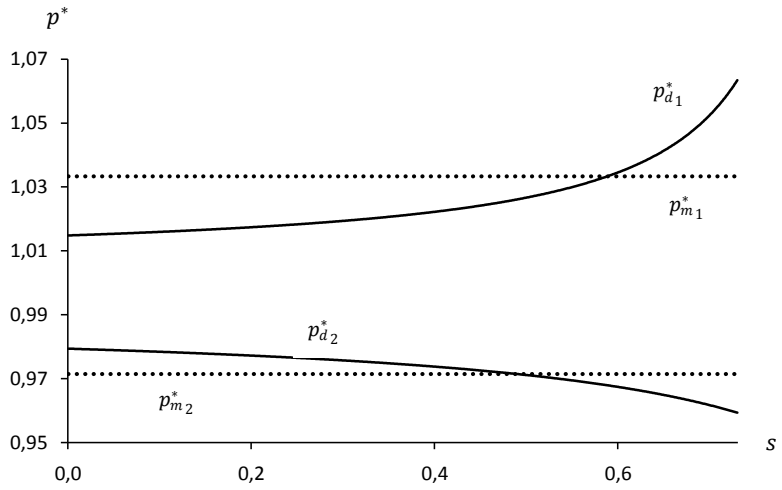


Figure 5 – Equilibrium Pricing Levels of Content (Scenario 1: $\varphi < \frac{1}{2}$, Scenario 2: $\varphi > \frac{1}{2}$)

4.5 Welfare

In this section we focus on society's welfare level in equilibrium. While equilibrium outcomes differ slightly when introducing endogenous quality investments, economic welfare is defined correspondingly to Model 1. In particular, equal weights are ascribed to consumer- and producer surplus. Advertising is assumed to work in an informative manner with accompanying advertising surplus added to aggregate welfare. We first examine the three welfare elements separately; consumer surplus, advertising surplus and platform profits, before combining them to evaluate the model's aggregate welfare level.

It is important to emphasize that interior equilibrium content prices are employed when calculating welfare measures. Parameters are, consequently, assumed to be such that platforms will never find it optimal to set negative content prices.

4.5.1 Consumer surplus

Consumer demand in equilibrium is found by solving equation (2.6), subject to equilibrium content prices and quality levels for the two different scenarios duopoly competition and merged platforms. This yields the following equilibrium consumption per platform:

$$C_d^* = \frac{\varphi(2-s)}{2\varphi(4-3s)-(2-s)}\left(1-c+\frac{\alpha^2}{9\beta}\right) \tag{2.13}$$

$$C_m^* = \frac{\varphi}{4\varphi - 1}\left(1 - c + \frac{\alpha^2}{8\beta}\right) \tag{2.14}$$

A higher φ will, for both scenarios, reduce equilibrium consumption level, whereas a higher content substitutability will increase consumption in duopoly. Expressions for consumer surplus in equilibrium are found by inserting equilibrium consumption, content prices and quality levels into equation (2.2).

$$CS_d^* = 2\left(\frac{\varphi(2-s)}{2\varphi(4-3s)-(2-s)}\right)^2\left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 \tag{2.15}$$

$$CS_m^* = 2\left(\frac{\varphi}{4\varphi - 1}\right)^2\left(1 - c + \frac{\alpha^2}{8\beta}\right)^2 \tag{2.16}$$

Consumers benefit, in both scenarios, from a lower quality investment cost[47]. They also benefit from increased competition between duopoly platforms[48]. This demonstrates that the increased quality effect dominates the adverse content pricing effect that exists when $\varphi < \frac{1}{2}$.

In appendix B2 we prove that a merger between duopoly platforms will benefit consumers if products are sufficiently differentiated and the market is two-sided. The result, which is given absent efficiency gains, underlines our previous findings - in particular that conventional economic theory can be unsuitable in analyzing welfare effects of horizontal mergers in two-sided markets. If the market in question is one-sided a merger can no longer benefit consumers. This is in line with traditional literature on horizontal mergers.

4.5.2 Advertising surplus

Equilibrium unit advertising price per consumer is found by solving equation (2.3) with respect to equilibrium advertising levels, given by equations (2.8) and (2.11). The advertising price is strictly higher for the platform merger case $\left(r_m^* = \frac{\alpha}{2}\right)$ than for duopoly competition $\left(r_d^* = \frac{\alpha}{3}\right)$. Advertising surplus is calculated in line with Model 1, i.e. by subtracting the advertising price from the advertiser's willingness to pay for the ad, before summing across all ads and adjusting for equilibrium consumption level.

[47] $\frac{\partial CS_d^*}{\partial \varphi} = \frac{-4\varphi(2-s)^3}{\left(2\varphi(4-3s)-(2-s)\right)^3}\left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 < 0$, $\frac{\partial CS_m^*}{\partial \varphi} = \frac{-4\varphi}{(4\varphi-1)^3}\left(1 - c + \frac{\alpha^2}{8\beta}\right)^2 < 0$

[48] $\frac{\partial CS_d^*}{\partial s} = \frac{16\varphi^3(2-s)}{\left(2\varphi(4-3s)-(2-s)\right)^3}\left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 > 0$

$$AS_d^* = C_d^* \int_0^{2a_d^*} (r - r_d^*) d(a_1 + a_2) = \frac{2\varphi(2-s)}{2\varphi(4-3s)-(2-s)} \left(1 - c + \frac{\alpha^2}{9\beta}\right) \frac{\alpha^2}{9\beta} \quad (2.17)$$

$$AS_m^* = C_m^* \int_0^{2a_m^*} (r - r_m^*) d(a_1 + a_2) = \frac{2\varphi}{4\varphi - 1} \left(1 - c + \frac{\alpha^2}{8\beta}\right) \frac{\alpha^2}{16\beta} \quad (2.18)$$

As in Model 1, we are not able to infer that a horizontal merger between platforms is welfare detrimental for advertisers. This is easily observed from the above equations if parameters are such that the second factor of AS_d^* is close to zero and the ad market is existent $(\alpha > 0)$.

Advertisers profit from a merger if the higher advertisement price increases consumption, either through lower content prices or higher quality levels, sufficiently to outweigh the adverse pricing effect.

4.5.3 Producer surplus

Producer surplus is found by combing equilibrium profits for the two media platforms. Solving equation (2.4), subject to equilibrium conditions, yields profits per platform under duopoly competition. We employ the combined profit expression in (2.5) when calculating producer surplus for the merger case.

$$PS_d^* = 2\prod_d^* = \frac{\varphi(2-s)\big(8\varphi(1-s)-(2-s)\big)}{\big(2\varphi(4-3s)-(2-s)\big)^2} \left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 \quad (2.19)$$

$$PS_m^* = \prod_m^* = \frac{\varphi}{4\varphi - 1} \left(1 - c + \frac{\alpha^2}{8\beta}\right)^2 \quad (2.20)$$

First, we can infer that platforms in both scenarios make positive profits, and they will thus never have an economic incentive to exit the market. While this property is easily identified for the merger case, the proof concerning PS_d^* is left to appendix B3. We can also infer that duopoly profits are falling in the competitive pressure of the content market, thus reaching their maximum if products are completely differentiated from consumers' perspective[49]. From

[49] $\frac{\partial PS_d^*}{\partial s} = \frac{-16\varphi^3 s}{\big(2\varphi(4-3s)-(2-s)\big)^3} \left(1 - c + \frac{\alpha^2}{9\beta}\right)^2 \leq 0$

this it can be verified that producer surplus for the merger case strictly exceeds profits under duopoly competition if the market is two-sided. The proof is given in appendix B4.

While it can be easily verified that merged platforms always will suffer from a higher quality investment cost, the same cannot be concluded for duopoly platforms. The intuition is that media platforms in duopoly have an incentive to "overinvest" in quality in order to capture consumers from the rival firm. This business stealing effect, which is particularly large for undifferentiated content, can be regarded as a prisoner's dilemma for platforms, with an equilibrium outcome of declined profits. The effect increases as φ becomes smaller, and the profit losses accredited increased business stealing will, for given conditions, dominate investment cost savings[50].

4.5.4 Aggregate welfare level

Aggregate welfare is found by accumulating surplus conditions for all market participants: consumers, advertisers and platforms ($W = CS + AS + PS$). Equilibrium welfare conditions under the two scenarios are given by

$$W_d^* = \frac{\varphi(2-s)\left(1-c+\frac{\alpha^2}{9\beta}\right)}{\left(2\varphi(4-3s)-(2-s)\right)^2}\left(\left(2\varphi(6-5s)-(2-s)\right)\left(1-c+\frac{\alpha^2}{9\beta}\right)+\left(2\varphi(4-3s)-(2-s)\right)\frac{2\alpha^2}{9\beta}\right) \quad (2.21)$$

$$W_m^* = \frac{\varphi\left(1-c+\frac{\alpha^2}{8\beta}\right)}{(4\varphi-1)^2}\left((6\varphi-1)\left(1-c+\frac{\alpha^2}{8\beta}\right)+(4\varphi-1)\frac{\alpha^2}{8\beta}\right) \quad (2.22)$$

From equations (2.21) and (2.22) we can infer some central properties concerning the aggregate welfare level. A larger advertisement market or a reduction in marginal production costs will, under both scenarios, yield a positive shift in welfare level. Welfare level in duopoly is, consistent with findings from Model 1, increasing in the substitutability parameter s[51]. An increase in the investment cost parameter φ will be welfare detrimental for both duopoly competition and the merger case. The former shows that potential benefits in platform profits from a lower business stealing effect will be more than outweighed by the

[50] $\frac{\partial PS_d^*}{\partial \varphi} = \frac{(2-s)^2\left(2-s-2\varphi(4-5s)\right)}{\left(2\varphi(4-3s)-(2-s)\right)^3}\left(1-c+\frac{\alpha^2}{9\beta}\right)^2 > 0 \; if \; \varphi(4-5s) < \frac{2-s}{2}$

[51] $\frac{\partial W_d^*}{\partial s} = \frac{\varphi^2\left(1-c+\frac{\alpha^2}{9\beta}\right)}{\left(2\varphi(4-3s)-(2-s)\right)^3}\left(\left(32\varphi(1-s)\right)\left(\left(1-c+\frac{\alpha^2}{9\beta}\right)\right)+\left(2\varphi(4-3s)-(2-s)\right)\frac{8\alpha^2}{9\beta}\right) > 0$

losses encountered by consumers and advertisers. While the proof of $\partial W_m^*/\partial\varphi < 0$ is given in the footnote, proving $\partial W_d^*/\partial\varphi < 0$ is left to appendix B5[52]. Figure 6 illustrates a situation where a merger is welfare enhancing for low levels of s, whereas high levels of s renders it welfare detrimental[53].

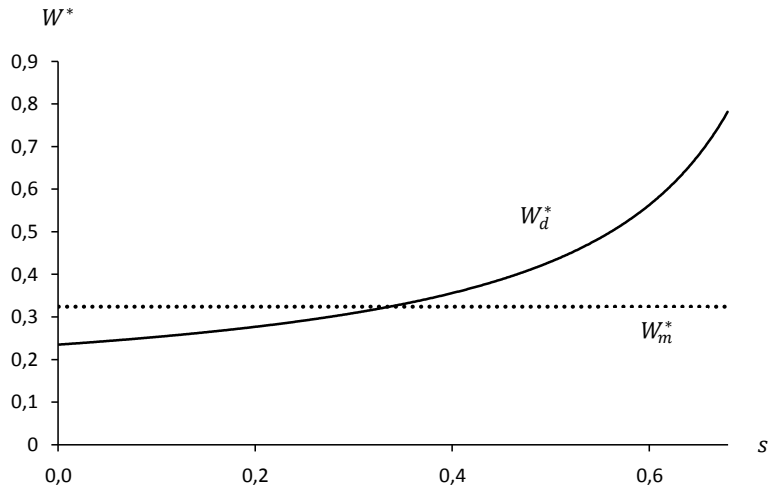


Figure 6 – Aggregate Welfare Level

Figure 6 is, together with the abovementioned welfare properties, consistent with previous finding under Model 1. We are able to conclude that different market structures can benefit society as a whole by making assumptions on parameter values. The welfare conclusions derived under model 1 are thereby not altered when allowing for platforms to invest in quality improvements of content. Furthermore, a merger can only be welfare beneficial if the market is two-sided, and the proof of this is given in appendix B6. While it is, due to the complexity of the welfare conditions, difficult to solve explicitly for when a merger is welfare enhancing we have, in appendix B7, solved for the special case of undifferentiated content.

From this we have:

Proposition 7 *A horizontal merger between platforms choosing quality levels, in addition to content prices and ad levels, can be welfare enhancing if the market is two-sided.*

The key trait of this particular model is that it stresses the importance of considering decision variables other than prices. A horizontal merger in a two-sided media market can, in some

[52] $\frac{\partial W_m^*}{\partial\varphi} = \frac{-\left(1-c+\frac{\alpha^2}{8\beta}\right)}{(4\varphi-1)^3}\left((8\varphi-1)\left(1-c+\frac{\alpha^2}{8\beta}\right)+(4\varphi-1)\frac{\alpha^2}{8\beta}\right) < 0$

[53] Chosen parameter values are $\alpha = 3$, $\beta = 1$, $c = 1.85$ and $\varphi = 0.4$.

cases, be welfare beneficial even if it results in higher equilibrium content- and advertising prices. The intuition is that merged platforms will utilize increased ad revenues by intensifying quality investments. This results in increased consumption, which is rewarding to all market participants. Higher content prices will merely constitute a side-effect of increased willingness to pay for higher-quality products.

5. EXTENSIONS

In this section, we discuss possible limitations of our model and provide suggestions for how the analysis might be enriched and extended in future research. Several assumptions underlie our model, and although making precise predictions of model alterations can be challenging, we will attempt to make conjectures about how relaxing key assumptions might impact our results. Although our model was never meant to capture all aspects of today's enormously complex media markets, we nevertheless provide an intuition for how our model can best be understood in the context of recent media market developments.

Keep in mind that our model is a simple one, designed to illustrate the important realization that conventional anti-trust rationale might not apply to mergers in two-sided markets. We have shown, through a theoretical model, how a merger – even in the absence of efficiency gains – can be welfare enhancing for society as a whole. This is an important result, directly accredited to the two-sided nature of the media industry, underlining that care should be taken by anti-trust authorities when assessing these markets.

Following our theoretical predictions, we would expect a merged media firm to utilize its increased market power by setting a lower level of advertising. The intuition is that a monopolist will internalize the effect a higher advertising level has on advertising prices and profits of the other platform. The merged media firms' monopoly power in the advertising market translates into higher ad prices. In accordance with results from Godes et al. (2009), we find that ad bundling is higher under duopoly than under monopoly, and that the margin which can be made of ads therefore is unequivocally higher in monopoly. This is a key mechanism in our model, giving rise to the result that it might be optimal for the merged platform to reduce content prices, and potentially invest more in quality, relative to firms competing in a duopoly fashion, in order to expand demand and bring more consumers on board. It is this effect that enables a merger to be welfare beneficial.

We emphasize that this result is conditioned on there being no alternative channels for advertisers and no other competing media firms in the model. Two obvious extensions to our model then, would be to account for competition for advertising also from other media types and to accommodate multiple firms. A third possible extension would be to introduce a nuisance parameter. Before discussing each of these extensions in detail, however, we first reflect on how our model best fits with casual observations from today's media markets.

One of the more pronounced developments in media markets over the last decade has been the emergence of a wide range of new media types, such as smart phones, an enormous amount of internet-based solutions – and more recently, the iPad – challenging the traditional media platforms of newspapers, radio-, and television broadcasts. Although most media users today utilize more than one media platform, and media use overall is ever-increasing[54], it is a wide-spread opinion that media firms in general face tougher competition for users and advertisers. A media firm, such as a newspaper, today faces competition for the attention of consumers from other media types while also competing for the marketing budgets of advertisers who typically spread their budgets across different media types. Advertisers today have an array of alternative advertising channels to choose from, which should intuitively increase their bargaining power when dealing with media platforms.

In light of this realization, one can best think of our model as depicting a merger between two media firms within a particular media segment. Regional newspapers or magazines could be such an example. There are conceivably few substitutes for advertising in local newspapers as they often contain unique content, attracting a correspondingly unique subscribing group of consumers. As advertisers in local newspapers and magazines have few – if any – alternate advertising channels, the prediction that the merged media firm can enjoy monopoly power in advertising might not be too far off. Recall also that we assumed advertisers to regard consumers as a homogenous mass, meaning they are not interested in targeted advertising and only care about the relative prices of advertising in the different media outlets. Moreover, by deploying the framework of the representative consumer, we assumed all consumers to have identical preferences. Again, this fits well when applied to the segment level. Within a particular segment, consumers are likely to be very similar and there is little scope for targeted advertising. A local grocery store, for instance, is not likely to care about the segment levels amongst readers of the local newspaper it advertises in, and it has, presumably, few alternate channels for reaching consumers. In this setting, the mechanisms of our model could very much be in play, and the corresponding welfare implications would therefore persist.

5.1 Across-media competition for advertising

In reality however, media firms will often compete for advertising with firms belonging to other media industries. Recall that this was the novelty of Godes et al. (2009). By accounting for across media competition for advertising, we would expect the scope for raising

[54] Norwegian statistics on media use are available at: http://www.ssb.no/english/subjects/07/02/30/medie_en/

advertising revenue to be restricted. Even though a media firm has monopoly power in selling content to consumers, the firm will, in many instances, have its market power in advertising restricted if there are substitutes available to advertisers. In the context of our model, this means that the welfare effects we find are likely to be somewhat mitigated as the monopolist will not be able to increase his advertising revenues to the same extent as when he faces no competition for advertising.

It is not given, however, that advertisers always see different media types as substitutes. Recall that Godes et al. (2009) raised the possibility that different media types might also be considered complements by advertisers, i.e. that the benefit of spreading advertising across different media types is greater than if all ads were run on the same media platform. This seems reasonable in certain scenarios. Most media users today divide their time between different media types and there might be a reinforcing effect of running ads on several platforms[55]. Think back to the case of a monopolist facing competition for advertising from two firms belonging to a different media industry. If it indeed is the case that advertising in different media types are complements, Godes et al. (2009) find that the monopolist will bundle more ads and enjoy higher profits than the two competing media firms in the other media. They also find that lower content prices will be set by the monopolist if advertising complementarity is high. This is because the presence of a second media now works to increase the margin which can be made of ads, further encouraging underpricing of content to generate demand on the consumer side. As all parties – media platforms, advertisers and consumers – will benefit, we can only surmise that a merger in this scenario will strengthen the welfare results from our model.

5.2 Multiple firms

In our paper, we restricted the number of firms to two. When analyzing a merger in a less concentrated media market, where there is more than one independent firm left in the industry post-merger, matters are more complicated as the merged media firm will also compete with other firms from its own media market. Typically, how much advertising will be bundled, and how much advertising revenue can be raised, will in this scenario depend also on the media firm's substitutability with other firms in the same market. This was covered extensively in Kind et al. (2009a). In our model, we would expect an increase in the number of firms to have a similar effect as the introduction of advertising substitutes. There will be tougher

[55] Chang and Thorson (2004) discuss synergies between internet- and television advertising.

competition for advertising and the merged media firm will therefore not be able to increase the margin on the sale of ads to the same extent as before. While a merger could still be welfare enhancing, effects on welfare are likely to be less pronounced.

5.3 The nuisance effect of advertising

In this paper, we chose to disregard the nuisance parameter mainly in order to simplify algebra. We argued, however, that empirical estimates of the nuisance effect of advertising vary greatly amongst different media markets. While demand is often found to be independent of ads in the newspaper market, most empirical estimates of the effect of advertising in television- and radio broadcasts show that consumers generally dislike advertising. While these matters have been covered extensively throughout this paper, we have not yet discussed how the omission of the nuisance parameter in our model might impact results.

In the event that consumers dislike ads, an increase in one firm's ad level will affect the rival firm in two ways. First, just as when there is no nuisance effect, by increasing the amount of advertising, the price of advertising goes down. In addition, however, there is now a second and indirect effect of raising the ad level; because consumers dislike advertising, the media firm that has more ads becomes less attractive – leading some consumers to shift to the other media firm. The indirect effect will therefore lead to increased demand for the other product, a positive externality that a monopolist will take into account. This indicates that the presence of a nuisance effect leads to merged platforms setting higher ad levels. From this we can see that the consumer surplus will be reduced, as the level of advertising increases, whereas advertisers naturally profit from a higher ad level. The overall impact of the merger on welfare, however, is ambiguous.

5.4 A final word on the value of media diversity

Finally, we point to one important consideration in a merger assessment, which is unique to media markets. As we deployed a model in the mold of the representative consumer, we could not analyze how a merger might affect media diversity. The media play an integral role in any democracy as they are pivotal in providing decision-makers and citizens with unbiased, undistorted information. They are important opinion providers and ensure that the public debate is not limited or dominated by one powerful group. The variety of media is therefore in itself of great value to society. In relation to the merger between Schibsted and Media Norge, concerns were raised that local journalism would be threatened, that content would become

more similar, and that there would be an increased focus on revenue generating. While these concerns may very well be warranted, more research is needed in investigating how mergers in media markets affect how media firms choose to differentiate content.

6. EMPIRICS

In this section, we seek to relate our findings to empirical work and recent observations from media markets. As we in this paper analyze the somewhat special case where two duopoly firms merge to form a monopoly, we cannot easily compare our results to specific anti-trust cases and empirical observations. We have not been able to identify a case analogous to the one we discuss in this paper, but we also find that little data is available from merger cases in two-sided markets in general. As reiterated throughout this paper, research on mergers in two-sided markets – of both a theoretical and an empirical nature – is very scarce, and most competition authorities have only recently started to take note. One notable exemption is a working paper by Filistrucchi et al. (2010) which attempts to build a model of merger simulation applied to the Dutch newspaper market. This article will be helpful when we in the following reflect on some of the key characteristics of our model and how they might extend to the more typical merger case.

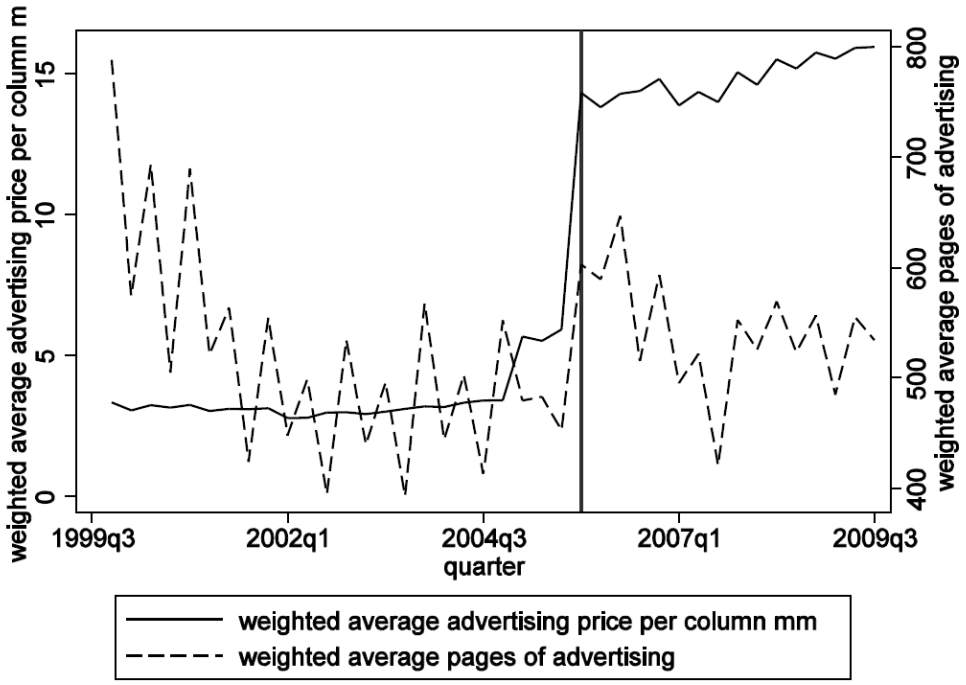
In this working paper, the authors build a structural econometric model of merger effects on content- and advertising prices[56]. The framework is then applied to simulate a hypothetical merger in the Dutch market for newspapers, from which they data for the period 1999-2009. The data set at their disposal is quite unique as a big merger was effectuated in September 2005 – involving 7 regional newspapers – allowing them to study the change in prices pre- and post-merger. Descriptive statistics from the Dutch newspaper market reveal that total amount spent on advertising in daily newspapers actually increased over the study period – an observation reflective of two important features of the advertising market. While several studies have shown that newspapers account for a declining share of the market for advertising, the overall growth of advertising has more than compensated newspapers for the loss associated with some advertisers shifting their focus to other media types[57].

Filistrucchi et al. (2010) allow advertising demand to depend on reader characteristics, such as gender, age and region. Related to previous discussion of the possible nuisance effect of advertising, it is interesting to observe that advertising is found to have no effect on consumer demand. This is in line with most previous estimates of the newspaper market. They also find advertising demand to depend negatively on ad price, and positively on circulation, which fits

[56] For a thorough discussion of their model, we refer to their article which can be found at: http://merlin.fae.ua.es/activities/list/pdf/filistrucchi_klein20101019.pdf

[57] The same pattern is apparent from Norwegian statistics which are available at www.regjeringen.bo/nb/dep/kud/nouer/2010/nou-2010-14/8.html?id=628690

nicely with our model. From total advertisement spending and the total number of column millimeters, the authors obtain the average advertising price per column millimeter. They note that although this is standard procedure, two notable shortcomings come with this way of computing advertising prices. First, as total advertising spending is based on list prices from Nielsen, any discounts which certain advertisers presumably obtain are abstracted from. Second, in general, the actual price paid does not equal the average price. Average advertising prices are deflated by the consumer index and given in 1999 Euros from the third quarter. The following graph shows the development in weighted average price per column millimeter for the merging parties, where weights are proportional to circulation. The merger is marked by the vertical line.



Calculated for group of newspapers merging in 2005q3.

As is clearly evident from the above graph, there was a distinct hike in advertising rates in the immediate aftermath of the merger. Advertising quantities do not behave in the manner predicted as they were expected to decline. Judging from the graph, however, advertising levels appear to fluctuate around the same level as before while advertising prices remain at a higher level in the years after the merger was effectuated. Following predictions from our model, we can surmise that the higher price level of advertising after the merger is due to the merging newspapers strengthening their bargaining position towards advertisers. This gives an indication that our model predictions are present also in the more typical merger scenario

where there are multiple independent firms left in the industry post-merger. We have not been able to identify similar papers addressing mergers in other types of media markets – such as television- and radio markets. Studies related to these markets could provide key insights into the effect of the nuisance of advertising as this will not be a factor in the newspaper market.

We also noted that Filistruchi et al. (2010) build a structural model which they deploy to simulate a hypothetical merger involving 6 of a total of 20 newspapers. In addition to estimating the pricing effects on advertising and content sales, they also derive overall welfare pre- and post-merger. Their results show that, in this particular case, the merged newspapers do not raise content prices as much as they would have if the market was one-sided. This is in line with our model predictions. Furthermore, welfare effects are found to be smaller because of the two-sided nature of the market.

Filistrucchi et al. (2010) emphasize that results may suffer from a number of limitations and should not be taken at face value. In particular, data do not contain newspaper characteristics while demand specifications are found to be insufficiently flexible. They control for fixed effects, but are not able to detect whether characteristics change over time. This is an important aspect when comparing their findings to ours. Recall from our model that welfare can increase even with higher content prices if the merger is accompanied by higher quality investments compensating consumers for lost utility due to the price increase. A change in quality is difficult to capture in an econometric model as developed in this paper, and as such, will not be accounted for in their calculations of welfare. Filistrucchi et al. (2010) is nevertheless an interesting paper as they develop a structural econometric model meant to evaluate mergers in two-sided markets.

7. CONCLUSION

The main purpose of this paper is to investigate whether classic anti-trust rationale with regard to mergers extends to the case of two-sided markets, or whether a merger assessment can – due to the unique nature of such markets – produce results at odds with existing merger theory. We believe this to be a warranted question as it is evident from recent research that two-sided markets, as exemplified by media markets, function in ways not easily reconcilable with common economic intuition. We argue that it is essential for competition authorities to understand the special characteristics of these markets as a failure to do so could lead to policies that decrease society welfare.

Media firms rely on income from two very different, but inextricably linked, customer groups: consumers and advertisers. As a result, their strategic decisions are far more complex than those of firms operating in conventional single-sided industries. More specifically, because media firms can earn an additional margin of their consumers by selling their attention to advertisers, they have an incentive to underprice content in order to stimulate demand. We suspect that such considerations can play a key part in merger assessments involving two-sided media firms.

To address this issue, we develop two theoretical models encapsulating media markets. These models account explicitly for these markets' two-sided nature, allowing us to evaluate the pricing- and welfare implications of mergers between firms initially competing in a duopoly fashion. In order to focus solely on the pure market power effect of the merger, we abstract from the existence of efficiency gains. In accordance with traditional merger theory, such a merger scenario should inevitably be detrimental to prices and overall welfare. In the first of our two models, we keep the quality level fixed. Media firms can thereby only stimulate demand by lowering content prices. In the second model, we endogenize quality investments, allowing media firms to boost demand also by increasing the inherent quality of their product.

It turns out that merged media firms could find it optimal to set lower content prices than if the two were competing in a classic duopoly setting. This seemingly counterintuitive result arises because the two media firms can, by coordinating their efforts, obtain monopoly power in the advertising market which they leverage to generate higher supplementary revenues per consumer. The additional revenue increases a platform's incentive to stimulate demand, which can be achieved by lowering content prices. Our analysis is corroborating recent

findings from Godes et al. (2009) and Leonello (2010) who also find that prices could be lower with increased concentration.

In addition, we perform an explicit welfare analysis of the merger effects. Our findings show that welfare could indeed increase following a merger, a result not in line with conventional merger theory. Reduced content prices lead to higher consumer surplus, while increased consumption benefits advertisers as they reach a bigger audience with each advertisement. This illustrates that a competition-eliminating merger can in fact be beneficial for all market participants, not only the merging parties. We emphasize that this result is given absent efficiency gains, and that potential welfare gains arise specifically due to the two-sided nature of media markets. If there was no market for advertising, and the media market was a regular single-sided one, traditional merger analysis would apply, also to our model.

Finally, we show how a merger can be welfare enhancing, even with higher prices on the consumer side. This result is accredited quality investments, which we find can be higher following a merger. If incentives to invest in quality are higher for the monopolist, consumers can be compensated for the lost utility due to higher prices.

Appendix

Appendix A refers to Model 1 (exogenous quality), while appendix B refers to Model 2 (endogenous quality).

A1) Proof that duopoly prices are falling in s, $\partial p_d^*/\partial s < 0$:

Differentiating equation (1.9) with respect to s gives

$$\frac{\partial p_d}{\partial s} = \frac{-2}{(4-3s)^2}\left(1 - c + \frac{\alpha^2}{9\beta}\right)$$

where the first term is negative. To confirm that the second term is positive we have to impose further restrictions on the parameter values of c, α and β. This can be done by regarding equilibrium consumption level C_d^*. Recall that consumption was constricted to be strictly positive. C_d^* is found by inserting equation (1.9) into equation (1.8).

$$C_d^* = \frac{2-s}{2(4-3s)}\left(1 - c + \frac{\alpha^2}{9\beta}\right)$$

The first term is positive, which implies that consumer demand is strictly positive only if the second term is strictly positive. From this it follows that the second term in $\partial p_d^*/\partial s$ is positive, Q.E.D.

A2) Proof that content prices set by merged platforms in a two-sided market are strictly lower than for the duopoly case if products are sufficiently differentiated, $p_m^* < p_d^*$ if $s \leq s_{cri}$, $s_{cri} \in [0, 1)$:

Consider the minimum case of s_{cri} where products are entirely unrelated in content $(s = 0)$. The difference in content prices $p_m^* - p_d^*$ is then given by

$$p_m^* - p_d^*(s = 0) = -\frac{\alpha^2}{144\beta}$$

which is, conditioned on the existence of the ad market, strictly negative, Q.E.D.

A3) Proof that we cannot infer that duopoly prices are lower than that of merged prices if content is sufficiently substitutable:

To ensure non-negative consumption we impose that

$$1 - c + \frac{\alpha^2}{9\beta} > 0 \quad \rightarrow \quad \frac{\alpha^2}{\beta} > 9(c-1)$$

Content prices for duopoly platforms reach their minimum when products are perfect substitutes ($s \rightarrow 1$). In this case the difference in content prices $p_m^* - p_d^*$ is given by

$$p_m^* - p_d^*(s \rightarrow 1) = \frac{1}{2}\left(1 - c + \frac{7\alpha^2}{72\beta}\right)$$

If parameter values α and β are such that

$$9(c-1) < \frac{\alpha^2}{\beta} < \frac{72}{7}(c-1)$$

the minimum content prices for duopoly platforms will be strictly greater than that for merged platforms. The conditioned can only be satisfied if $c > 1$.

A4) Proof that platform profits are strictly higher under a merger than duopoly, $PS_m^* > PS_d^*$:

Producer surplus in duopoly is decreasing in s and therefore reach a maximum at $s = 0$. In this case the difference in producer surplus is given by

$$PS_m^* - PS_d^*(s = 0) = \frac{\alpha^2}{288\beta}$$

which is strictly positive if the market is two-sided ($\alpha, \beta > 0$), Q.E.D.

A5) Conditions for unrelated content where the level of wealth is greater with merged platforms, $W_m^* > W_d^*(s = 0)$:

$$W_m^* - W_d^*(s = 0) = \frac{\alpha^2}{72\beta}\left(\frac{7\alpha^2}{192\beta} - \left(1 - c + \frac{\alpha^2}{9\beta}\right)\right)$$

Both factors inside the outer parenthesis are non-negative. W_m^* exceeds $W_d^*(s = 0)$ if

$$9(c-1) < \frac{\alpha^2}{\beta} < \frac{576}{43}(c-1)$$

The condition is satisfied for a sufficiently small advertising market and $c > 1$.

A6) Proof that a merger cannot improve welfare if the market is one-sided, $W_m^*(\alpha = 0) \leq W_d^*(\alpha = 0)$:

Welfare levels are, under the condition of a non-existing advertisement market, given by

$$W_d^*(\alpha = 0) = \frac{(2-s)(6-5s)}{2(4-3s)^2}(1-c)^2$$

$$W_m^*(\alpha = 0) = \frac{3}{8}(1-c)^2$$

W_d^* is increasing in s, and thus reaches its minimum in $s = 0$. At its minimum the welfare level in duopoly equals

$$W_d^*(\alpha, s = 0) = \frac{3}{8}(1-c)^2 = W_m^*(\alpha = 0)$$

Welfare level under duopoly competition is therefore always greater than, or equal to, welfare level with merged platforms, if the media market is one-sided, Q.E.D.

B1) Proof that content quality set by merged platforms in a two-sided market strictly exceeds that of duopoly platforms if products are sufficiently differentiated, $q_m^* < q_d^*$ *if* $s \leq s_{cri}$, $s_{cri} \in [0, 1)$*:*

Consider the minimum quality case of s_{cri} where products are completely unrelated $(s = 0)$. The difference in quality levels $q_m^* - q_d^*$ is then given by

$$q_m^* - q_d^*(s = 0) = \frac{\alpha^2}{72\beta(4\varphi - 1)}$$

which is, conditioned on the existence of the ad market, strictly positive, Q.E.D.

B2) Proof that consumers benefit from a merger in a two-sided market if content is sufficiently differentiated, $CS_m^* > CS_d^*$ *if* $s \leq s_{cri}$, $s_{cri} \in [0, 1)$*:*

Consider the case of unrelated content where consumer surplus in duopoly reaches its minimum. In this case, the difference in consumer surplus prices $CS_m^* - CS_d^*$ is given by

$$CS_m^* - CS_d^*(s = 0) = \frac{\alpha^2}{36\beta}\left(\frac{\varphi}{4\varphi - 1}\right)^2$$

which is, conditioned on the existence of the ad market, strictly positive, Q.E.D.

B3) Proof that producer surplus in duopoly is strictly positive, $PS_d^* > 0$*:*

Producer surplus in equilibrium is given by

$$PS_d^* = \frac{\varphi(2-s)\big(8\varphi(1-s)-(2-s)\big)}{\big(2\varphi(4-3s)-(2-s)\big)^2}\left(1-c+\frac{\alpha^2}{9\beta}\right)^2$$

where the last component and the denominator of the first factor is strictly positive. The first two elements of the numerator of the first factor, $\varphi(2-s)$, are also strictly positive. The requirement for strictly positive profits then becomes,

$$8\varphi(1-s)-(2-s) \quad \rightarrow \quad \varphi > \frac{(2-s)}{8(1-s)} = \varphi_{d,cri}^*$$

This condition is satisfied through assumptions made to fulfill all second-order conditions for profit maximization.

B4) Proof that producer surplus is strictly higher under a merger than duopoly competition, $PS_m^* > PS_d^*$:

Producer surplus in duopoly is decreasing in s and therefore reaches its maximum at $s = 0$. In this case the difference in profits between a merged platform and a duopoly one is given by

$$PS_m^* - PS_d^*(s=0) = \frac{\varphi}{4\varphi-1}\left(\left(1-c+\frac{\alpha^2}{9\beta}\right)+\frac{\alpha^2}{144\beta}\right)\frac{\alpha^2}{36\beta}$$

Which is, conditioned on the existence of the ad market, strictly positive, Q.E.D.

B5) Proof that welfare level in duopoly is decreasing in quality investment costs, $\partial W_d^*/\partial\varphi < 0$:

Differentiating equation (2.21) with respect to φ yields

$$\frac{\partial W_d^*}{\partial\varphi} = \frac{-(2-s)^2\left(1-c+\frac{\alpha^2}{9\beta}\right)}{(2\varphi(4-3s)-(2-s))^3}\Bigg((2\varphi(8-7s)-(2-s))\left(1-c+\frac{\alpha^2}{9\beta}\right) + \big(2\varphi(4-3s)-(2-s)\big)\frac{2\alpha^2}{9\beta}\Bigg)$$

$\partial W_d^*/\partial\varphi$ is strictly negative if

$$2\varphi(8-7s)-(2-s) > 0 \rightarrow \varphi > \frac{2-s}{2(8-7s)}$$

By recalling assumptions earlier made on φ we are able to infer that the preceding restriction for φ is in fact satisfied.

$$\varphi > \varphi^*_{d,cri} = \frac{2-s}{8(1-s)} > \frac{2-s}{2(8-7s)} \quad if\ s \in [0,1)$$

B6) Proof that a merger cannot improve welfare if the market is one-sided, $W^*_m(\alpha = 0) \leq W^*_d(\alpha = 0)$:

Equilibrium welfare levels are, under the condition of a non-existing advertisement market, given by

$$W^*_d(\alpha = 0) = \frac{\varphi(2-s)\big(2\varphi(6-5s) - (2-s)\big)}{\big(2\varphi(4-3s) - (2-s)\big)^2}(1-c)^2$$

$$W^*_m(\alpha = 0) = \frac{\varphi(6\varphi - 1)}{(4\varphi - 1)^2}(1-c)^2$$

W^*_d is increasing in s, and thus reaches its minimum in $s = 0$. At its minimum the welfare level in duopoly equals

$$W^*_d(\alpha, s = 0) = \frac{\varphi(6\varphi - 1)}{(4\varphi - 1)^2}(1-c)^2 = W^*_m(\alpha = 0)$$

Welfare level under duopoly competition is therefore weakly greater than welfare level for the merger case if the market is one-sided, Q.E.D.

B7) Conditions for unrelated content where the level of wealth is greater with merged platforms, $W^*_m > W^*_d(s = 0)$*:*

$$W^*_m - W^*_d(s = 0) = \frac{\varphi}{(4\varphi - 1)^2}\left(\left(1 - c + \frac{\alpha^2}{8\beta}\right)\left((6\varphi - 1)\left(1 - c + \frac{\alpha^2}{8\beta}\right) + (4\varphi - 1)\frac{\alpha^2}{8\beta}\right)\right.$$
$$\left. - \left(1 - c + \frac{\alpha^2}{9\beta}\right)\left((6\varphi - 1)\left(1 - c + \frac{\alpha^2}{9\beta}\right) + (4\varphi - 1)\frac{2\alpha^2}{9\beta}\right)\right)$$

The expression will, under the following condition, be strictly positive:

$$\frac{1}{4} < \varphi < \frac{5}{16}\left(\frac{1 - c + \frac{\alpha^2}{12\beta}}{1 - c + \frac{43\alpha^2}{576\beta}}\right)$$

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