An Economic Analysis of Media Markets

Inaugural-Dissertation

zur Erlangung des Grades

Doctor oeconomiae publicae (Dr. oec. publ.)

an der Ludwig-Maximilians-Universität München

2011

vorgelegt von

Tanja Greiner

Referent: Prof. Dr. Andreas Haufler

Korreferent: Prof. Dr. Tobias Kretschmer

Datum der mündlichen Prüfung: 26. Januar 2012

Promotionsabschlussberatung: 8. Februar 2012

Acknowledgements

My first and foremost thanks go to my advisors Andreas Haufler and Tobias Kretschmer for guiding my steps along this academic journey. I owe my deepest gratitude to Andreas Haufler for giving me the opportunity to pursue this dissertation. His outstanding support and continuous encouragement, as well as his helpful comments and suggestions were invaluable to me. This thesis benefited a lot from Tobias Kretschmer's experience and knowledge. He always took the time to give me advice on my research projects and provided me with many valuable comments. I am also very grateful to Monika Schnitzer who kindly agreed to join my thesis committee. I also want to acknowledge Marco Sahm, my co-author of Chapter 3 of this thesis, from whom I learned a lot during our joint project. Special thanks go to my friends and colleagues at the Seminar for Economic Policy and the Munich Graduate School of Economics who made my time as a graduate student a very enjoyable experience.
I am very much indebted to Maximilian von Ehrlich, not only for his helpful proofreading, but for always supporting and encouraging me. Last but not least, I want to thank my parents for their unequivocal support throughout all the years of my studies.

Tanja Greiner
Munich, September 2011

To my parents.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

The economic analysis of media markets has received a lot of attention in recent years, which can be attributed to two main causes: First, political decisions seem to be increasingly influenced by public opinion, with the advent of horse-race journalism[1] in the late 1970s being indicative of this development. The second cause is the growing economic importance of the media and advertising industry. Earlier contributions studied the role of the media for political decisions and democratic societies. The focus then shifted towards analyzing the microeconomics underpinnings of media outlets' behavior and their interactions with the advertising industry, which is also central to this thesis. In the following chapters, this dissertation sheds light on how three major trends have affected the media market, with each of these trends corresponding to one of the chapters: the tabloidization of news contents, the regulation of television advertising, and the rise of online media.

Chapter 2: The effect of entertainment in newspaper and television news coverage

This chapter investigates the economics of *tabloidization*, which defines a trend towards more entertainment and sensationalism in media coverage.[2] Empirical evidence suggests that media outlets' style of coverage shifts towards predominantly entertaining

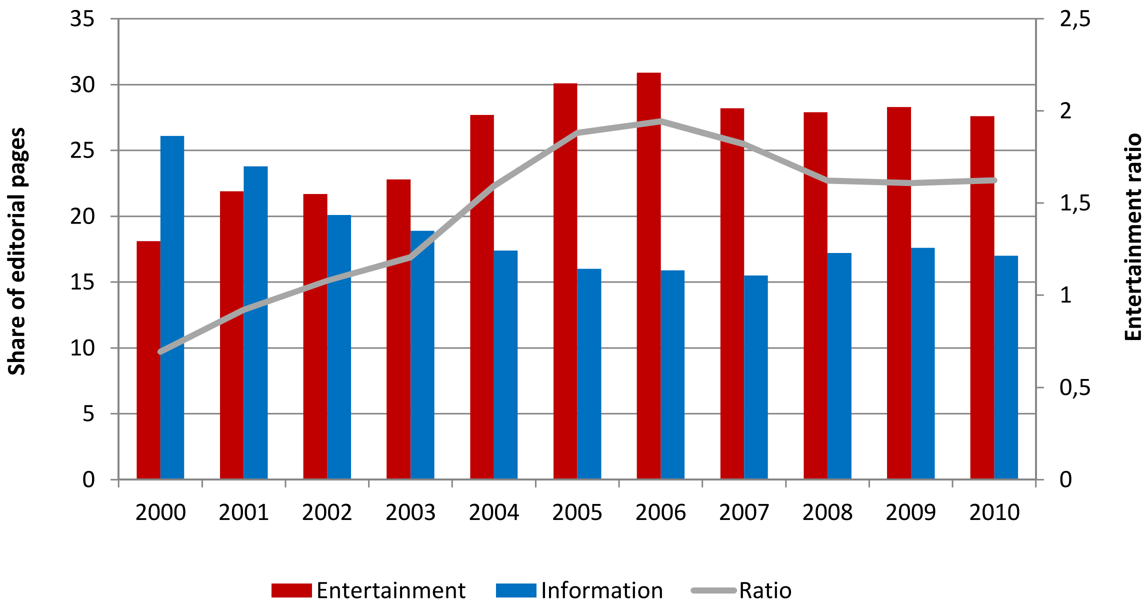
[1]The term *horse-race journalism* refers to news coverage on politicians and politics especially prior to elections that focusses on confrontation and competition.

[2]Tabloidization describes changes to the way of media coverage with respect to the style as well as the contents, and, in most cases, a decline in journalistic standards. Tabloid contents are typically easily recognizable by sensationalism, bold headlines, and unambiguous coverage that cater to the audience's base instincts. For an etymology and a detailed definition see Bird (2008).

contents. The model derived in this chapter looks into the causes of this shift and provides a general framework of two competing media outlets with endogenous choice of the style of news coverage.

Serious and unbiased news had already in the 1960s a reputation for selling worse than light entertainment.[3] This has lead to "hard" news and information being gradually replaced by entertaining "soft" news stories. Figure 1.1 illustrates for the magazine market in the U.S., how the style of media coverage has shifted towards entertainment.

Figure 1.1: Tabloidization in U.S. magazines



Note: This figure illustrates the share of the number of editorial pages in U.S. magazines falling under one of the categories. *Entertainment/Celebrities*, and *Wearing Apparel* is counted as Entertainment, and *National Affairs*, *Business&Industry*, *Foreign Affairs* as well as *Culture/Humanities* is counted as Information. The entertainment ratio is calculated by dividing the share of editorial pages containing entertainment contents by the number of pages containing information. Data source: American Society of Magazine Editors (2011).

[3]William S. Paley, former chief executive of Columbia Broadcasting System (CBS) allegedly told his newsroom staff: "You guys cover the news; I've got [the comedian] Jack Benny to make money for me." (Kalb, 1998, p.10)

The growing popularity of "soft" news and entertainment has been observable since the mid-1970s and affects all kinds of media types, as shown by a content analysis of about 4,000 new stories broadcasted in NBC, CBS, and ABC news, as well as on the covers of the main U.S. news magazines and newspapers from 1977 to 1997 conducted by The Project for Excellence in Journalism. The findings indicate that the share of entertaining stories, categorized under celebrity, gossip, and scandal coverage, relative to the total number of stories rose from 15% to 43% (see Hickey, 1998).
This development is symptomatic of the changes to the media market, although it is not clear what it has been triggered by. This chapter presents two scenarios that lead to media outlets' changing their way of news coverage. The model developed in this chapter explores how two competing media outlets, a newspaper and a television channel, choose their equilibrium amount of entertainment in news coverage in a spatial competition framework. The amount of entertainment (or, more generally, the style of coverage) is a feature of horizontal differentiation between the two outlets, and consumers have heterogeneous preferences with respect to the optimal amount of entertainment. The strategic variables of the media outlets are the amount of entertainment, and the prices they charge to consumers, similar to a traditional spatial competition model à la Hotelling, where firms compete in prices and locations. I account for type-specific differences between the media outlets by assuming different cost functions of content production, as well as for different ways of media financing by analyzing the equilibrium with and without the advertising market. The latter implies extending the framework from a one-sided to a two-sided markets model.

In order to explain shifts in the optimal amount of entertainment as shown for instance in Figure 1.1, I introduce directional constraints to the model which implies that consumers have different costs of choosing a specific platform. The directional constraints can take two forms: First, they can bilaterally shift consumers' distance costs such that accessing the newspaper's platform becomes more expensive, and accessing the broadcaster's platform becomes cheaper, and second, the distance costs to the broadcaster's platform can decrease unilaterally. These two scenarios reflect two of the driving forces behind the trend towards more entertainment: The first type of directional constraints refers to a decrease in consumers' inclination to read, while the second type represents technological progress in audio-visual media which makes the broadcaster's platform more attractive to consumers. I find that a bilateral shift in consumers' distance costs induces both media outlets to incorporate more entertaining elements in news coverage. A unilateral decrease of the distance costs to the broadcaster's platform, however, yields different results. It induces a negative effect on the profits of both media outlets, and increases price competition. As a consequence, the newspaper offers less while the television channel offers more entertainment. Overall, the unilateral decrease in distance costs leads to a marginalization of informational content, as the television channel gains market shares at the expense of the newspaper. This chapter is based on Greiner (2010).

Chapter 3: How effective are advertising bans? – On the demand for quality in two-sided media markets

Chapter 3 deals with the question of how advertising regulation affects television markets. Despite their differences in market size and market structure as well as ownership structure (public vs. private) and way of financing (pay-TV, license fees, or free-to-air broadcasting), the EU countries are subject to the same minimum regulatory framework. The EU Directive *Television without Frontiers*[4] regulates the duration of television advertising in public as well as private channels. By imposing advertising ceilings (i.e. time restrictions), the EU directive pursues the aim of consumer protection, as advertisements need to be readily recognizable, and should not interfere with regular programming.[5] Each member country has the right to impose stricter advertising regulations than those of the *TWF* Directive, which leads to some countries asymmetrically discriminating against public service broadcasters by imposing an advertising ban rather than advertising ceilings as suggested by the EU directive. The rationale behind this regulation seems to be to increase the market share of the public service broadcaster by providing consumers with an ad-free environment. This chapter is devoted to analyzing the impact of an advertising ban on the public service broadcasters in different financing schemes, which allows us to evaluate the effectiveness of this regulatory instrument. Table 1.2 gives an overview on the countries' advertising regulations.

[4]Council Directive 89/552/EEC of 1989, amending act 2007/65/EC of 2007.

[5]For an overview on the EU's audio-visual regulation policies, see European Commission (2011).

Figure 1.2: Advertising regulation in the EU

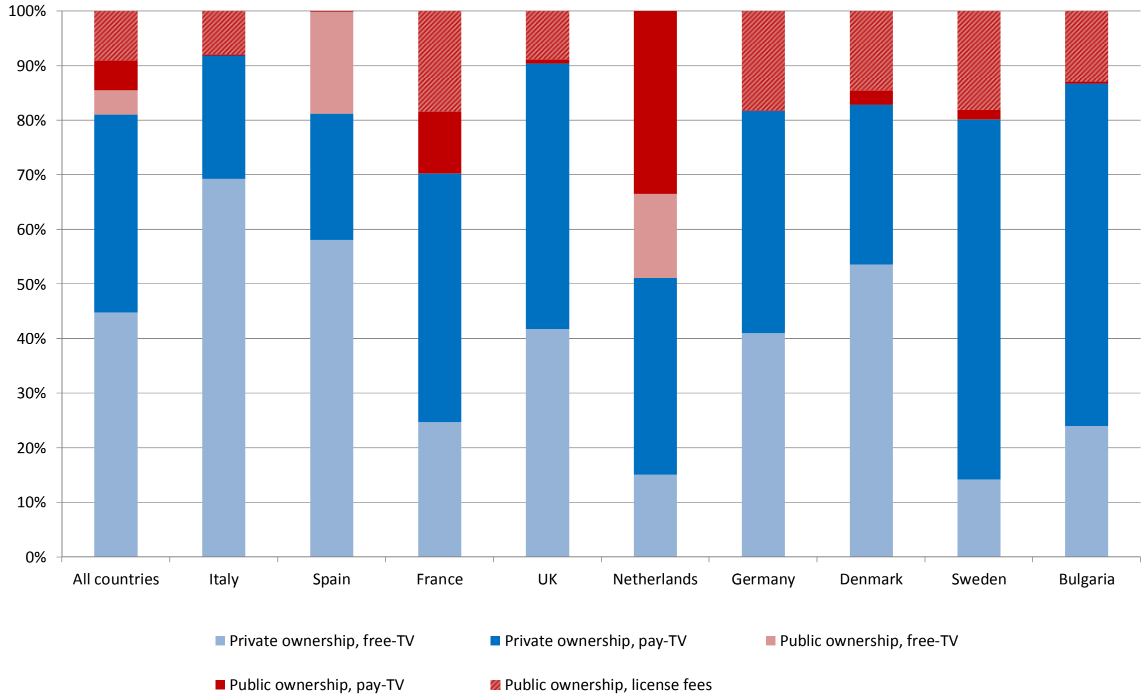
Country	Restrictions apply to	Advertising ceilings
EU	all channels	no more than 12 min/h; but no more than an average of 9 min/h
U.K.	public service broadcasters	no advertising allowed
Germany	public service broadcasters	full ban from 6pm-midnight
France	all channels	no more than an average of 6 min/h
	public service broadcasters	full ban under debate
Netherlands	public service broadcasters	ads may comprise up to 6.5% of daily programming
Sweden	public service broadcasters	no advertising allowed

Note: This overview of advertising regulation in the European Union shows that some countries have even stricter regulations than those imposed by the EU (first line). For additional information, and for advertising regulation outside the EU, see Anderson (2007).

In order to analyze how an advertising ban on the public service broadcasters affects the television markets, differences in the composition of pay-TV, licensing fees and free-TV channels on the respective television markets play an important role (see Figure 1.3 for a comparison of broadcasters' financing structures across EU countries). In some countries like the U.K., France, the Netherlands, Sweden, Germany, and Bulgaria, more than 50% of the available channels are financed through pay-TV or licensing fees, whereas the majority of the channels in the other countries are available free-to-air.[6] The countries with a large number of paid channels seem to coincide with the ones imposing even stricter advertising regulations on their public service broadcasters than required by the EU directive.

[6]For an overview on the distribution of the market shares of the largest television channels in each country, see Figure 3.7 in Chapter 3.

Figure 1.3: Ownership structure and television financing in the EU



Note: The figure contains the aggregate share of all (national and local) television channels that can be accessed in one of the countries, and fall under one of the five categories. Pay-per-View, Video-on-Demand (UK only) and Paid Premium Content is counted as pay-TV. Mixed ownership channels are not included. In all countries but Spain and the Netherlands, public service broadcasters charge consumers with license fees. Data source: MAVISE database, provided by the DG Communication of the European Commission, see European Audiovisual Observatory (2011).

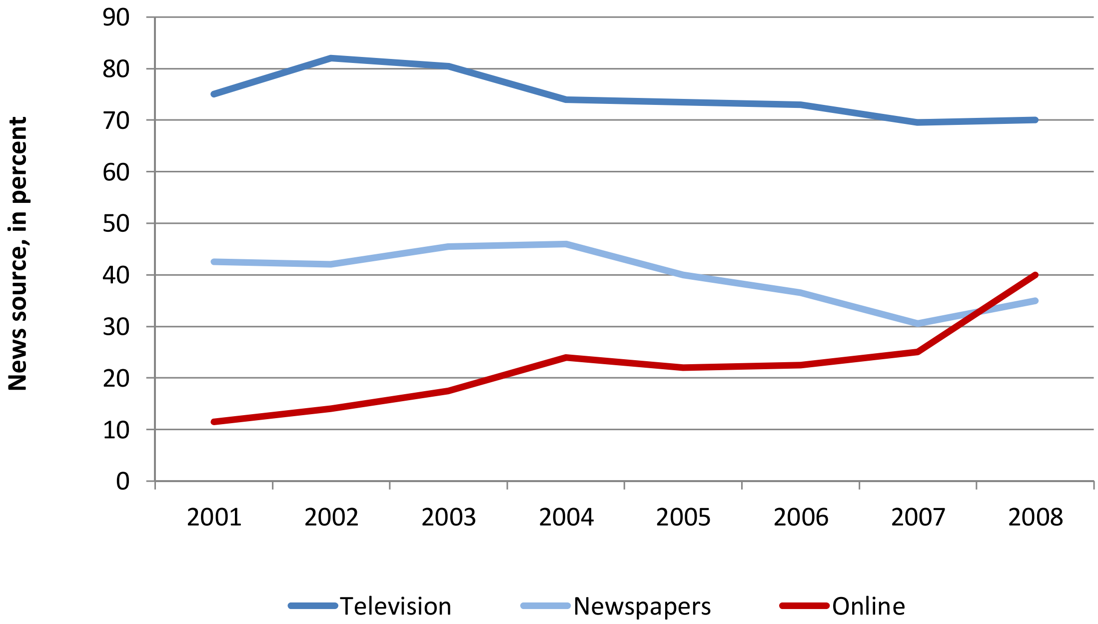
The model developed in Chapter 3 considers a two-sided market of two competing television stations that offer content of differentiated quality to ad-averse consumers and advertising space to firms. The high quality broadcaster corresponds to the public service provider, and may be subject to an advertising ban. As all consumers prefer high over low quality content, competition for viewers is vertical. This setup allows us to capture the effects of an advertising ban in a world in which the ad-free public service broadcaster provides the most appealing mix of no advertisements and high broadcasting quality. Taking into account that advertisers pursue a targeted advertising motive in the sense that their profits increase in reaching the subset of consumers most likely to buy their products, the advertising side of the market is modeled such that media outlets compete for advertisers horizontally. We analyze the impact of the network effects between the consumer and the advertising side of the market, as well as the effects of advertising regulation on the viewers' equilibrium demand for high quality content. The analysis is conducted in a pay-TV as well as in a free-TV regime in order to be able to apply the model to different media markets. In a pay-TV regime, an advertising ban on the high quality medium reduces its viewer market share, although consumers dislike advertisements. This result indicates that an advertising ban in a country with paid public broadcasting may be counterproductive as it lowers the equilibrium reception of high quality contents. This chapter is based on joint work with Marco Sahm (Greiner and Sahm, 2011).

Chapter 4: The role of online platforms for media markets – Multidimensional spatial competition in a two-sided market

Chapter 4 examines the changes to the media markets triggered by the introduction of online platforms. The aim of this chapter is to explain why media outlets offer online platforms although it is uncertain whether or when they will yield a profit. To a certain degree, offline platforms have been substituted by online platforms on both the consumer as well as the advertising market. As the internet penetration and the availability of broadband access spread throughout most industrialized countries, consumers' media consumption habits have changed considerably. The number of individuals going online for news coverage has increased steadily, as has the number of platforms.[7] Apart from traditional media outlets, a growing number of new players are competing for consumers' attention in the online market as for instance webmail platforms, search aggregators, social networking sites, and blogs. Figure 1.4 illustrates where individuals get their news from, and shows for the U.S., that online platforms even attracted more consumers than newspapers in 2008.

[7]See also Figure 4.7 in Section 4.5 for an overview on the time individuals spend on platforms of different type.

Figure 1.4: Main news sources by media type, U.S.

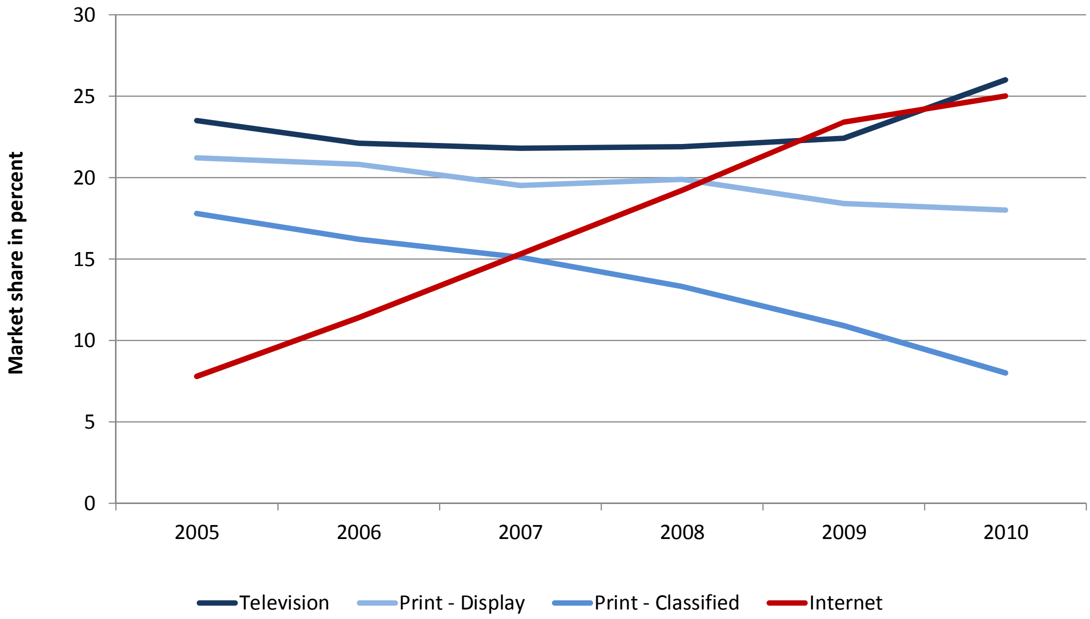


Note: The figure shows the fraction of individuals in the U.S. naming television, newspapers, or online media as one of their two main news sources (Q.13 of the Pew Research Center for the People & the Press's Political and Economic Survey). N=1,489. Annual data are the average of the data collected in the respective year with the wording "How do you get most of your news about national and international issues?". Data source: Pew Research Center for the People & the Press (2008).

Given the exodus of consumers to online news sites, media outlets tried to mark their turf by providing own online platforms. Besides participating in the revenues generated on the consumer side of the online market, media outlets have an additional incentive to go online: The share of the advertising budget allocated to online media has also increased steadily over time[8] See Figure 1.5 for an example of the U.K. advertising market.

[8]It is not only the number of consumers that makes the online market attractive to advertisers, but also the profile of individuals gathering information on the web. Well-educated and wealthy individuals are more likely to access news websites than less educated and low income groups. 27% of the individuals holding a College degree (N=802) and 25% of individuals with an annual income of above USD 75,000 (N=650) have paid for accessing a newspaper or magazine website, or downloaded an article or special report. Data source: Pew Internet & American Life Project (2010).

Figure 1.5: Online advertising expenditures, U.K.



Note: This figure illustrates annual ad expenditures in the U.K., with online ad expenditures denoting the advertising budget that goes into online platforms in general (rather than only to news websites of media outlets). The data is from the annual *IAB online adspend study* carried out by the Internet Advertising Bureau (IAB) in cooperation with Price Waterhouse Coopers. Data source: Factsheets 2005-2010, see Internet Advertising Bureau (2010).

Media outlets seem to interpret the trends on the consumer as well as the advertising market such that it is inevitable to go online in order to remain in the business. Offering their own online platforms enables them to get a share of the cake from the online advertising expenditures, and presumably also from consumers, as there seems to be a positive willingness to pay for online contents.[9] The flip side of the medal is, however, that online platforms also reduce the market share of their offline counterparts, as consumers with a high brand loyalty but a rather low preference for offline media switch to the online platform. This may decrease media outlets' total revenues, if consumer prices are lower in the online than in the offline market, and it will also jeopardize revenues from advertising, as the price per advertising slot typically is a function of the number of ad impressions, i.e. the number of consumers reached by the advertisement.

[9]In 2010, 18% of all individuals taking part in the Pew Internet & American Life Project on U.S online use claimed that they paid for a newspaper website, an online magazine, a journal article or a special report online. N=2,385; data source: Pew Internet & American Life Project (2010).

Evidence from the U.S. advertising market suggests that print advertisements have to certain degree been substituted by online advertisements: In 2003, the advertising industry in the U.S. has spend $45 billion for advertisements in newspapers, compared to $1 billion for advertisements on newspapers' online platforms. The amount spent for online advertisements has tripled until 2010, but ad expenditures for the offline platforms dropped about 50% to $23 billion.[10]
Empirical evidence suggests that entering the online market has - at least for a significant number of media outlets - reduced their profits. In 2004, only 13% of the U.S. broadcasters made profits with their online platforms. While this share increased over time, it still remained at a relatively low level of 31.2% in 2008, where the last data is available.[11] A similar trend is observable in newspaper data. Newspapers went online earlier than broadcasters, presumably due to lower fixed costs of entry. The four major U.S. publishers, Tribune Company[12], New York Times Digital, Knight Ridder, and Belo, reported their online platforms' profits to the public only from 2000 through 2003. Tribune Company, New York Times Digital, and Belo incurred losses of $53, $70, and $46 million in 2000. Three years later, New York Times Digital and Belo were making profits of $20.4 and $15.2 million, while Knight Ridder still had losses of $5.5 million.[13] Although this trend indicates that online platforms may generate profits eventually, the distribution effect of consumers switching to the online platform dims the enthusiasm, as the overall effect on profits may be negative.

In order to address the questions why online platforms may not be profitable, and why media outlets go online despite the mixed evidence on profitability, I introduce a multidimensional spatial competition model in a two-sided market framework. Similar to the two-sided markets section of the model in Chapter 2, media outlets sell contents to consumers and advertising space to advertisers. Consumers have heterogenous preferences with respect to two characteristics of the media platform they intend to choose:

[10] Data source: Newspaper Association of America (2011).

[11] In most cases, the revenues and profits of the online platform are not stated separately in the annual reports, which makes it next to impossible to judge the success of online platforms by the numbers from the outside perspective. The data is based on a RTNDA/Ball State University Survey among all operating, non-satellite television stations (N=890 in 2004, and N=1,241 in 2008). Data source: Pew Project for Excellence in Journalism (2004) for 2004 data, and Radio Television Digital News Association (2009) for 2008 data.

[12] bankruptcy in 2008

[13] Note that the New York Time's profits in the digital market may partly be attributed to their strategy of providing costly access to premium contents, which the other media outlets did not do at the time period under consideration. In 2000 (2003), Knight Ridder (Tribune Company) did not report online profits to the public. Data source: SEC Filings, see Pew Project for Excellence in Journalism (2005).

the style of coverage and the type of medium. On the consumer market, the style of coverage is a feature of horizontal differentiation between the platforms. The type dimension adds an additional dimension of horizontal differentiation to the framework and stands for the way how the platform can be accessed (online or offline). A main insight from adding the additional dimension of product differentiation contradicts an intuition gained from one-dimensional spatial competition models suggesting that firms' profits increase in the degree of product differentiation. In this framework, the entrance to the online market reduces the profits of media outlets although product differentiation is two-dimensional rather than one-dimensional. I can show that the reason for media outlets' entering the online market nevertheless is them being in a prisoner's dilemma situation. This chapter is based on Greiner (2011).

Chapter 2

The effect of entertainment in newspaper and television news coverage

2.1 Introduction

Media use has increased substantially in the past decades. Although individuals devote more of their time budget to media use, traditional media like newspapers have to compete harder for the attention of the consumers as competition has increased both horizontally and vertically: There are more media outlets that offer their services to consumers, and the variety of styles and formats has increased as well.

This chapter investigates how recent structural changes on the media market have affected the style of news coverage: the emergence of new media (e.g. the introduction of commercial television, or pay-per-view technologies in digital television), and a shift in media consumption habits from print to audio-visual media. A variety of studies show that the way how media outlets cover the news is relevant for political outcomes.[1] Anecdotal evidence suggests that media coverage in general became more sensational

[1] A large part of the political economics literature on media markets (Besley and Prat, 2006; Djankov et al., 2003) has focussed on showing that a deviation from neutral (and truthful) media coverage, or over-representation of certain groups or opinions may distort political outcomes. With respect to public spending, Strömberg (2001) and Besley and Burgess (2002) show that groups that are politically important or valuable to advertisers are favored by politicians due to their being over-represented in media coverage or media exposure.

and entertainment-oriented in recent years.[2] The question I intend to investigate in this chapter is whether a shift in consumer preferences towards more entertaining media contents is met by a change in the style of news coverage in television broadcasts *and* newspapers such that news coverage contains more entertaining elements.

The methodological contribution of this chapter is the analysis of directional constraints in a spatial competition framework. Directional constraints describe differences in the per unit distance costs a consumer incurs in a spatial competition model. For instance, moving to a platform located to the left of the consumer's position is more costly than moving to the platform located on the right. I study the strategic interaction of two competing media outlets of different type where consumers incur distance costs when choosing a media platform that does not exactly meet their preferred style of news coverage. Exogenous shocks affecting media consumption habits can alter the distance costs of consumers and result in directional constraints such that the costs per unit of distance are no longer equal for the two platforms. In an extension, I introduce a two-sided market in order to analyze how this affects the benchmark model's outcomes. Discussing the model in a media economics context is the most natural application. However, one could think of a variety of other directional constraints in one-sided spatial competition, as well as in a two-sided markets framework (although there are less examples for the latter). There are two different kinds of directional constraints: (i) a shift in consumer preferences such that distance costs to one platform (the one containing more entertaining elements) fall while the costs to the other platform increase by an equal absolute amount, and (ii) a unilateral fall in the distance costs to one platform (the entertainment abundant) that decreases the average distance costs. Although in both cases, consumers' costs of accessing the platform of one type of media outlet have decreased, the scenarios yield qualitatively different results. In Scenario (i), the platform with the higher distance costs chooses a location closer to the center of the distribution compared to the situation before the shock, and sets a lower price. It serves the smaller part of the market and has lower profits. The competitor moves towards the margin of the distribution and sets a higher price which leads to higher profits. For the style of coverage, this implies that news coverage in television

[2] A popular saying among journalists reads: "if it bleeds, it leads", which implies that a piece of news has to be sensational in order to become a lead article or broadcast, as neutral information is uninteresting to most consumers. Oestgaard (1965) and Galtung and Ruge (1965) from the Norwegian Peace Research Institute in Oslo were the first to analyze how a selection bias in news coverage can arise. They identified a set of 15 characteristics that increase the probability of a piece of news to be published. Some of these characteristics are also typical traits of entertainment in news coverage, as for instance simplification, sensationalism, unambiguity, negativity, and personalization. A similar argument is made in psychology studies, like in the one of Baumeister et al. (2001), who show why individuals are more interested in negative than in positive information.

as well as in newspapers becomes more entertaining. In Scenario (ii), however, product differentiation increases compared to the situation before the shock which leads to a content-wise specialization of media platforms, as both platforms move towards the margins of the distribution. Price competition increases, which leads to declining profits of both media outlets. In this situation, only the television channel shifts towards more entertainment whereas news coverage in newspapers becomes more neutral and informative.

This chapter consists of two parts, with Section 2.2 analyzing the question of how media platforms evolve in a one-sided market without advertising, and Section 2.3 extending the benchmark model to a two-sided market. Each of these two main sections is structured as follows: First, the setup and the symmetric case are briefly discussed (Sections 2.2.1 and 2.3.1). Then I consider two asymmetric cases that arise due to exogenous shocks: a bilateral shift in the distance costs of consumers (Sections 2.2.2 and 2.3.2), and a unilateral decrease of the distance costs to one of the two platforms (Sections 2.2.3 and 2.3.3). Section 2.4 concludes.

Related literature

The model developed in this chapter is at the interface between the literature on media bias and the literature on spatial competition and two-sided markets.

As for the former strand of literature, Mullainathan and Shleifer (2005) as well as Gentzkow and Shapiro (2006) show how slant in coverage arises by explicitly modeling the emergence of media bias. There are two ways of media bias influencing public opinion: One way is to slant news in a certain direction as shown by Della Vigna and Kaplan (2007), and another way is to create a selection bias by covering only a special kind of news (for instance news in favor of a certain political party) as in the work of George and Waldfogel (2006). I consider the possibility that media outlets deviate from neutral coverage not for political or ideological reasons but rather out of a simple profit-maximizing rationale.

The framework used in this model dates back to the seminal work by Hotelling (1929) who analyzes spatial competition between two firms that are differentiated in a horizontal dimension (their location). He describes a two stage game, where both a location and a pricing decision are made. In this chapter, I interpret the location of firms not in the spatial dimension but as the *style of news coverage*. I adapt the sequence of the standard price-location game by letting both media outlets choose the optimal style of

news coverage in the first stage of the game, and prices in the second stage.
Various authors have modified the Hotelling framework in order to generalize the assumptions. D'Aspremont et al. (1979) find that the linear cost function Hotelling was using does not necessarily yield a solution in the pricing subgame, and introduces a quadratic cost function. This opened up many possibilities to extend the framework for instance by introducing more firms (Anderson et al., 1995; Economides, 1993), vertical instead of horizontal product differentiation (Mussa and Rosen, 1986), or a non-uniform distribution of consumers over the characteristics space (Tabuchi and Thisse, 1995). Anderson et al. (1997) show that deviating from the standard assumption of consumers being uniformly distributed over the characteristics space by considering more flexible (yet symmetric) distributions does not alter the results qualitatively.
The two-sided markets part of the chapter primarily builds on Anderson and Coate (2005) and Armstrong (2006) who analyze two competing platforms in a two-sided market with content being exogenously given. In this model, however, the decision on contents (the location stage of the game) is endogenous. The pricing decision of media outlets is often modeled such that only print platforms set positive prices, and television channels offer their services free-to-air. However, recent contributions analyze equilibria in pay-per-view regimes in which accessing television broadcasts is costly for consumers, which is motivated by the fact that analogue free-to-air television is being replaced by digital television, direct broadcast satellites, or cable services. In the following, television channels directly set prices as in the models by Gabszewicz et al. (2006) and Ambrus and Reisinger (2006). Alternatively, prices can be set by cable providers who act as distributers as in Kind et al. (2010).[3] For a comparison of free-to-air and pay-per-view regimes, see Peitz and Valletti (2008).
Contributions on directional constraints in spatial competition focused exclusively on one-sided market frameworks.[4] The larger part of the literature deals with firms having asymmetric transportation costs rather than allowing for asymmetric consumer distance costs (see for instance Lai, 2001; Matsumura and Matsushima, 2010; Sun, 2010; Colombo, 2011). This literature is based on the study of asymmetric transporta-

[3] Kind et al. (2010) argue, however, that online technologies allow consumers to bypass the cable provider, which implies that television stations again are the ones to set consumer prices as in this model.

[4] Note that directional constraints can either be direction-specific (for instance if the locations on the Hotelling line are interpreted as certain points in time before which consumption is not possible), or they can be platform-specific as in the model studied in this chapter (the distance costs hinge on the characteristics of the platforms). These interpretations differ such that, in the first case, moving for instance in the left direction causes the same costs irrespective of the platform the consumer moves towards, and in the second case, moving to the left causes different costs subject to the platform that is located there.

tion costs originally proposed by Launhardt (1885), who assumes that firms differ in their exogenously given locations, as well as in their costs of delivering their products to the consumers.[5] One of the first contributions that analyze directional constraints in consumers' distance costs is by Cancian et al. (1995) who discuss the optimal time of television news scheduling of two competing broadcasters. They show that there exists no equilibrium in pure strategies, if consumers can only watch news after a certain point in time (i.e. it is impossible to move in one of the two directions on the Hotelling line).

The Cancian et al. (1995) framework is extended by a number of contribution: Nilssen (1997) analyzes the effect of asymmetric distance costs on equilibrium locations in a setup where firms can locate without any costs anywhere on the unit interval, and Nilssen and Sorgard (1998) set up a sequential game. Gabszewicz et al. (2008) show that there exists an equilibrium in mixed strategies if broadcasters can randomly attract a fraction of consumers who are not directionally constrained. If consumers have heterogeneous preferences with respect to an additional horizontal product characteristic, as in Gabszewicz et al. (2010) and Barros (2008), there exist equilibria in pure and in mixed strategies.

In this model, the directional constraints are such that consumers can move in *both* directions on the Hotelling line (unlike in the Cancian et al., 1995; Nilssen and Sorgard, 1998; Gabszewicz et al., 2008, 2010; Barros, 2008, models where moving in one direction is prohibitively costly), but incur different per unit distance costs subject to the direction they choose. For media outlets, the location choice is costly if they deviate from their point of origin.

2.2 Competition in a one-sided market

Two media outlets - a newspaper, indexed by N, and a broadcaster, indexed by T - compete by selling news coverage of different style in the form of newspapers or television broadcasts to a continuum of η consumers. The style of news coverage of a media outlet is determined by the share of entertaining contributions relative to the

[5] See Dos Santos Ferreira and Thisse (1996) for an extensions of the Launhardt (1885) model in a vertical and horizontal competition framework.

total number of contributions as in Gabszewicz et al. (2004).[6] Any style of coverage from full information to full entertainment is feasible.

The game is modeled in three stages, where the style of news coverage is chosen in the first stage, and Bertrand competition for prices takes place in the second stage. In the third stage, consumers simultaneously choose their preferred media platform.

Media outlets

Media outlet $i \in N, T$ offers a platform of style θ_i, and maximize profits, given by

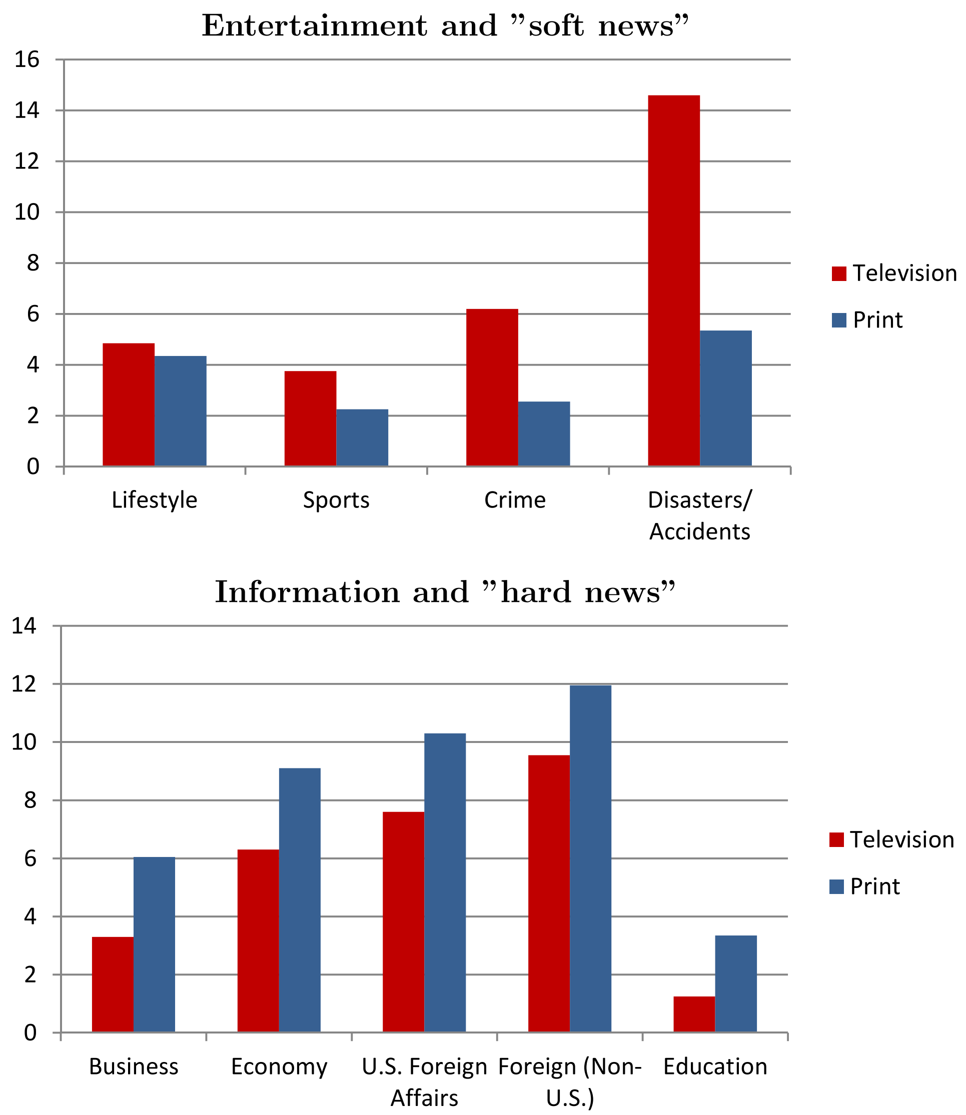
$$\Pi_i = D_i p_i - C\left(\theta_i\right), \tag{1}$$

where D_i stands for the number of consumers choosing platform i at price p_i. The costs of generating contents depend on the style of news coverage, $\theta_i \in [0, 1]$, and are denoted by $C\left(\theta_i\right)$. Both media outlets choose their style of coverage, e.g. whether they want to present news in a rather neutral or in an entertaining way, with $\theta_i = 0$ indicating completely neutral coverage without any entertaining elements, and $\theta_i = 1$ standing for the maximum amount of entertainment. I assume that $\theta_T > \theta_N$, which implies that the style of coverage is such that television broadcasts always contain more entertaining elements than a newspaper.[7] Figure 2.1 depicts the share of entertaining news topics subject to media types and illustrates that television channels systematically cover more stories that fall under one of the "entertainment" categories than newspapers, and newspapers are more active in the "information" categories. This supports the assumption of $\theta_T > \theta_N$.

[6]For simplicity, visual and emotional coverage is subsumed under the term "entertainment". This refers to a large body of literature discussing the shift from informational to entertaining contents, which treats entertainment and information as being mutually exclusive. See Graber (1988) for a comprehensive list of formal differences between informational and entertaining news contents.

[7]The fact that news coverage in television is more entertaining than in print media is well documented in the literature. See for instance Neuman et al. (1992) and Graber (1990) for a comprehensive overview.

Figure 2.1: Topics in news coverage, 2010



Note: This figure is based on the PEJ's News Coverage Index and illustrates the topics covered in the news in U.S. media in 2010 that fall under one of the categories. The data is based on a content analysis of 52,613 news stories in daily news media. Each column expresses the average share of news stories of a certain category relative to the total number of news stories covered in this media type. Television data (red columns) includes Network TV News (morning and evening) with a total reach of about 43.5 million viewers per day. Newspaper data (blue columns) consist of a representative sample of large papers (circulation over 650,000 readers per day) and medium papers (circulation of 100,000 to 650,000 readers per day). Data source: Pew Project for Excellence in Journalism (2011a).

The assumption of different media types being ex ante specialized in their style of coverage is reflected in the cost function. The variable costs do not depend on the sold copies but only on the style of news coverage. The cost function is discussed in detail below and can be interpreted as adjustment costs of choosing a type of coverage the media platforms are not specialized in.[8] Marginal costs of reaching one additional consumer are assumed to be zero for both broadcaster and newspaper, as the costs for paper and ink (newspaper) are negligible, and an additional viewer does not cause the broadcaster any costs. Furthermore, there are fixed costs for staff and facilities (which are for simplicity assumed to be equal across media types). The cost functions take the form of $C(\theta_N) = c\theta_N^2 + F$, and $C(\theta_T) = c(1-\theta_T)^2 + F$, with $c \geq 1$, and F denoting the fixed costs. The variable costs for the newspaper are zero, if $\theta_N = 0$, and the broadcaster has no variable costs of content production, if $\theta_T = 1$.[9] The asymmetric cost functions are due to the fact that newspapers and television stations are media outlets of different types. Newspapers are a type of medium specialized in transmitting information, and have a set of journalists and experts they are working with as well as subscriptions to the services of a number of news agencies. Publishing informational content typically requires no on-site material other than footage provided by news agencies. If news articles have to be made more entertaining, for instance by including visual elements, journalists have to be sent on site in order to take exclusive pictures, or pictures have to be bought from news agencies. These costs are captured by the adjustment costs. Television stations, on the contrary, have a clear focus on entertainment as they broadcast films, TV shows, sports events, or games shows in the majority of their air time. If they have to focus more on information in news coverage, they have to hire additional staff and expert people, or subscribe to the services of additional news agencies, which represents their adjustment costs.

Consumers

The consumer market is structured such that there is a mass of $\eta = 1$ consumers. Consumers differ in their preferred style of coverage and are uniformly distributed on the unit interval of the Hotelling line. I assume that individuals consume news only once in a given time period, which implies that consumers single-home, i.e.

[8] The adjustment costs correspond to the relocation costs in a traditional spatial competition framework where firms have their plant at a certain location and the shops where they sell their goods to consumers at a different location.

[9] This can be interpreted as newspapers providing only informational content, and television station providing only entertaining broadcasts before the styles of coverage are being chosen.

they choose precisely one platform. Furthermore, the assumption of single-homing consumers circumvents the distortions on the advertising market that would arise in a two-sided markets model, if both sides of the market chose to multi-home.[10] In order to provide equal grounds for the comparison to the two-sided markets model in Section 2.3, consumers are assumed to single-home in the one-sided market model in this section as well.

The utility of a representative consumer n consuming medium i is defined as follows:

$$U_i^n = \bar{u} - k_i \left|\theta^n - \theta_i\right| - p_i \qquad \forall\, n, i \tag{2}$$

where $\bar{u}$ denotes the reservation utility of being informed about recent events, which is reduced by the price of the medium p_i, and by the distance between the style of news coverage θ_i of medium i, and the preferred style of news coverage θ^n of consumer n, multiplied by the medium-specific distance cost parameter k_i. The parameter $k_i \in (0, 1]$ indicates that the cost of deviation per unit of distance may vary between the media types. As $k \in (0, 1]$, the distance costs to the platform of one media outlet can be interpreted as a fraction of the costs to the competitor's platform. The higher k, the larger the disutility consumers incur from not obtaining their preferred style of coverage. For instance, the cost of the deviation from the preferred style of news coverage of an individual with a small θ^n can be interpreted as the cost of figuring out the objective pieces of news while non-objective news that might be appealing to entertainment oriented individuals is nothing but nuisance to him. On the contrary, an individual with a high θ^n finds it costly to endure lengthy and detailed explanations instead of having a gripping headline associated with illustrative footage. These distance costs are the equivalent to the transportation costs in the standard Hotelling setting.

[10] One of the limitations of two-sided spatial competition models is that it is not possible to obtain plausible equilibria, if both sides of the market are multi-homing. See for instance Armstrong (2006) for a general model of two-sided markets where agents of one side of the market are single-homing and the other agents are multi-homing. He shows that this competitive bottleneck (i.e. media platforms are monopolists for multi-homing advertisers when it comes to reaching single-homing consumers) leads to higher prices on the multi-homing side. In the case of multi-homing consumers, it would be rational for advertisers to place exactly one advertisement (i.e. to single-home), since being exposed to an advertisement more than once does not increase consumers' likelihood to buy the advertised good. As multi-homing is allowed for on the advertising market in my model, the consumer market must be structured such that consumers single-home, as in the seminal papers by Anderson and Coate (2005) or Gabszewicz et al. (2001).

2.2.1 Symmetric model

In the third stage of the game, consumers decide which platform to choose. The pivotal consumer, indexed by ^{piv}, is indifferent, if the utility from reading the newspaper equals the utility from watching news on television:

$$\begin{aligned} U_N^{piv} &= U_T^{piv} \\ &\Leftrightarrow \; p_T - p_N = k_N(\theta^{piv} - \theta_N) - k_T\left(\theta_T - \theta^{piv}\right) \end{aligned} \tag{3}$$

Since each consumer chooses exactly one platform, all consumers with a preferred style of news coverage θ^n below the preferred style θ^{piv} of the pivotal consumer choose the newspaper while all consumers with θ^n above θ^{piv} choose the broadcasted news. Solving this equation for θ^{piv} yields the following demands:

$$\begin{aligned} \theta^{piv} &= D_N(p_N, p_T) = \frac{k_N\theta_N + k_T\theta_T - p_N + p_T}{k_N + k_T} \\ 1 - \theta^{piv} &= D_T(p_N, p_T) = \frac{(1-\theta_N)k_N + (1-\theta_T)k_T + p_N - p_T}{k_N + k_T}. \end{aligned} \tag{4}$$

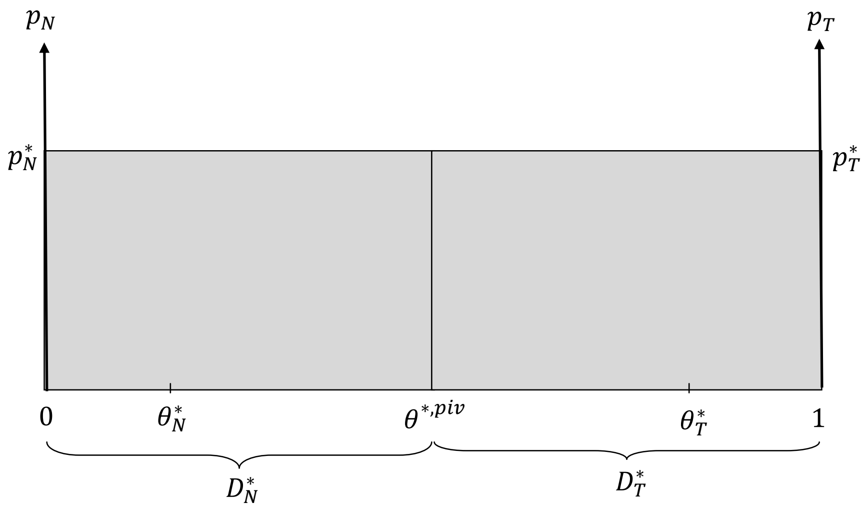
In the symmetric case, consumers have equal per unit distance costs when choosing either of the media, which implies $k_N = k_T = k$, with $k \in (0, 1]$.
In the second stage, both media outlets simultaneously maximize profits (Eq. 1) with respect to their respective prices, which yields the equilibrium prices as functions of θ_i. In order to solve the first stage of the game, this result is plugged again into (1) and maximized with respect to θ_i. Substituting the optimal θ_i into the reaction functions of the prices from the second stage of the game, and into (4) and (1) yields the following equilibrium, with * indicating the symmetric model:[11]

$$\begin{aligned} p_N^* &= p_T^* = k, & D_N^* &= D_T^* = \frac{1}{2}, \\ \theta_N^* &= \frac{k}{6c}, & \theta_T^* &= 1 - \frac{k}{6c}, \\ \Pi_N^* &= \Pi_T^* = \frac{k}{2} - \frac{1}{c}\left(\frac{k}{6}\right)^2 - F. \end{aligned} \tag{5}$$

[11]See Section A1 of the Appendix for a formal derivation of the equilibrium.

Both media outlets set the same price and share the market equally. The style of news coverage is chosen such that the amount of entertainment in the newspaper is relatively small whereas the amount of entertainment in television is large with the deviations from the extreme points being equal for both media outlets. The following figure illustrates the equilibrium outcome of the symmetric model.

Figure 2.2: Equilibrium of symmetric model, one-sided market



Note: This figure illustrates market shares, prices, and style of coverage of the two media outlets in the symmetric model in a one-sided market. The vertical axes illustrate the prices of the two media outlets, and their respective style of coverage is given by their location on the horizontal line of unit length.

As depicted in Figure 2.2, equilibrium styles of coverage are such that firms locate close to their point of origin at the respective endpoints of the distribution.[12] This implies that, contrary to the standard Hotelling model with linear transportation costs, devi-

[12] $\theta_N \leq 1/6$, and $\theta_N \geq 5/6$, as $0 < k \leq 1$, and $c \geq 1$.

ating by moving towards the center of the distribution does not yield higher profits.[13] The reason is that, in contrast to the traditional Hotelling model, the media outlets incur disproportionately increasing costs from relocating (convexity of cost function).

Proposition 1 *If consumers' distance costs become larger (k increases), and* $k \in (0, 1]$ *as well as* $c \geq 1$*,*

- *prices and profits of both media outlets increase.*
- *product differentiation in the style dimension decreases.*

If media outlets' adjustment costs become larger (c increases),

- *the profits of both media outlets increase.*
- *product differentiation in the style dimension increases.*

Proof. See Section A3 of the Appendix. ■

Dropping the assumptions of $c \geq 1$ and $k \in (0, 1]$ yields the following results: The effect of an increase of k on profits is positive, as long as $k < 9c$. Note that there only exists an interior solution as long as $k < 3c$. Therefore, given that an interior solution exists, the effect of an increase of k on profits is positive.

The effects of an increase in k is standard to spatial competition models: As k increases, obtaining the right style of coverage becomes relatively more important for consumers' choice than low prices, which allows both media outlets to charge higher prices. Both media outlets have an incentive to move towards the center of the distribution in order to increase their market share, which raises their adjustment costs. As the price increase dominates the cost increase, profits are higher. As the adjustment costs c of media outlets increase (i.e. moving towards the center of the distribution becomes more costly), the marginal costs of a one-unit increase in θ_i increases whereas the marginal gain remains the same. Hence, firms will locate closer to the margins of the distribution. As the decrease in relocations costs of firms due to moving to the margins is larger than the increase in c, profits increase.

[13] Non-existence of an equilibrium as in the original Hotelling model with linear utility in the characteristics space is not a problem in this model, since firms locate sufficiently close to the margins of the distribution, as moving towards the center is costly. Hence, choosing the location of the competitor and serving the entire market decreases the profits, and the equilibrium is stable. See the proof in Section A2 of the Appendix.

In the following sections, I analyze how the equilibrium varies when allowing for asymmetric consumer distance costs. Asymmetric distance costs imply that the costs of a unit of distance are systematically more expensive for consumers when moving in one or the other direction. Intuitively, one would expect lower consumer distance costs to one of the two platforms to be beneficial for the owner of this platform as it should result in higher profits. In the following sections, I explore why this is not necessarily the case.

2.2.2 Bilateral shift in distance costs

I analyze the changes induced by a shift in consumer preferences such that the distance cost parameter of the broadcaster k_T decreases by the amount e, with $k_T = k - e$, and $0 < e < k$. The distance cost parameter of the newspaper increases by the same amount, which yields $k_N = k + e$. Thus, the average distance costs remain the same as in the symmetric model.

One could for instance imagine that such a shift in consumer preferences is triggered by a decreasing inclination to read, which is met by an increased preference for watching television in general. This is supported by a number of empirical studies. Television is the most preferred medium for 70% of the 1,489 participants in the Pew Research Center's study on U.S. media use, while only 35% of the surveyed people name newspapers are their primary choice (Pew Research Center for the People & the Press, 2008).[14] The Audit Bureau of Circulation finds that, in 2009, the newspaper circulation in the U.S. has hit its lowest level in seven decades, which equals a loss of roughly 10 million readers since 1940.[15] In European countries, one can observe a similar development: In Germany, for instance, the number of individuals claiming to read a news magazine on a daily basis dropped by 20 percentage points from 1980 to today (Schneller, 2008).[16] In contrast to the decline in print media use, the share of individuals who watch television more than three hours a day rose by 30 percentage points since 1976

[14] See also Figure 1.4 in Chapter 1.

[15] The data is based on a study on paid newspaper consumption among 379 of the largest American newspapers. In 2009, 30.4 million newspapers were sold, compared to 41.1 million in 1940 (Ahrens, 2009).

[16] The report summarizes the findings of the Allensbacher Markt- und Werbeträgeranalysen of the following years: 1987, 1995, 2000, 2008. Magazine data is based on a representative sample of individuals older than 14 years, in the Federal Republic of Germany, and the circulation rates of the news magazines *Focus*, *Der Spiegel*, *Stern*, and *Time* (in 2000).

to roughly one half of the total population (Schneller, 2008).[17] This evidence indicates that there might be a shift in consumer preferences such that audiovisual media become increasingly popular, and the popularity of print media decreases. In the following, I analyze how this affects the style of news coverage as well as the prices and profits of both media outlets.

The solution of the game follows the same logic as described in Section 2.2.1: In the second stage, both media outlets maximize the profit function (1) with respect to prices. These reaction functions are again plugged into the profit function, which is maximized with respect to the equilibrium style of news coverage in the first stage. This yields

$$\begin{aligned} \tilde{\theta}_N &= \frac{e+k}{6c}\left[1-\frac{e(3c-2k)}{\tilde{\chi}}\right], \\ \tilde{\theta}_T &= \frac{1}{2}-\frac{k}{6c}+\frac{3c(9ak-k^2+2ek)+e(k^2-2ek-e^2)}{6c\tilde{\chi}}, \end{aligned} \tag{6}$$

with $\tilde{\chi} \equiv (9ak-k^2-e^2)$ and tilde variables $\tilde{}$ denoting the shift in preferences. Accordingly, the full equilibrium is characterized as follows:[18]

$$\begin{aligned} &\tilde{p}_N = k\left[1-\frac{e(3c-2k)}{\tilde{\chi}}\right], \qquad \tilde{p}_T = k\left[1+\frac{e(3c-2k)}{\tilde{\chi}}\right], \\ &\tilde{D}_N = \frac{1}{2}-\frac{e(3c-2k)}{2\tilde{\chi}}, \qquad \tilde{D}_T = \frac{1}{2}+\frac{e(3c-2k)}{2\tilde{\chi}}, \\ &\tilde{\Pi}_N = \left[1-\frac{e(3c-2k)}{\tilde{\chi}}\right]\left[\frac{k}{2}-\frac{1}{c}\left(\frac{k}{6}\right)^2-\frac{e(2k+e)}{36a}\right]-F, \\ &\tilde{\Pi}_T = \left[1+\frac{e(3c-2k)}{\tilde{\chi}}\right]\left[\frac{k}{2}-\frac{1}{c}\left(\frac{k}{6}\right)^2+\frac{e(2k-e)}{36c}\right]-F \end{aligned} \tag{7}$$

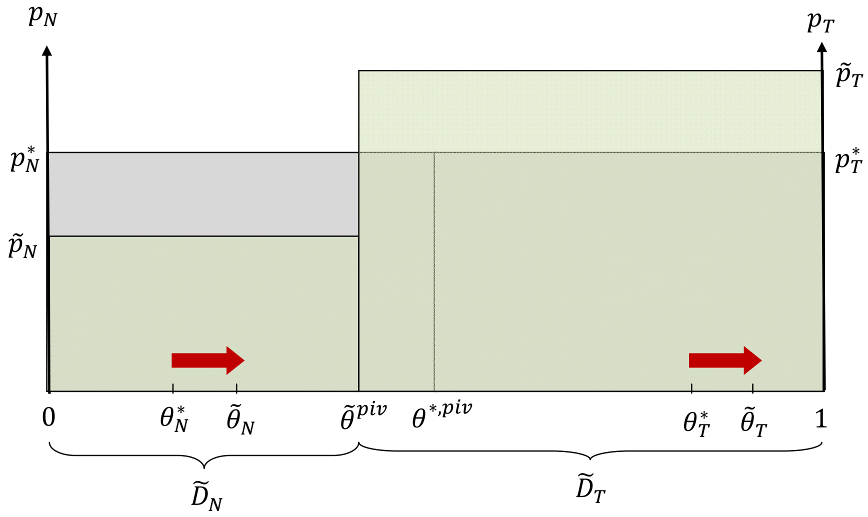
In equilibrium, the broadcaster charges higher prices than the newspaper and serves the larger part of the market which leads to higher profits. Although the profits of the broadcaster are higher than in the symmetric case, aggregate profits are lower, as the newspaper's profits decrease. Figure 2.3 compares the symmetric equilibrium to the

[17] according to survey data from the Allensbacher Markt- und Werbeträgeranalysen, IfD-Umfrage 3037, among individuals in the Federal Republic of Germany older than 14 years (older than 16 years for 1976 data).

[18] The formal derivation is analogous to the one in Section A1 of the Appendix.

equilibrium after introducing asymmetric distance costs.

Figure 2.3: Equilibrium with bilateral shift in consumer preferences, one-sided market



Note: This figure illustrates market shares, prices, and style of coverage of the two media outlets in the model with a bilateral shift in consumers' distance costs where $k_N = k+e$ and $k_T = k-e$ compared to the symmetric model where $k_N = k_T = k$ in a one-sided market. The vertical axes illustrate the prices of the two media outlets, and their respective style of coverage is given by their location on the horizontal line of unit length.

The effects of an increase in the size of the shock

An increase in e implies that the difference between the distance costs becomes larger such that accessing the newspaper becomes ceteris paribus more expensive for consumers while accessing the television broadcast becomes cheaper.

Proposition 2 *An increase in e yields the following effects in equilibrium:*

1. *Both platforms raise their level of entertainment.*
2. *The broadcaster sets higher prices, and increases its market share, which leads to an increase in profits.*

3. *The newspaper lowers its price, and market shares fall such that profits decrease.*

Proof. See Section A4 of the Appendix. ■

When it comes to watching television, consumers are willing to tolerate a larger distance between their preferred style of coverage and the location of the broadcaster, as a unit of distance has become cheaper for consumers due to the increase in e. Hence, the broadcaster can set a higher price and reduce its own costs by moving towards the margin of the distribution. As accessing the newspaper is prohibitively costly for some consumers from the center of the distribution, the broadcaster serves the larger part of the market despite the higher price. As a consequence, the profits of the broadcaster increase. When choosing the newspaper, consumers' costs per unit of distance are $k_N = k_T + 2e$. Hence, the newspaper has to move towards the center of the distribution by increasing the entertainment intensity. It also lowers the price as soon as the marginal costs of increasing θ_N become larger than the marginal costs of cutting prices. By moving towards the center of the distribution, the newspaper increases the size of the uncontested hinterland at the left margin. Since the price as well as the demand for the newspaper is lower than before the shock, the newspaper's profits decrease.
These results show that, for the competitive disadvantage of one player being sufficiently high, the other player is able to increase his profits. The higher the cost disadvantage with respect to distance costs of one player, the higher the profits of his opponent. However, the results are sensitive to how changes in the distance costs are modeled. An alternative scenario is presented in the following section. The empirical relevance of this scenario is discussed in Section 2.4.

2.2.3 Unilateral decrease in distance costs

In the previous section, I have analyzed the case where the average distance costs remain unchanged and increased preferences for audiovisual coverage are met symmetrically by higher distance costs to the print medium. However, it is equally possible to think of situations where a reduction of distance costs to the television channel has no effect on the preferences for newspapers. For instance, in recent years, the number of television channels has increased due to the introduction of Digital Video Broadcasting Terrestrial (DVB-T).[19] Besides the increase in available channels, there has

[19]The number of news channels in Europe has increased from 5 in 1990 to 88 in 2003, which was met by an increase in the number of available channels from 103 to 1132 during the same time period (Europäische Audiovisuelle Informationsstelle, 2004).

also been a development towards new interactive formats, and novel technologies that allow consumers to use on-demand services. This has added to the attractivity of the medium and has lead to more consumers using the medium for various purposes other than news consumption. Although consumers' preferences with respect to the style of news coverage have not changed, the fact that individuals watch more television has decreased their distance costs towards consuming the news broadcast on television. Switching channels to consume the news broadcast of the television channel causes lower costs than switching to a different media type.
The per unit distance costs are now defined by $k_N = k$, and $k_T = k - e$, with $0 < e < k$, which implies that the sum of the distance cost parameters decreases. Therefore, not only a shift in preferences is considered but also a level effect that comes with the decrease of the average distance costs. In order to analyze the optimal style of news coverage for both media outlets, as well as the corresponding prices, quantities and profits, the equilibrium is derived by solving the game in a similar way as in the previous sections. The unilateral shift in preferences is denoted by hat variables $\hat{}$. In equilibrium, media outlets choose the style of coverage as follows:

$$\begin{aligned} \hat{\theta}_N &= \frac{3ak(3k-2e) - k(e-k)^2}{3c\hat{\chi}} \\ \hat{\theta}_T &= 1 - \frac{k}{6c} + \frac{3ae(5k-2e) - e^2k}{6c\hat{\chi}}, \end{aligned} \tag{8}$$

with $\hat{\chi} \equiv (2k-e)(9c+e) - 2k^2$. Equilibrium prices, market shares, and profits are:

$$\hat{p}_N = \frac{(2k-e)[3c(3k-2e)+(e-k)^2]}{\hat{\chi}} \qquad \hat{p}_T = \frac{(2k-e)[3c(3k-e)+k^2]}{\hat{\chi}}$$

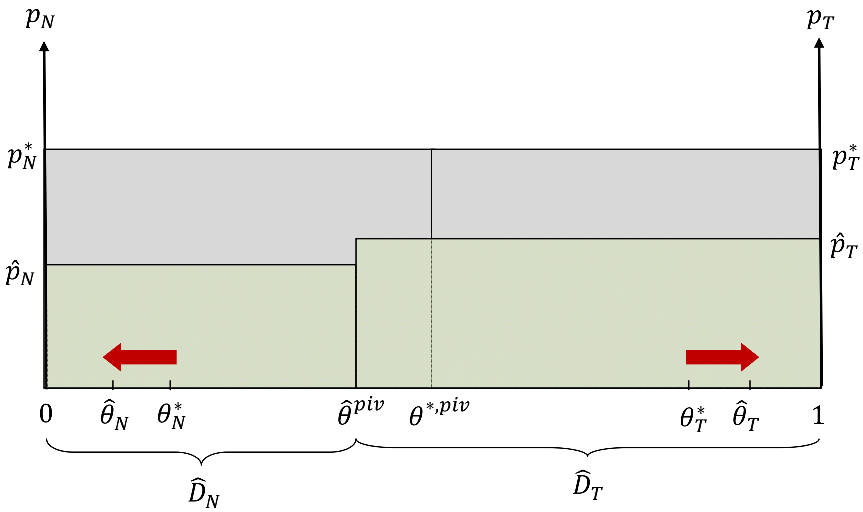
$$\hat{D}_N = \frac{3c(3k-2e)-(e-k)^2}{\hat{\chi}} \qquad \hat{D}_T = \frac{3c(3k-e)-k^2}{\hat{\chi}}$$

$$\hat{\Pi}_N = \frac{[3c(2e-3k)+(e-k)^2]^2[9c(2k-e)+k^2]}{9c(\hat{\chi})^2} - F$$

$$\hat{\Pi}_T = \frac{[9c(e-2k)+(e-k)^2][3c(3k-e)+k^2]^2}{9c(\hat{\chi})^2} - F \tag{9}$$

In Figure 2.4, the equilibrium following a unilateral decrease in distance costs is compared to the equilibrium of the symmetric model.

Figure 2.4: Equilibrium with unilateral shift in consumer preferences, one-sided market



Note: This figure illustrates market shares, prices, and style of coverage of the two media outlets in the model with a unilateral shift in consumers' distance costs where $k_N = k$ and $k_T = k - e$, compared to the symmetric model where $k_N = K_T = k$ in a one-sided market. The vertical axes illustrate the prices of the two media outlets, and their respective style of coverage is given by their location on the horizontal line of unit length.

Compared to the symmetric case, the newspaper reduces its entertainment intensity (i.e. θ_N shifts to the left), while the broadcaster increases its entertainment intensity (i.e. θ_T shifts to the right). The price of accessing the broadcast is higher than the price of the newspaper, and both prices are strictly positive. The demands for both media products are strictly positive, and add up to one, where the broadcaster serves the larger part of the market than the newspaper $\left(\hat{D}_T - \hat{D}_N > 0\right)$. Again, the profits of the broadcaster are higher than the profits of the newspaper, as it serves the larger part of the market at a higher price $\left(\hat{\Pi}_T - \hat{\Pi}_N > 0\right)$. Compared to the symmetric case, however, aggregate profits are lower.

The effects of an increase in the size of the shock

Proposition 3 *If consumers distance costs are altered such that the distance costs to the broadcaster's platform fall, and the distance costs to the newspaper's platform* *remain the same, an increase in e yields the following effects:*

1. *Product differentiation in the style dimension increases as both firms move to the margins of the distribution.*

2. *Both firms set lower prices and have lower profits.*

3. *The broadcaster increases his market share.*

Proof. See Section A5 of the Appendix. ■

The newspaper can either lower its price, or offer a higher amount of entertainment, in order to compensate for the fact that the broadcaster has become cheaper for consumers per unit of deviation from their preferred style. In contrast to the previous section, where the distance costs of the newspaper increased, the competitive disadvantage of the newspaper is less pronounced. As a marginal increase in θ_N is more expensive than marginally cutting prices, the newspaper sets a lower price. This, in turn, induces the broadcaster to lower his price as well, up to the point where the increase in market shares is offset by the decrease in prices. This already indicates that the reduction of the distance costs is not necessarily profitable for the broadcaster, either.
In contrast to the shock where distance costs shifted bilaterally, both firms move towards the margins of the distribution which indicates some tendency to specialize in information (newspaper), and entertainment (broadcaster). By moving towards the margins of the distribution, and thus increasing product differentiation, both media outlets save adjustment costs as the style of coverage has *on average* become less important to consumers. Since the newspaper offers less entertainment, it becomes *ceteris paribus* less attractive for the consumers from the center of the distribution to buy a newspaper. On the one hand, the newspaper has a smaller market share due to the reduction of the size of the hinterland, and on the other hand it is costly for the newspaper to attract consumers from the center of the distribution as this requires further price cuts. This results shows that the reduction in prices does not compensate for the shift towards less entertainment. Therefore, the broadcaster gains market shares at the expense of the newspaper.
The decrease in profits of the newspaper comes from the fact that it serves a smaller part of the market at a lower price. The saved adjustment costs, however, do not compensate for the price and demand reductions. For the broadcaster, it does not pay to have the platform with the lower distance costs, as the increase in market shares,

and the lower adjustment costs do not offset the price reduction, which leads to lower profits.

In the remaining part of the chapter, I discuss how the effects following the bilateral and unilateral shocks are affected by the introduction of a two-sided market.

2.3 Introducing a two-sided market: The effect of advertising

Introducing a two-sided market allows for capturing the effects that are caused by the inter-market externalities between the advertising and the consumer market. In a two-sided market where media outlets compete for consumers and advertisers, the number of consumers on the one side of the market typically exerts a positive externality on the revenues of advertisers on the other side of the market, which allows the media outlet to charge higher prices for an advertising slot. The implication of introducing the advertising side of the market can be summarized as follows: The advertising market exerts downward pressure on consumer prices as advertising revenues increase in the number of consumers. The results with respect to the distribution of market shares and profits, as well as the styles of coverage of the three models discussed in Section 2.2 are not affected by the existence of an advertising market as long as the effectiveness of an advertisement is equal across media types. If an advertisement in one media type is systematically more effective than an advertisement in the other media type, some of the results of the comparative statics analyses in Section 2.2 are reversed.

Media outlets

As profits are not only generated on the consumer market but also on the advertising market, the profits of media outlet i now read:

$$\Pi_i = p_i^c D_i + p_i^a a_i - C(\theta_i), \tag{10}$$

where the costs of generating content $C(\theta_i)$ do not change due to the introduction of the advertising market. The price per advertisement a_i in medium i is denoted by p_i^a. The number of advertisements does not enter the utility function of consumers, as consumers are assumed to be ad-neutral.[20]

Advertisers

The advertising market is modeled in the simplest possible way with the advertising price being linear in the market shares on the consumer side.[21] I assume that there is a large number of m advertisers acting as price takers on the advertising market. Each of them produces exactly one good which is sold at a price p_m normalized to one. Advertisements serve the purpose of making the goods known to consumers, as a fraction $\beta_i \in [0,1]$ of all consumers exposed to an advertisement buy the good. Hence, β_i is interpreted as the effectiveness of an advertisement in medium i. Advertising space per medium a_i is limited (either by technological restrictions or by political regulation) and may without loss of generality be normalized to one in each medium. Accordingly, the supply of advertising space is fully inelastic. Media outlets charge a medium-specific price per ad impression[22] (similar to the *Cost Per Mille*), and extract the full surplus from the advertisers. Hence, the price for an advertisement on platform i is:

$$\pi_m = \beta_i D_i \underbrace{p_m}_{=1} a_{i,m} - p_i^a a_{i,m} \qquad \Rightarrow \qquad p_i^a = \beta_i D_i, \tag{11}$$

where $a_{i,m}$ denotes the advertisers' demand for advertising space in medium i. For instance, if advertisements are very effective such that each ad impression triggers exactly one positive sales decision, $\beta_i = 1$, and the price per advertisement equals the number of consumers reached by this medium. This condition shows that advertising demand is perfectly elastic such that equilibrium ad prices are determined by the ad effectiveness and the number of consumers of medium i, only.

[20]If advertisements were a nuisance to consumers, it may be optimal for the media outlet to cut back on selling advertising space in order to remain attractive to consumers. See Chapter 3 for a model in which consumers are ad-averse.

[21]See Bergemann and Bonatti (2010); Gabszewicz et al. (2002, 2004) for a similar way of modeling the advertising side of a two-sided market.

[22]A consumer contact of an advertisement in medium i is referred to by the term "ad impression".

2.3.1 Symmetric model

In the symmetric case, each unit of distance between the preferred style of coverage and the style of coverage of the closest medium causes the same costs to consumers. Hence, $k_N = k_T = k$, as in Section 2.2.1.

In the third stage, consumers decide between medium N and T. This stage is as in the one-sided market due to the assumption that consumers are indifferent with respect to advertisements which implies that the demand functions of Eq. (4) remain valid. In the second stage, media outlets choose prices charged to consumers by maximizing Eq. (10) with respect to p_i^c. As in the case of a one-sided market, these prices are substituted back into Eq. (10) and the optimal style of coverage θ_i is derived. This yields the following equilibrium prices and reporting strategies:

$$p_N^{t,*} = \underbrace{k}_{=p_N^*} - \underbrace{\beta_N}_{\text{TSM effect}} + \underbrace{\frac{3c\Delta_\beta}{9c-k}}_{\text{ad asymmetry}}, \qquad p_T^{t,*} = \underbrace{k}_{=p_T^*} - \underbrace{\beta_T}_{\text{TSM effect}} - \underbrace{\frac{3c\Delta_\beta}{9c-k}}_{\text{ad asymmetry}},$$

$$\theta_N^{t,*} = \underbrace{\frac{k}{6c}}_{=\theta_N^*} + \underbrace{\frac{\Delta_\beta}{2(9c-k)}}_{\text{ad asymmetry}}, \qquad \theta_T^{t,*} = \underbrace{1 - \frac{k}{6c}}_{=\theta_T^*} + \underbrace{\frac{\Delta_\beta}{2(9c-k)}}_{\text{ad asymmetry}}, \tag{12}$$

with $\Delta_\beta \equiv \beta_N - \beta_T$.

As expected, consumer prices are lower than in a one-sided market which is due to the standard argument of the positive externality of consumer market shares on advertising revenues, indicated by the *TSM effect* in Eq. (12).[23] The externality implies that competition in the consumer pricing dimension becomes more intense if an advertising market is introduced. The asymmetry Δ_β in the ad effectiveness parameters affects consumer prices differently: If the ad effectiveness of medium i is higher than the ad effectiveness of his competitor, media outlet i has a stronger incentive to attract consumers via low prices than his competitor, and thus sets lower prices. The asymmetry in consumer prices increases in Δ_β.

The choice of the style of coverage, however, is not affected by the existence of an advertising market but only by the potential asymmetry in the ad effectiveness. The media outlet with the higher ad effectiveness competes harder for consumers by pro-

[23] See for instance Blair and Romano (1993) who show that newspapers set consumer prices below the marginal costs for paper and ink in order to increase their revenues on the advertising market by attracting consumers.

viding a style that is closer to the tastes of the pivotal consumer, i.e. it moves further to the center of the distribution, which is costly. Product differentiation in the style dimension, however, remains constant, as the competitor moves towards the margin of the distribution by the same amount. Using the above prices and styles of coverage, equilibrium market shares and profits are:

$$D_N^{t,*} = \underbrace{\frac{1}{2}}_{=D_N^*} + \underbrace{\frac{3c\Delta_\beta}{2k(9c-k)}}_{\text{ad asymmetry}}, \qquad D_T^{t,*} = \underbrace{\frac{1}{2}}_{=D_N^*} - \underbrace{\frac{3c\Delta_\beta}{2k(9c-k)}}_{\text{ad asymmetry}}, \tag{13}$$

$$\Pi_N^{t,*} = \overbrace{\underbrace{\frac{k}{2}\left(1-\frac{k}{18c}\right)}_{=\Pi_N^*}\left(1-\frac{6c\Delta_\beta}{(k-9c)^2}\right)}^{>0} + \overbrace{\frac{c}{2}\left(\frac{9c}{k}-\frac{1}{2}\right)}^{>0}\overbrace{\left(\frac{\Delta_\beta(\Delta_\beta+6k)}{(k-9c)^2}\right)}^{\gtreqless 0} - F,$$

$$\Pi_T^{t,*} = \overbrace{\underbrace{\frac{k}{2}\left(1-\frac{k}{18c}\right)}_{=\Pi_T^*}\left(1+\frac{6c\Delta_\beta}{(k-9c)^2}\right)}^{>0} + \overbrace{\frac{c}{2}\left(\frac{9c}{k}-\frac{1}{2}\right)}^{>0}\overbrace{\left(\frac{\Delta_\beta(\Delta_\beta-6k)}{(k-9c)^2}\right)}^{\gtreqless 0} - F,$$

with superscript ^{t,*} denoting the symmetric model in a two-sided market. As prices are lower, and the hinterland of the media outlet with the higher ad effectiveness has increased (due to its offering a style which is closer to the center of the distribution), the respective medium serves the larger part of the consumer market.

If advertisements were equally effective on both platforms, media outlets' profits would be as in the symmetric model without advertising (see Eq. 5), as media outlets compete for consumers by setting low prices, until the per capita gains on the advertising market are fully offset. In the case of an asymmetry in the ad effectiveness parameters, i.e. if $\Delta_\beta \gtreqless 0$, the existence of the advertising market increases the profits of the media outlets with the higher ad effectiveness. If the ad effectiveness of media outlet i is lower than the ad effectiveness of the competing medium, however, operating on a two-sided market may in fact be profit-decreasing.

The result that the advertising market has no positive effect on profits unless there is an advantage in the ad effectiveness over the competitor is due to the fact that competition on the consumer market has become much stronger. As demand for advertising space is inelastic, the marginal return on attracting an additional consumer is $p_i^{t,*} + \beta_i$, which induces media outlets to fully subsidize the consumer market via the advertising market by setting consumer prices below marginal costs. In the symmetric setup where both

firms have the same ad effectiveness, prices are set so low that the gains from the advertising market are fully offset by the losses on the consumer market. It is only when one of the firms has a competitive advantage over the other firms that profits arise from introducing a two-sided market.
There are two effects that are to be distinguished from one another: The effect of the introduction of the advertising market, that decreases consumer prices but has no effects on equilibrium styles, market shares and profits, and the effects of the asymmetry in the ad effectiveness of different media types.[24] The asymmetry in the ad effectiveness has an impact on all equilibrium values as described above. Taking a look at the asymmetric scenarios, this effect will become even more pronounced.

2.3.2 Bilateral shift in distance costs

In this section, I analyze how the equilibrium is affected by the introduction of a two-sided market, if there is a bilateral shift in consumer preferences such that $k_N = k + e$ and $k_T = k - e$ as in Section 2.2.2. The derivation is as in Section 2.3.1 and is therefore not discussed here. The equilibrium is characterized as follows:

$$\tilde{p}^t_N = \tilde{p}_N - \beta_N + \underbrace{\frac{3ka\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}}, \qquad \tilde{p}^t_T = \tilde{p}_T - \beta_T - \underbrace{\frac{3ka\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}},$$

$$\tilde{\theta}^t_N = \tilde{\theta}_N + \underbrace{\frac{(k+e)}{6c}\frac{3c\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}}, \qquad \tilde{\theta}^t_T = \tilde{\theta}_T + \underbrace{\frac{(k-e)}{2}\frac{\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}},$$

$$\tilde{D}^t_N = \tilde{D}_N + \underbrace{\frac{1}{2}\frac{3c\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}}, \qquad \tilde{D}^t_T = \tilde{D}_T - \underbrace{\frac{1}{2}\frac{3c\Delta_\beta}{e^2 + k(k-9c)}}_{\text{ad asymmetry}}. \tag{14}$$

It is evident that the introduction of a two-sided market primarily affects consumer prices. Only if advertisements differ in their effectiveness across media types, the other equilibrium values differ from the case of a one-sided market. The differences to the one-sided market results are more pronounced, the larger $|\Delta_\beta|$, and follow the same reasoning as discussed in the previous section.

[24] The difference in ad effectiveness of different media is reflected in the Cost Per Mille (CPM) which is the price per ad impression.

The profits of the media outlets are as follows:

$$\tilde{\Pi}_N^t = \frac{\left[(e-k)^2 - 3c(3k - e + \Delta_\beta)\right]^2 \left[18ak - (e+k)^2\right]}{36c\left[e^2 + k(k-9c)\right]^2} - F,$$

$$\tilde{\Pi}_T^t = \frac{\left[(e+k)^2 - 3c(3k + e - \Delta_\beta)\right]^2 \left[18ak - (e-k)^2\right]}{36c\left[e^2 + k(k-9c)\right]^2} - F. \quad (15)$$

The result with respect to the profits also have a similar pattern as the results in the previous section: If medium i has a competitive advantage on the advertising side, its profits are higher than in the one-sided market. If this is not the case, the profits may be lower (if the difference in the ad effectiveness is sufficiently large). For equal values of the ad effectiveness across media types, there is no positive effect on profits due to the introduction of the advertising market.

The effects of an increase in the size of the shock

As e increases, the difference in the distance costs and hence the disadvantage of the newspaper becomes larger. The one-sided markets model of Section 2.2.2 predicts that the prices of the newspaper decrease, and the prices of the broadcaster increase in e. Maximizing Eq. (14) with respect to e shows that these effects remain qualitatively the same as in a one-sided markets model with once exception:

With respect to the optimal style of coverage $\tilde{\theta}_i^t$, the relation of the ad effectiveness Δ_β determines the results. If $\Delta_\beta > 0$, which implies that advertising space in the newspaper yields a higher marginal return per ad impression than advertisements in the television channel, the result of a one-sided market unambiguously survives for the newspaper but is ambiguous for the broadcaster: The newspaper moves towards the center of the distribution. The broadcaster, however, chooses $\tilde{\theta}_T^t$ subject to the size of his advantage on the consumer market. If e is large, which implies that consumers are strongly biased towards choosing the broadcaster, he acts as in the one-sided markets model and moves towards the margin of the distribution. If e is small, the broadcaster moves towards the center, as he takes into account that the newspaper has become more attractive to the consumers from the center of the distribution by decreasing its price and by increasing the amount of entertainment (product differentiation decreases).

The argument can be reversed if $\Delta_\beta < 0$, which implies that there is a disadvantage

for the newspaper on the advertising market. Combined with the disadvantage of having higher distance costs than the competing broadcaster, it is only profitable for the newspaper to offer more entertainment, if the disadvantage in distance costs is not too large (e must be sufficiently small). The effect of an increase in e on the optimal value of $\tilde{\theta}_T^t$ remains unaffected and is positive as in the one-sided market.
For consumer prices, the effects derived for the one-sided market scenarios still hold: An increase in e induces the newspaper to set lower prices (in order to compensate for becoming less attractive to consumers), and the broadcaster sets higher prices. The one-sided market model predicts that, with e increasing, the market shares of the newspaper will decrease, and the broadcaster will benefit from this loss in market shares. As a result, the profits of the newspaper decrease, whereas the profits of the broadcaster increase. Regarding the market shares on the consumer market, it is unambiguous that the results of the one-sided market model hold if $\Delta_\beta < 0$, as this is, apart from the higher distance costs, an additional disadvantage for the newspaper. However, even if $\Delta_\beta > 0$, the results are qualitatively the same as in the one-sided markets model as the positive effect on market shares is too weak to dominate the negative effect of an increase in e. The same reasoning applies for the profits.

This simple analysis shows that the results of the one-sided markets model are not only robust to the introduction of a two-sided market, but hold also if asymmetric ad effectiveness is being introduced with the exception of the effects of an increase in e on $\tilde{\theta}_i^t$, if e becomes too large (newspaper's reaction) or too small (broadcaster's reaction).
In the following section, I analyze how the equilibrium of the model with the unilateral decrease in distance costs is affected by accounting for a two-sided market.

2.3.3 Unilateral decrease in distance costs

In this section, only the distance costs to the broadcaster decrease, and the distance costs to the newspaper remain unchanged: $k_N = k$, and $k_T = k - e$. The results will be compared to the corresponding section 2.2.3, where the same scenario is analyzed in a one-sided market without advertising. The equilibrium is characterized as follows:

$$\hat{p}_N^t = \hat{p}_N - \beta_N + \underbrace{\frac{3c\Delta_\beta(2k-e)}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}}, \qquad \hat{p}_T^t = \hat{p}_T - \beta_T - \underbrace{\frac{3c\Delta_\beta(2k-e)}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}},$$

$$\hat{\theta}_N^t = \hat{\theta}_N + \underbrace{\frac{k\Delta_\beta}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}}, \qquad \hat{\theta}_T^t = \hat{\theta}_T + \underbrace{\frac{(k-e)\Delta_\beta}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}},$$

$$\hat{D}_N^t = \hat{D}_N + \underbrace{\frac{3c\Delta_\beta}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}}, \qquad \hat{D}_T^t = \hat{D}_T - \underbrace{\frac{3c\Delta_\beta}{(2k-e)(9c+e)-2k^2}}_{\text{ad asymmetry}}. \tag{16}$$

Again, only the prices react to the introduction of a two-sided market if advertisements were equally effective in both media types. As the sign of the denominators of the ad asymmetry terms of Eq. (16) are positive, the sign of Δ_β is decisive.
If $\Delta_\beta > 0$, advertisements are more effective in the newspaper than in the television channel. This increases the newspaper's incentive to attract consumers. As the distance costs have become relatively more important for consumers with low θ_n (due to the increase in e), N moves towards the center of the distribution by offering a higher $\hat{\theta}_N^t$ than in the case of $\Delta_\beta = 0$. As a reaction, T sets a higher $\hat{\theta}_T^t$ as well, but the degree of differentiation between the platforms is smaller than in the symmetric case. As a consequence of its higher costs, media outlet N increases its price. In contrast, T lowers its price by the same amount which leads to T gaining market shares at the expense of N. For $\Delta_\beta < 0$, the effects are the reverse. The equilibrium profits can be stated as:

$$\begin{aligned} \hat{\Pi}_N^t &= \frac{\left[(e-k)^2 + 3c(2e-3k-\Delta_\beta)\right]^2 \left[k^2 + 9c(2k-e)\right]}{9c\left[(9c+e)(e-2k)+2k^2\right]^2} - F, \\ \hat{\Pi}_T^t &= \frac{\left[k^2 + 3c(3k-e+\Delta_\beta)\right]^2 \left[(e-k^2) - 9c(2k-e)\right]}{9c\left[(9c+e)(e-2k)+2k^2\right]^2} - F. \end{aligned} \tag{17}$$

Apart from Δ_β in both of the terms, the profits are identical to the one-sided market result. As in the previous section, the medium with the higher ad effectiveness gains compared to the situation without the ad market. If the ad effectiveness of the respective medium is lower than that of the competitor, the effect of the introduction of an advertising market may even be profit-reducing.

The effects of an increase in the size of the shock

The one-sided market model of Section 2.2.3 predicts that an increase in e has the following effects: Prices and profits of both firms decrease, product differentiation increases and T gains market shares at the expense of N. Again, all of these effects persist in a two-sided markets framework with the exception of the equilibrium style of news coverage, if $\Delta_\beta \neq 0$.
Similar to the previous section, an increase in e affects the equilibrium amount of entertainment as follows: If $\Delta_\beta < 0$, i.e. the advantage of T over N is even stronger, and the effects remain as in the one-sided market. If, however, $\Delta_\beta > 0$, and e is sufficiently large, product differentiation decreases as both firms move towards the center of the distribution. This is due to the distance costs becoming increasingly important for consumers' decision.
Extending the model to a two-sided market framework has shown that the effects of a unilateral decrease in distance costs as discussed in Section 2.2.3 remain almost unaffected. Whether the ad effectiveness of the television channel exceeds the newspapers's ad effectiveness is an empirical question which may as well depend upon the specific outlets.

2.4 Conclusion

The model derived in the previous sections has studied the choice of prices and locations, interpreted as the amount of entertainment in news coverage, of media outlets of different types. In symmetric benchmark model in a one-sided market, media outlets offer differentiated platforms by locating close to the margins of the style-dimension. In an extension to the model, introducing an advertising market has shown that media outlets set lower prices than in a one-sided market in order to increase their revenues on the advertising side of the market. Selling advertising space, however, does not increase the profits of media outlets, unless one of the two platforms has an advantage such that advertisements are more effective. I analyzed two scenarios that describe exogenous shocks on the market for news coverage. Comparing the results of a bilateral shift in consumer preferences in the one-sided as well as the two-sided market to the effects of unilaterally decreasing distance costs in the one-sided and the two-sided market yields the following differences: In the case of the bilateral shift (Sections 2.2.2 and 2.3.2), both platforms offer more entertaining contents, and the broadcaster benefits from the shock as his prices and profits increase. If there is a unilateral decrease (Sections 2.2.3 and 2.3.3), only the television broadcast becomes more entertaining, whereas the newspaper specializes in transmission of information. Price competition becomes more intense, which leads to reduced profits of both firms.

Empirical evidence sheds light on (i) consumers' preferences, which helps to determine the nature of the shock on the distance costs (unilateral or bilateral), and (ii), media outlets' strategic behavior with respect to the style of coverage, the price-setting, and the profits of the broadcaster.

Consumer preferences and patterns in media use

The advent of novel technologies in the 1980s has motivated a number of authors to study the implications for consumers' media use patterns. Compaine (1983) predicts that the inclination and ability to read complex contents in print media decreases, and that individuals develop skills which he calls the "new literacy", as they are able to filter information out of broadcasted news, or computer-based services. He describes a shift in consumer preferences towards audio-visual contents as analyzed in the scenarios where consumers' distance costs shift bilaterally. Graber (1988) identifies similar changes in the patterns of media use by studying the recall rates of different news stories among a representative sample of individuals in the U.S.. She finds that consumers tend to ignore objective news or pay little attention to the contents, which leads to a significantly lower recall rate compared to news that are attention-grabbing and entertaining. Novel data confirm these findings: Berg and Ridder (2002) analyze long-term trends in consumers' media use with data from 1964-2000 of a representative sample of German television channels, radio stations, and daily newspapers. They find that consumers' preference for simple and unambiguous news coverage has increased, and that the number of consumers indicating television as their preferred medium has also grown over time.

The popularity ranking of media types also depends upon various socio-demographic determinants as the area individuals live in (rural vs. urban), education, or the income distributions, as shown by Oskam and Hudson (1999). They conduct a survey among 492 individuals in the Texas rural area, and find that television is claimed to be the preferred source of news, as stated by 66% of the respondents, followed by the newspaper (18.8%). Supposedly, the gap between television and newspaper popularity is less pronounced in urban areas, or in wealthier regions.

In the context of this model, an increased preference for simple and unambiguous news coverage, as well as an increase in the preference for the medium television is reflected by lower distance costs to the platform that offers more entertainment (e.g. the television channel) than to the other platform. Hence, it is most plausible to interpret the empirically observed preference shift as a decrease in the distance costs to the news broadcast accompanied by an increase in the distance costs to the newspaper's platform.

The change in consumer demands triggered by the exogenous shocks is qualitatively the same in both scenarios, and stable across the two market structures (one-sided vs. two-sided). This effect is clearly visible in the data: In recent years, newspapers have not only experienced a drop in circulation rates, but also a reduction in advertising revenues. Peters (2010) finds that in 2010, daily newspapers' circulation in the U.S. has declined by 5% (compared to a 10.6% drop in 2009), and advertising revenues have dropped by 6.3% (26% in 2009).

A similar development is reflected in the time individuals devote to using a specific media type: In 1999, U.S. citizens claimed to watch television 4.5 hours a day, which increased by 19.4% through 2007. At the same time, the time of reading a newspaper has decreased from about 72 minutes per day in 1999 by 33% in 2007 (MediaInfoCenter, 2011).

Media outlets' profits and style of coverage

The decrease in newspaper profits is well documented. For the U.S., the profit margin of major newspapers was 5% in 2010, compared to about 20% in the 1990s (Pew Project for Excellence in Journalism, 2011c). For television channels, the previous years provided an increase in profits. Revenues from cable news rose by 10.7% from 2009 to 2010, and for local news, the revenue increase over the same time period amounted to 17% (Pew Project for Excellence in Journalism, 2011c). The same pattern is observable in other countries, as well.

Earlier studies argued that a consolidation on the media market inevitably leads to distortions in news coverage, initiating a downward spiral with respect to objectivity and news quality (see for instance Alger, 1998). Evidence on television broadcasts becoming more entertaining is unambiguous. Among others, Barnett et al. (2000), and Winston (2002) find for British news broadcasts that the composition of topics covered in the news shifts towards crime, sports, and elite persons. Krueger and Zapf-Schramm (2001) show in a full sample survey of German television channels that news

are presented as "infotainment" in order to compete with new entertainment formats which is in line with the results of both scenarios analyzed in the above model.
When determining whether newspapers contain more entertaining elements today than in previous years, the way how newspapers are sold drives the results. If newspapers are mainly sold at newsstands as in the U.K., for instance, gripping headlines play a larger role than in a country like Germany where a large number of sales are generated through subscriptions. For the U.K., Tulloch et al. (2000) develop a number of indicators for an increased "tabloidization" of news coverage in major British newspapers from 1952 through 1997, and find for instance that the number of photographs per page and the number of stories featuring entertaining contents has increased, whereas the number of stories with international content has decreased. Uribe and Gunter (2004) find that major British tabloids are increasingly dominated by "soft" news.[25] For other countries, the trend towards more entertainment in print media is evident but less pronounced (see Esser, 1999). Schoenbach (2000) finds for German newspapers that shifting towards entertainment, e.g. following the trend towards more tabloidization, decreases their profits.

Summary and outlook

This chapter provides a theoretical framework that allows for making predictions on how the media market will react to future structural changes. One of the major trends in the years to come will be the switch from analogue technology to digital television which already took place in the U.S. in 2009. Most European countries and Japan will follow until 2012. As digital channels require less bandwidth, broadcasters can provide more channels in the same space, and the number of platforms will increase dramatically.
The evidence presented above supports the view that the newspaper shifts towards providing more entertaining contents which is the result of the scenario where distance costs decrease bilaterally. As the time budget of consumers has to be allocated to more options available on the media market, inter-media competition between newspapers and television channels becomes more intense, too. In terms of the theoretical model, this development implies that the distance costs to the broadcaster decrease even more, thus decreasing the profits of the newspaper, and leading to more entertaining contents on both platforms. A growing majority of consumers will watch television, which is increasingly biased towards predominantly entertaining contents.

[25] For the trend towards more entertaining contents in U.S. magazines see Figure 1.1 in Chapter 1.

A trend that is beyond the scope of this model is the introduction of online platforms. Many newspapers have chosen to provide their contents online in order to cushion their declining revenues. How this affects media profits and market structures is analyzed in Chapter 4 of this dissertation.

Appendix

A1: Derivation of symmetric game equilibrium in a one-sided market

The consumer demands derived in Eq. (4) are substituted in the profit function of media outlet i (Eq. 1):

$$\begin{aligned} \Pi_N(\theta_i, p_i) &= \frac{p_N[p_T - p_N + k(\theta_N + \theta_T)]}{2k} - c\theta_N^2 - F, \\ \Pi_T(\theta_i, p_i) &= \frac{p_T[p_T - p_N + k(\theta_N + \theta_T - 2)]}{2k} - c(1-\theta_T)^2 - F. \end{aligned} \tag{A1}$$

Maximizing Eq. (A1) with respect to p_i in the second stage of the game yields

$$\frac{\partial \Pi_N}{\partial p_N} = \frac{p_T - 2p_N + k(\theta_N + \theta_T)}{2k}, \qquad \frac{\partial \Pi_T}{\partial p_T} = \frac{p_N - 2p_T - k(\theta_N + \theta_T - 2)}{2k}. \tag{A2}$$

The prices as a function of the styles of coverage are obtained by solving Eq. (A2) for p_i:

$$p_N(\theta_i) = \frac{k(2 + \theta_N + \theta_T)}{3}, \qquad p_T(\theta_i) = \frac{k(4 - \theta_N - \theta_T)}{3}. \tag{A3}$$

In the first stage of the game, Eq. (A3) are substituted into the profit function of media outlet i:

$$\begin{aligned} \Pi_N(\theta_i) &= \frac{k(2 + \theta_N + \theta_T)^2 - 18c\theta_N^2}{18} - F, \\ \Pi_T(\theta_i) &= \frac{k(4 - \theta_N + \theta_T)^2 - 18c(1-\theta_T)^2}{18} - F. \end{aligned} \tag{A4}$$

Maximizing Eq. (A4) with respect to θ_i yields

$$\frac{\partial \Pi_N}{\partial \theta_N} = \frac{k(2+\theta_N+\theta_T) - 18c\theta_N}{9}, \qquad \frac{\partial \Pi_T}{\partial \theta_T} = \frac{k(\theta_N+\theta_T-4) - 18c(\theta_T-1)}{9}. \tag{A5}$$

The equilibrium in Eq. (5) is obtained by solving Eq. (A5) for θ_i, and substituting the result into Eq. (4), (A3), and (1).

A2: Proof of stability of symmetric game equilibrium in a one-sided market

The problem of the original Hotelling model with linear consumers' distance costs does not arise, if choosing the same location as the competitor and serving the whole market does not lead to higher profits.

The profits in the symmetric game equilibrium in a one-sided market are

$$\Pi_N^* = \Pi_T^* = \frac{k}{2} - \frac{1}{c}\left(\frac{k}{6}\right)^2 - F, \tag{A6}$$

with $\theta_N = \frac{k}{6c}$, and $\theta_T = 1 - \frac{k}{6c}$, and the consumer market being divided equally between N and T. Suppose that N chooses the same location as T (e.g. $\theta_N = 1 - \frac{k}{6c}$), and serves the whole market at price $p_N = p_T = k$. The profits of media outlet N would then be

$$\Pi_N^d = k * 1 - c\left(1 - \frac{k}{6c}\right)^2 - F = \frac{4}{3}k - c - \frac{1}{c}\left(\frac{k}{6}\right)^2 - F, \tag{A7}$$

with superscript ^{d} denoting the deviation from the symmetric equilibrium. If deviating was profit increasing, the following condition would hold:

$$\Pi_N^d > \Pi_N^* \qquad \Leftrightarrow \qquad \frac{4}{3}k - c - \frac{1}{c}\left(\frac{k}{6}\right)^2 - F > \frac{k}{2} - \frac{1}{c}\left(\frac{k}{6}\right)^2 - F$$

$$\frac{5}{6}k - c > 0. \tag{A8}$$

Condition (A8) can never be fulfilled, as $1 \geq k > 0$ and $c \geq 1$. This implies that deviating from the symmetric game equilibrium is never profitable for media outlet N. Analogically, the same holds for media outlet T, such that the equilibrium is stable.

■

A3: Proof of Proposition 1

Differentiating the equilibrium of the symmetric model (Eq. 5) where $k \in (0,1]$ and $c \geq 1$ with respect to k and c yields:

$$\frac{\partial \theta_N^*}{\partial k} = \frac{1}{6c} > 0, \qquad \frac{\partial \theta_T^*}{\partial k} = -\frac{1}{6c} < 0,$$
$$\frac{\partial p_i^*}{\partial k} = 1 > 0, \qquad \frac{\partial \Pi_i^*}{\partial k} = \frac{1}{2} - \frac{k}{18c} > 0,$$
$$\frac{\partial \theta_N^*}{\partial c} = -\frac{1}{6c^2} < 0, \qquad \frac{\partial \theta_T^*}{\partial c} = \frac{1}{6c^2} > 0, \qquad \frac{\partial \Pi_i^*}{\partial c} = \frac{1}{c^2}\left(\frac{k}{6}\right)^2 > 0. \quad \text{(A9)}$$

■

A4: Proof of Proposition 2

Differentiating the equilibrium of the model with the bilateral shift in consumers' distance costs (Eq. 6 and 7) where $k \in (0,1]$ and $c \geq 1$ with respect to e yields:

$$\begin{aligned}
\frac{\partial \tilde{\theta}_N}{\partial e} &= \frac{e^4 - 3ekc(18c+7e) + 2k^2(9c+e)(3c+2e) + k^3(3c-4e) - k^4}{6c[e^2 - k(9c-k)]^2} > 0 \\
\frac{\partial \tilde{\theta}_T}{\partial e} &= \frac{e^4 + 3ekc(18c-7e) - 2k^2(9c-e)(2e-3c) + k^3(3c+4e) - k^4}{6c[e^2 - k(9c-k)]^2} > 0 \\
\frac{\partial \tilde{p}_N}{\partial e} &= -\frac{k(3c-2k)[e^2 + k(9c-k)]}{[e^2 - k(9c-k)]^2} < 0 \\
\frac{\partial \tilde{p}_T}{\partial e} &= \frac{k(3c-2k)[e^2 + k(9c-k)]}{[e^2 - k(9c-k)]^2} > 0 \qquad \text{(A10)}
\end{aligned}$$

$$
\begin{aligned}
\frac{\partial \tilde{D}_N}{\partial e} &= -\frac{(3c-2k)[e^2+k(9c-k)]}{2[e^2-k(9c-k)]^2} < 0 \\
\frac{\partial \tilde{\Pi}_N}{\partial e} &= -\frac{[3c(e-3k)+(e-k)^2][e^5+ke^3(e-21c)+k^2(486c^3-15ce^2+4e^3)]}{18[e^2-k(9c-k)]^3} \\
&- \frac{[3c(e-3k)+(e-k)^2][9ck^3(5e-36c)+k^4(39c-5e)-k^5]}{18[e^2-k(9c-k)]^3} < 0 \\
\frac{\partial \tilde{\Pi}_T}{\partial e} &= \frac{[(e+k)^2-3c(e+3k)][e^5-e^4k-e^3k(21c-4k)+15ce^2k^2+5ek^3(k-9c)]}{18[e^2-k(9c-k)]^3} \\
&+ \frac{[(e+k)^2-3c(e+3k)][k^2(9c-k)(54c^2-30ck+k^2)]}{18[e^2-k(9c-k)]^3} > 0 \qquad \text{(A11)}
\end{aligned}
$$

From $\frac{\partial \tilde{D}_N}{\partial e} < 0$ follows that $\frac{\partial \tilde{D}_T}{\partial e} > 0$, as the consumer market is always covered.

■

A5: Proof of Proposition 3

Differentiating the equilibrium of the model with the unilateral shift in consumers' distance costs (Eq. 8 and 9) where $k \in (0,1]$ and $c \geq 1$ with respect to e yields:

$$
\begin{aligned}
\frac{\partial \hat{\theta}_N}{\partial e} &= \frac{k[2k^2(e-k)-27c^2k+3c(e^2-6ek+7k^2)]}{3c[(e-2k)(9c+e)+2k^2]^2} < 0 \\
\frac{\partial \hat{\theta}_T}{\partial e} &= \frac{(9c-k)[ek(e-2k)+3c(e^2-4ek+5k^2)]}{3c[(e-2k)(9c+e)+2k^2]^2} > 0 \\
\frac{\partial \hat{p}_N}{\partial e} &= -\frac{-54c^2(e-2k)^2-(e-k)[e^3-3e^2k+6ek^2-6k^3]}{[(e-2k)(9c+e)+2k^2]^2} \\
&- \frac{+3c[27e^2k-6e^3-44ek^2+26k^3]}{[(e-2k)(9c+e)+2k^2]^2} < 0 \qquad \text{(A12)}
\end{aligned}
$$

$$
\begin{aligned}
\frac{\partial \hat{p}_T}{\partial e} &= \frac{k^2(e^2-4ek+2k^2)-27c^2(e-2k)^2-3ck(3e^2-8ek+2k^2)}{[(e-2k)(9c+e)+2k^2]^2} < 0 \\
\frac{\partial \hat{D}_N}{\partial e} &= -\frac{27c^2k-2k^2(e-k)-3c(e^2-6ek+7k^2)}{[(e-2k)(9c+e)+2k^2]^2} < 0 \\
\frac{\partial \hat{\Pi}_N}{\partial e} &= -\frac{[c(6e-9k)+(e-k)^2][243c^3(2e-5k)(e-2k)+189c^2(e-2k)(e^2-3ek+3k^2)]}{9c[(e-2k)(9c+e)+2k^2]^3} \\
&- \frac{[c(6e-9k)+(e-k)^2][3c(3e^4-12e^3k+35e^2k^2-66ek^3+44k^4)+4k^4(e-k)]}{9c[(e-2k)(9c+e)+2k^2]^3} < 0 \\
\frac{\partial \hat{\Pi}_T}{\partial e} &= -\frac{[3c(e-3k)+k^2][27c^2e^2(9c+e)-3cek(27c-4e)(9c+e)-4k^4(6c+e)]}{9c[(e-2k)(9c+e)+2k^2]^3} \\
&- \frac{[3c(e-3k)+k^2][k^2(3c-2e)(9c+e)(18c+e)+6k^3(3c+e)(9c+e)]}{9c[(e-2k)(9c+e)+2k^2]^3} < 0 \qquad \text{(A13)}
\end{aligned}
$$

From $\frac{\partial \tilde{D}_N}{\partial e} < 0$ follows that $\frac{\partial \tilde{D}_T}{\partial e} > 0$, as the consumer market is always covered.

■

Chapter 3

How effective are advertising bans? On the demand for quality in two-sided media markets

3.1 Introduction

The advertising industry has a long-standing history of regulatory intervention, which are primarily targeted towards advertisements on television.[1] Advertisements for some products may be restricted (product restrictions),[2] the restrictions may be binding within a special time period during the day (time restrictions), or may apply to special types of media (type restrictions). The latter are often imposed simultaneously such that public service broadcasters in many countries are not allowed to carry ads during a certain time of the day.[3] In this chapter, we investigate the effects of an advertising ban on the broadcaster who provides high quality content which corresponds best to public service broadcasters. In particular, we analyze how an advertising ban affects market shares on the viewer and advertising market.

[1]See Figure 1.2 in Chapter 1 for an overview on EU advertising regulation.

[2]Since the 1980s, many OECD countries imposed advertising bans for instance on tobacco as well as on (some or all) alcoholic beverages, or even on junk food (UK, South Korea). The aim of this policy instrument is to reduce consumption of unhealthy goods, but its effectiveness is discussed controversially in the literature. While some authors find little or no negative effects of advertising bans on consumption (Frank, 2008; Nelson, 1999; Seldon et al., 2000; Stewart, 1993), other authors find that there are circumstances under which an advertisement ban may reduce consumption (Saffer and Chaloupka, 2000; Blecher, 2008).

[3]See Anderson (2007) and Motta and Polo (1997) for a comprehensive overview of advertising regulation in different countries.

A combination of time and type restrictions is currently in place for instance in Germany. German public service prime-time television is ad-free from 8pm. In January 2009, France adapted the German way of advertising regulation which resulted in a drop in advertising revenues of 187.6 million Euro in 2009.[4] A day and night advertising ban is currently under debate in France, and the parliament is expected to decide on this issue after the general elections in 2012. This would turn the French system into a pure type restriction regime.
The purpose of public service broadcasting is to establish quality standards in audio-visual media by providing high-profile information and quality entertainment.[5] For policy makers, it is desirable to increase market shares of the public service broadcasters in order to expose as many citizens as possible to supposedly well-balanced and informative media contents.[6] Hence, from the policy makers' perspective, the rationale behind imposing an advertising ban on the public service broadcaster seems to be as follows: (Temporarily) eliminating the nuisance from advertisements makes the reception of quality contents more attractive for consumers, and the market shares of the public service broadcaster goes up.
However, the model developed in this chapter shows that an advertising ban does not increase the market shares of the quality television channel in a pay-TV regime where a high-quality (public service) and a low-quality (commercial) broadcaster compete for viewers and for advertisers. In a two-sided market, broadcasters have two incentives to attract viewers: the direct one via the market shares on the consumer market, and the indirect one via the spillover effects between the two sides of the market. Since the number of viewers exerts a positive externality on advertisers' revenues, competition for advertisers intensifies competition for viewers. An advertising ban on one type of broadcaster asymmetrically eliminates this type's indirect incentive to attract viewers. In equilibrium, the advertising ban leads to a reduction of the restricted type's share in the viewer market. Consequently, if the type restriction applies to the high quality platform, the ban reduces the reception of high quality content.

Besides analyzing the effectiveness of advertising bans which may contribute to evaluating political actions, the model offers the following methodological contribution:

[4]see France Télévisions (2010).

[5]See for instance the German Interstate Broadcasting Agreement (ARD, 2010), or the Royal Charter of the BBC (BBC, 2011), that clarify the objective of public service broadcasters.

[6]See Hargreaves-Heap (2005) for an overview of the positive externalities induced by quality standards in public service broadcasting. He argues that quality broadcasts have positive effects on individuals' behavior, or provide "horizon stretching" contents. Apart from the impact on individuals, providing quality information also affects the quality of political outcomes, as shown for instance by Besley and Burgess (2002) and Strömberg (2004).

Considering a product characteristic – like the quality of content in our model – which is perceived as a feature of vertical differentiation on one side and a feature of horizontal differentiation on the other side of a two-sided market is new to the literature.[7] The combination of horizontal and vertical competition allows to capture an additional form of strategic interdependence between the two sides of the market that goes beyond purely quantitative network effects.

We assume that viewers differ in their valuation for the quality of content, but they ceteris paribus prefer high over low quality content which implies vertical competition on the viewer market. The latter assumption is quite strong, but it enables us to show that an advertising ban would lead to a reduced reception of high quality contents, even if consumers strictly preferred high over low quality. If tastes for quality were differentiated horizontally, the high quality medium would be less attractive to consumers, and the results of the model would be even stronger.[8]

On the advertising side of the market, competition is horizontal. The advertised products differ in quality such that there is a correlation with the viewers' preferences for the quality of content. Consumers' preferences for the quality of consumption goods are sorted by their preferences for broadcasting quality. Advertisers' benefit from advertising is maximized when reaching consumers whose preference for broadcasting quality exactly meets the quality of the good the advertiser is selling.

We analyze the market equilibrium for two types of scenarios: symmetric ones in which both broadcasters are allowed to sell advertising space, and an asymmetric scenario with an advertising ban on the high quality medium. In the first symmetric regime, all advertisers enter the market, and in the second symmetric regime, market abstention of advertisers is allowed for. We find that selling high quality content is an advantage that allows for higher prices on both markets and leads to higher profits. This result is stable across all scenarios, and holds in a pay-TV as well as in a free-to-air broadcasting system. Introducing an advertising ban for public service broadcasters in the pay-TV system turns out to be detrimental to the goal of increasing the reception of quality contents.

The outline of the paper is as follows: Section 3.2 describes the model setup and the underlying assumptions. In Section 3.3, we analyze the equilibria that arise under the three different regimes. Since the number of viewers exerts a positive externality on advertisers' profits, and the number of advertisements exerts a negative externality on

[7] An exception is Kotsogiannis and Serfes (2010) who combine vertical and horizontal differentiation in a tax competition framework.

[8] In Section 3.5, we discuss how relaxing this assumption affects the results.

consumers' utility, it is essential to analyze the effects of an increase of the network effects, which is what we do in Section 3.4. In Section 3.5, we analyze the effectiveness of an advertising ban in the light of reaching the policy goals of making the quality broadcast more attractive to consumers. The robustness of the model in a free-to-air system is discussed in Section 3.6. Section 3.7 concludes.

Literature overview

This chapter builds on the two-sided market literature initially addressed by Rochet and Tirole (2003, 2006), Caillaud and Jullien (2001, 2003), Anderson and Coate (2005), Evans and Schmalensee (2007), and Armstrong (2006), who analyze network externalities and pricing in different contexts. Applying a general two-sided markets framework to the competition between two media outlets yields a tradeoff between audience and advertising which is well documented in the literature (see for instance Anderson and Gabszewicz, 2006; Dukes and Gal-Or, 2003). On the television market, broadcasters can either sell more advertisement slots and thus increase their revenues from advertising, or reduce the amount of advertisements, which attracts more consumers. In our model as well as in most theoretical contributions, consumers are assumed to consider advertisements as a nuisance (see for instance Zhou, 2004; Anderson and Coate, 2005).[9] This assumption is widely agreed upon when it comes to television advertising. Empirical evidence has for instance been provided by Wilbur (2008) or in an experimental study by Brown and Rothschild (1993).

In the Anderson and Coate (2005) framework, horizontally differentiated media platforms can be accessed for free, but consumers incur nuisance costs from advertisements, and costs from not receiving the preferred program. Reisinger (2011) analyzes a model in which platforms are differentiated from the viewpoint of consumers, but are homogenous for advertisers. He shows that the profits of media outlets may increase, if consumers become more ad-averse, which we also find in our model. Our framework deviates from the above contributions in two main respects: Platforms are heterogeneous not only for consumers but for advertisers as well, which implies that each advertiser has a specific target group among the viewers. Furthermore, in the benchmark case of our model, media outlets are in a pay-TV regime, i.e. they charge positive prices to consumers which can be interpreted as monthly subscription fees for watching the

[9] There are some theoretical contributions that deviate from the assumption of ad-averse consumers and explore the role of consumers' attitude towards advertisements by accounting for ad-loving and ad-neutral individuals (see for instance Sonnac, 2000; Kind and Stähler, 2010; Ferrando et al., 2008).

respective channel. Our modelling of the price setting behavior of media outlets in the pay-TV regime is similar to Peitz and Valletti (2008), who differentiate between pay-TV and free-to-air stations and analyze the advertising intensity as well as the content choice of platforms. They find that there is more advertising in the free-to-air regime, which is in line with the findings of our model.

In contrast to the models endogenizing content quality (as for instance Kind et al., 2007, who analyze the welfare effects of media quality), we assume broadcasting quality to be exogenously fixed. This enables us to obtain robust results that hold even if the quality of the medium without advertisements is maximal. Since consumer utility is strictly increasing in quality, demand for the quality medium without advertisements would be even lower, if the quality was lower.

The way how an advertising ban on a specific type of broadcaster affects the media market has not yet been studied in a theoretical model. Contributions on advertising ban are restricted to analyzing what happens if *all* broadcasters are subject to regulation. Kind et al. (2011) show in a framework where advertisements on a monopoly platform are being taxed that ad-averse consumers do not benefit from this policy, because consumer prices increase. Their result points in a similar direction as our findings. Anderson (2007) is the first to evaluate the effects of advertising caps (time restrictions on the length of advertising breaks) on broadcasting quality in a theoretical model. He assumes viewer utility to strictly increase in broadcasting quality, and shows that advertising caps reduce the broadcasters' incentive to provide high quality contents. In line with our model of a duopoly media market, Anderson (2007) finds that the profits of a monopolist broadcaster are reduced by the advertising cap. The difference to our model is that the advertising caps affecting all broadcasters do not create an asymmetry between the two broadcasters on the market. Our contribution to the literature on the effectiveness of advertising bans is to evaluate the effects of asymmetric advertising restrictions. Since the advertising ban in our model only applies to the high quality broadcaster, the interplay between low quality (commercial) and high quality (public service) broadcasting is accounted for.

3.2 Model setup

We consider a duopoly model of a two-sided media market. Two competing broadcasters (or, more generally, platforms) offer content of a certain quality to viewers (consumers) and advertising space to advertisers (producers). In this section, we specify the decision problems for the three types of agents as well as the structure of the underlying market game.

Broadcasters

Two broadcasters $j \in \{A, B\}$ compete for market shares in the advertising market by offering advertising space, and for market shares in the viewer market by providing contents of quality $x_j \in [0, 1]$. We treat the quality levels as exogenously given and discuss this assumption in detail below and in Section 3.5. The broadcasters' strategic variables are the viewer prices p_j, and the advertising prices τ_j.
To simplify the exposition, the broadcasters' costs are assumed to be zero. With the quality of content being exogenously fixed, quality costs would enter the profit function of the media outlets as fixed costs and thus have no impact on the optimal pricing decision on the submarkets.[10] Marginal costs of additional viewers or advertisers are negligible. Hence, the profit of broadcaster j consists of the revenues generated on the advertising market and on the viewer market:

$$\Pi_j = n_j^{ad} \tau_j + n_j^v p_j, \tag{1}$$

where n_j^{ad} denotes the number of advertisers who place their advertisement on platform j, and n_j^v the number of viewers who choose platform j. Both, the total number of advertisers and the total number of viewers are normalized to unity.
In the free-to-air financing scheme discussed in Section 3.6, the viewer prices p_j are zero. In this section, viewer prices are positive, and can be interpreted in two ways: Viewer prices can either represent monthly subscription fees (for non-public channels), or broadcasting fees (for public service broadcasters), or can be interpreted as pay-per-view access prices per broadcast, as in Peitz and Valletti (2008). Peitz and Valletti (2008) argue that that pay-per-view will become the major way of generating revenues on the consumer side (rather than levying a lump sum fee), as new technologies enable the broadcaster to grant or prevent access to their content conditional on consumers paying a positive price. An additional argument in favor of modeling the consumer side as pay-TV is that it fully internalizes inter-group externalities: If revenues on the viewer side of the quality (public service) broadcaster were generated by fixed broadcasting subsidies, the broadcaster would not have to worry about his performance on the viewer

[10] See Chapter 2 for a model with endogenous quality choice of media outlets in a framework where competition for consumers is horizontal, and advertisers regard platforms as homogenous.

market and thus set advertising prices too low.[11]

Viewers

There is a continuum of viewers who differ with respect to their individual valuation ϑ for the quality of media content, which is uniformly distributed on the unit interval $\vartheta \in [0,1]$. We assume that viewers single-home, i.e. that they are watching no more than one channel in the time period under consideration. The utility $u_{\vartheta,j}$ of viewer ϑ when watching channel j is additively separable in advertising and content provision, and is denoted by

$$u_{\vartheta,j} = \bar{u} + \vartheta x_j - \beta n_j^{ad} - p_j. \tag{2}$$

Gross utility $\bar{u}$ is assumed to be sufficiently large such that, in equilibrium, each consumer has a positive net utility from watching television. For simplicity, we assume that $\bar{u} > 1$ which implies that the viewer market is always covered. The price consumers have to pay to access the services of platform j is denoted by p_j. The utility of each consumer is strictly increasing in the broadcasting quality x_j.[12] As viewers differ with respect to their valuation ϑ of quality, content of differentiated quality is a source of vertical product differentiation on the viewer market.
The number of advertisements n_j^{ad} in medium j exerts a negative externality on its viewers, which is supposed to be linear in our model. The strength of this externality is expressed by the parameter $\beta \in (0,1]$ capturing the marginal nuisance from advertising.[13] We assume that the degree of ad-aversion is the same for all consumers. In the comparative statics part in Section 3.4.1, we analyze how the degree of ad-aversion affects the equilibrium outcomes. The utility consumers receive from consuming an advertised good is assumed to be zero (see the following section for a discussion of the market transactions between consumers and producers).

[11] Assuming that broadcasters receive financing irrespective of their performance on the viewer market does not represent the situation in countries with public service broadcasting, either, since quotas are subject to a strict monitoring process. If the market shares of public service broadcasters dip too low, it becomes questionable whether there still is a case for public financing. Hence, public service broadcasters do seek to maximize their viewer market shares.

[12] The assumption that consumers' utility increases in broadcasting quality is used in a number of contributions, see for instance Anderson (2007).

[13] For empirical evidence for consumers' ad aversion, see for instance Wilbur (2008) who finds that a 10 % increase in advertising time induces an audience loss by 25 %. There are few instances in which viewers are ad-lovers, e.g. in the case of superbowl commercials. Overall, the negative externality clearly dominates such that the restriction to a negative ad externality on consumer utility is uncritical.

Advertisers

There is a continuum of advertisers who differ with respect to the type of the good they produce, $\gamma \in [0,1]$, which is uniformly distributed on the unit interval. We assume that advertisers are single-homing as well, i.e. that they face a discrete choice between either placing an advertisement on platform A or B, or not entering the advertising market. The profit of advertiser γ when advertising on channel j is

$$\pi_{\gamma,j} = \bar{a} + \delta n_j^v - |\gamma - x_j| - \tau_j, \tag{3}$$

and $\pi_\gamma = 0$ when abstaining from the advertising market. The parameter $\bar{a}$ accounts for the fact that advertisers may derive a reputational gain from advertising per se, which is not directly reflected in the profits from selling the advertised product. In Section 3.3.1, we consider a situation in which $\bar{a}$ is sufficiently high such that, in equilibrium, entering the advertising market is always profitable for every advertiser. We then allow for market abstention by setting $\bar{a} = 0$ (Section 3.3.2). The price for placing an advertisement on platform j is denoted by τ_j.
The strength of the externality the number of consumers n_j^v exerts on the revenues of advertisers on platform j is expressed by the ad effectiveness parameter $\delta \in (0,1]$. It may be interpreted as the fraction of viewers who buy the advertised products. The stronger this externality, i.e. the higher δ, the more valuable is an advertisement to the advertisers, as it represents the receptiveness of consumers towards advertisements in general. This formulation may serve as a shortcut for an explicit model of the market transactions between consumers and producers: Advertisers are monopolists for the variety γ of the good they produce at zero marginal costs. Via advertising, a producer informs viewers (i.e. prospective consumers) about the existence of this product. Consumers' expected willingness to pay, which is denoted by k, for each producers' good is assumed to equal 1.[14] It can be fully extracted by the producer, if the respective consumer becomes aware of the existence of the product. In this context, δ may be understood as the probability that a consumer becomes aware of the existence of a product, if he is exposed to the respective advertisement (for an

[14]This is a simplifying assumption in order to keep the analysis tractable. In reality, one might expect a user's expected willingness to pay k for a certain product to increase in both γ (if interpreted as a signal for the quality of the product) and ϑ (if interpreted as a signal for the individual's general valuation of quality). However, this effect is mitigated by the fact that, due to income effects, in reality the distribution of the users' valuation ϑ follows some left skewed income distribution rather than the uniform distribution used in the model.

analytical outline of the market transactions between consumers and producers, see also Reisinger, 2011).

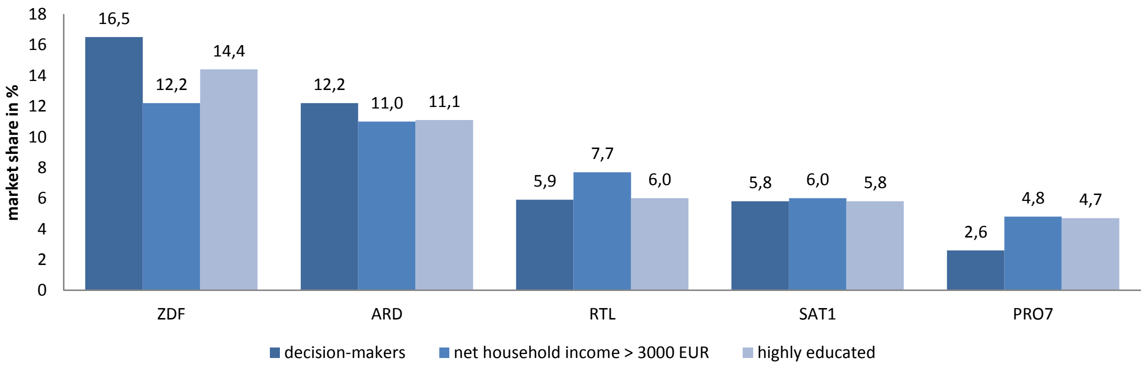
The advertiser's profits are negatively related to the distance $|\gamma - x_j|$ between the quality level that is optimal for a successful marketing of his type of product γ, and the broadcasting quality x_j offered by the respective broadcaster. In other words, content of differing quality is a source of horizontal product differentiation on the advertiser market. There are at least two possible economic interpretations of how the advertisers' type of product γ can be used for modeling a targeted advertising motive. First, the type γ of the product can be interpreted as the advertisers' intended or perceived image of his product. When placing his advertisement on a certain platform, the advertiser suffers from the discrepancy between his preferred image and the image conveyed by the medium which is closely related to the quality of content it offers.

Second, γ can represent the quality of the advertiser's product. If there is a positive correlation between the consumers' tastes for quality when choosing a media platform and when consuming other goods, the advertiser's type will determine his target group: For example, a high quality advertiser tries to make use of the fact that consumers with a high willingness to pay for high quality broadcasts also have a higher willingness to pay for his good than consumers who watch the low quality broadcast. Hence, the type of an advertiser translates directly into his preferred broadcasting quality.

For the German market, there is evidence suggesting that potential buyers of high quality goods prefer high quality over low quality television channels. Public service broadcasters (*ARD* and *ZDF*) who provide high quality broadcasts, have a significantly larger share in the viewer market of highly educated and high-income individuals than the largest competing commercial channels. Figure 3.1 illustrates the market shares of the two German public service broadcasters *ARD* and *ZDF* compared to the three largest commercial channels *RTL*, *SAT1* and *PRO7* in the target groups of decision makers, households with a monthly net income higher than 3000 EUR, and the group of highly-educated individuals for the time slot of 5pm through 8pm.[15]

[15]We chose this time slot over the 8pm-11pm slot in order to avoid distortions induced by the public service broadcasters not carrying advertisements.

Figure 3.1: Market shares per target group



Note: Decision makers are individuals who run intermediate to large businesses, higher officials, or managers. Individuals qualify as highly educated when having passed the German A-levels (Abitur). The data is based on a 2007 survey of the AGF/GfK Fernsehforschung, available through ZDF Werbefernsehen (2008).

Modeling targeted advertising as a source of horizontal product differentiation on the advertiser market in the sense that each advertiser intends to achieve the closest possible match between the quality of the media broadcast and the type of his product, captures the fact that advertisers value not only the size of the group of viewers who are exposed to their advertisement, but also the profile of this group.[16]

Game structure and further assumptions

In our model, the broadcasting quality is exogenous. More specifically, we assume that when broadcasters decide on their program quality (in an early stage of the game not modeled here), they choose maximum differentiation with one broadcaster offering the lowest possible quality ($x_A = 0$) and the other broadcaster offering the highest possible quality ($x_B = 1$). The reason for fixing the quality levels at the extremes is the following: One aim of the chapter is to analyze the effects of an advertising ban on the high quality medium B on the viewers' demand. Since consumers *ceteris paribus* prefer high quality over low quality, and no advertisements over any positive amount of

[16]For empirical evidence on advertisers' preference for reaching members of their target group, see Chandra and Kaiser (2011). They find that advertising prices in magazines with a homogenous group of consumers are higher than in magazines with heterogeneous readers, as advertisers have a higher willingness to pay for reaching their target group than for reaching any other consumers.

advertisements, the combination of the highest possible quality and no advertising (as in medium B when the advertising ban is in place) is the most appealing of all quality-advertising combinations. This guarantees that any eventual decrease in viewer market shares of the quality medium induced by the advertising ban is not due to (changes in) the quality settings.

The timing of the game is as follows: In the first stage, both media outlets simultaneously choose prices on the viewer market, and in the second stage, media outlets simultaneously choose prices on the advertising market. This sequential setting accounts for the fact that advertising prices are changed more frequently than viewer prices.[17] In stage three, viewers and advertisers simultaneously choose a platform. The game is solved via backward induction.

For the structure of the market equilibrium, the relation of the externality parameters β and δ is crucial. We assume that the effectiveness δ of an advertisement is always larger than the nuisance β induced by the advertisement, which makes sure that there is always some producer who finds it profitable to advertise in equilibrium. Put differently, this assumption rules out equilibria without advertising activities.[18]

3.3 Equilibria in pay-TV systems with and without an advertising ban

In this section, we derive the market equilibria that evolve under three different regimes denoted by *sym1*, *sym2* and *asym*. Under the symmetric advertising regimes *sym1* and *sym2*, we analyze situations in which both broadcasters are allowed to sell advertising slots without any restrictions.

In the first case of symmetric advertising (*sym1*), we assume that the reputational gain from advertising $\bar{a}$ is sufficiently high to ensure market coverage. In this situation, all producers decide to advertise either on channel A or B, which implies that the broadcasters' shares on the advertising market are determined by some marginal advertiser $\hat{\gamma}$ who is indifferent between placing his advertisement on channel A or B.

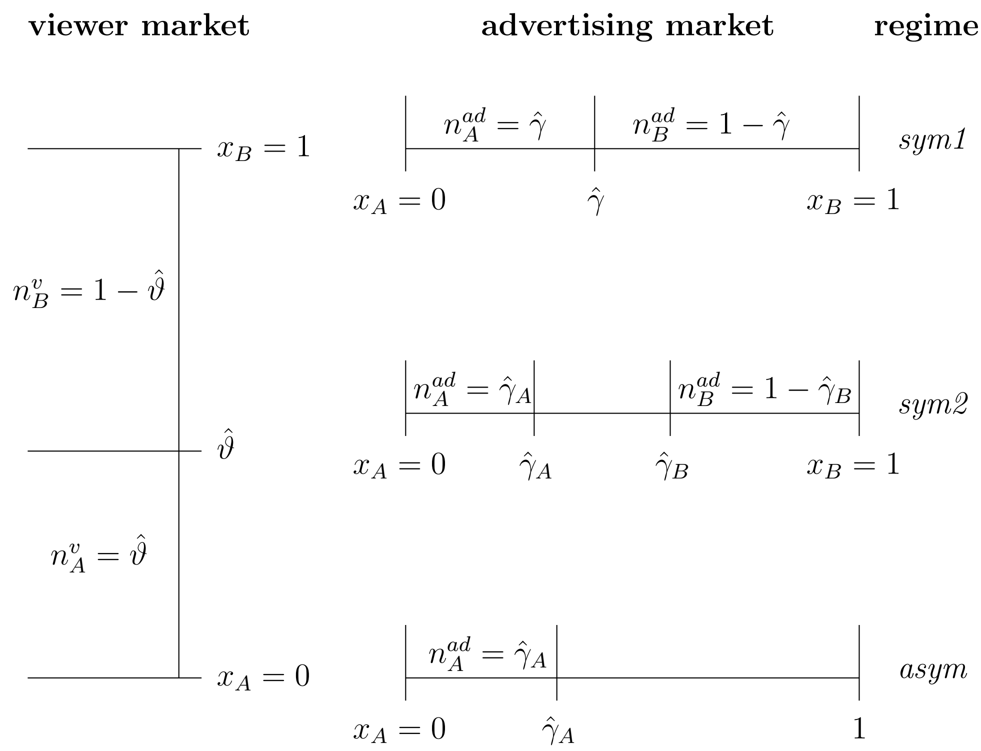
In the second case of symmetric advertising (*sym2*), we allow for abstention in the

[17]Note that advertising prices are often determined with respect to market shares on the viewer market which are subject to fluctuations.

[18]For $\delta < \beta$, the net effect of advertising is negative for media outlets, as the negative externality of an additional advertisement on viewer utility is larger than the positive effect on advertisers' profits. Hence, media outlets set prices such that, for the difference between β and δ being sufficiently large, no advertiser buys an advertising slot in equilibrium.

advertising market by setting $\bar{a} = 0$. Given the horizontal structure of the advertising market with maximum differentiation, the extreme types of producers advertise whereas the intermediate types abstain from the market. As advertiser $\hat{\gamma}_j$ is indifferent between advertising on channel $j \in \{A, B\}$ and not entering the advertising market, there are two marginal advertisers who define the market shares of the broadcasters.
Under regime *asym*, only the low quality medium A is allowed to enter the advertising market, as an advertising ban on the high quality medium B is in place. We refer to this case as asymmetric advertising. In this situation, the advertising market share of broadcaster B is zero, and A's market shares are derived according to the marginal advertiser $\hat{\gamma}_A$ who is indifferent between advertising on channel A and not placing an advertisement.
As mentioned above, we assume in all scenarios that the market for viewers is covered. Therefore, under all regimes, the broadcasters' shares on the viewer market are determined by the marginal consumer $\hat{\vartheta}$ who is indifferent between watching broadcast A or B. The demand structure of the two market sides under the different regimes is summarized in Figure 3.2.

Figure 3.2: Demand structures under the different regimes



As the derivation of the equilibrium is similar for the three regimes, we present it in more detail only for *sym1*, and then just sketch it for regime *asym*. The derivation of the *sym2*-equilibrium can be found in Section A1 of the Appendix.

3.3.1 Symmetric advertising without market abstention (*sym1*)

In the third stage of the game, viewers and advertisers simultaneously choose a platform. Advertiser $\hat{\gamma}$ is indifferent between placing his ad on platform A or B if the following condition holds:

$$\pi_A = \pi_B \qquad \Leftrightarrow \qquad \delta(n_A^v - n_B^v) + (x_B - \hat{\gamma}) - (\hat{\gamma} - x_A) = \tau_A - \tau_B. \tag{4}$$

Since all types of advertisers with $\gamma \leq \hat{\gamma}$ prefer to advertise on channel A, and all types of advertisers with $\gamma > \hat{\gamma}$ prefer channel B, the demand for advertisements in medium j is

$$\begin{aligned} n_A^{ad}(n_A^v, n_B^v) &= \hat{\gamma} = \frac{\delta\,(n_A^v - n_B^v) - \tau_A + \tau_B + (x_A + x_B)}{2}, \\ n_B^{ad}(n_A^v, n_B^v) &= 1 - \hat{\gamma} = \frac{2 - \delta\,(n_A^v - n_B^v) + \tau_A - \tau_B - (x_A + x_B)}{2}. \end{aligned} \tag{5}$$

Viewer $\hat{\vartheta}$ is indifferent between watching channel A and B, if the following condition holds:

$$u_A = u_B \qquad \Leftrightarrow \qquad \hat{\vartheta}(x_B - x_A) + \beta(n_A^{ad} - n_B^{ad}) = p_B - p_A. \tag{6}$$

Consumers choose medium A, if their marginal willingness to pay for quality is lower than that of the marginal consumer, i.e. if $\vartheta \leq \hat{\vartheta}$, and choose medium B otherwise:

$$\begin{aligned} n_A^v(n_A^{ad}, n_B^{ad}) &= \hat{\vartheta} = \frac{p_B - p_A - \beta(n_A^{ad} - n_B^{ad})}{x_B - x_A}, \\ n_B^v(n_A^{ad}, n_B^{ad}) &= 1 - \hat{\vartheta} = \frac{x_B - x_A - p_B + p_A + \beta(n_A^{ad} - n_B^{ad})}{x_B - x_A}. \end{aligned} \tag{7}$$

Substituting (5) in (7), and solving for the viewers' and advertisers' demand for medium j, with $x_A = 0$ and $x_B = 1$, we obtain:

$$\begin{aligned} n_A^v(p_A, p_B, \tau_A, \tau_B) &= \frac{p_B - p_A + \beta(\delta + \tau_A - \tau_B)}{1 + 2\beta\delta}, \\ n_B^v(p_A, p_B, \tau_A, \tau_B) &= \frac{1 + p_A - p_B + \beta(\delta - \tau_A + \tau_B)}{1 + 2\beta\delta}, \\ n_A^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{1 + 2\delta(\beta - p_A + p_B) - \delta - \tau_A + \tau_B}{2(1 + 2\beta\delta)}, \\ n_B^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{1 + 2\delta(\beta + p_A - p_B) + \delta + \tau_A - \tau_B}{2(1 + 2\beta\delta)}. \end{aligned} \tag{8}$$

In the second stage of the game, both broadcasters simultaneously set their prices on the advertising market. We take the results from Eq. (8), and substitute them into the profit function of broadcaster j as given by Eq. (1). Maximizing the broadcasters' profits with respect to the advertising prices τ_j yields the following optimal prices:

$$\begin{aligned} \tau_A(p_A, p_B) &= 1 - 2\beta\delta + \frac{2\left[p_A(2\beta - \delta) + p_B(\beta + \delta)\right] - \delta}{3}, \\ \tau_B(p_A, p_B) &= 1 - 2\beta\delta + \frac{2\left[p_B(2\beta - \delta) + p_A(\beta + \delta)\right] - \delta}{3}. \end{aligned} \tag{9}$$

In the first stage, the broadcasters simultaneously set their prices on the viewer market. We substitute Eq. (9) into the profit function (1) which then is maximized with respect to p_j. This yields the following viewer prices:[19]

$$\begin{aligned} p_A^{sym1} &= \frac{1}{4} + \frac{\beta - 2\delta}{3} + \frac{9 - 8\beta^2 + 10\beta\delta}{4\Delta^{sym1}}, \\ p_B^{sym1} &= \frac{3}{4} + \frac{\beta - 2\delta}{3} - \frac{9 - 8\beta^2 + 10\beta\delta}{4\Delta^{sym1}}, \end{aligned} \tag{10}$$

where $\Delta^{sym1} \equiv 27 - 8\beta^2 + 38\beta\delta - 8\delta^2 > 0$.

[19]Note that the second order conditions are fulfilled as $\frac{\partial^2 \Pi_A}{\partial p_A^2} \mid_{p_A^{sym1}} = -\frac{18 + 4(7\beta\delta - \beta^2\delta^2)}{9(1+2\beta\delta)} < 0$ and $\frac{\partial^2 \Pi_B}{\partial p_B^2} \mid_{p_B^{sym1}} = -\frac{18 + 4(7\beta\delta - \beta^2\delta^2)}{9(1+2\beta\delta)} < 0$.

The advertising prices are obtained by substituting these viewer prices into Eq. (9) which yields:

$$\begin{aligned}\tau_A^{sym1} &= 1+\frac{5\beta}{4}+\frac{2\beta\left(\beta+\delta\right)}{3}-\frac{12\delta+\beta\left(39-8\beta^2+46\beta\delta\right)}{4\Delta^{sym1}},\\ \tau_B^{sym1} &= 1+\frac{3\beta}{4}+\frac{2\beta\left(\beta+\delta\right)}{3}+\frac{12\delta+\beta\left(39-8\beta^2+46\beta\delta\right)}{4\Delta^{sym1}}.\end{aligned}\tag{11}$$

Substituting the viewer and advertising prices into the viewer market shares as well as into the advertising market shares (Eq. 8), we find that

$$\begin{aligned}n_A^{v,sym1} &= \frac{1}{2}-\frac{9+4\beta\left(\beta+\delta\right)}{2\Delta^{sym1}}, & n_B^{v,sym1} &= \frac{1}{2}+\frac{9+4\beta\left(\beta+\delta\right)}{2\Delta^{sym1}},\\ n_A^{ad,sym1} &= \frac{1}{2}+\frac{3\left(2\beta-\delta\right)}{2\Delta^{sym1}}, & n_B^{ad,sym1} &= \frac{1}{2}-\frac{3\left(2\beta-\delta\right)}{2\Delta^{sym1}}.\end{aligned}\tag{12}$$

We substitute the equilibrium prices and quantities on both markets into Eq. (1), and obtain the following profits:

$$\begin{aligned}\Pi_A^{sym1} &= \frac{5}{8}+\frac{\beta(9+4\beta)}{12}+\frac{\delta(\beta-1)}{3}-\Phi^{sym1},\\ \Pi_B^{sym1} &= \frac{7}{8}+\frac{\beta(7+4\beta)}{12}+\frac{\delta(\beta-1)}{3}-\Phi^{sym1},\end{aligned}\tag{13}$$

where $\Phi^{sym1} \equiv \frac{1}{32}\left[\frac{9\left[8\beta^4-18-43\beta^2-10\beta\delta\left(4+7\beta^2\right)\right]}{(\Delta^{sym1})^2}+\frac{18+36\beta(2+\delta)+\beta^2(80\delta-23-64\beta)}{\Delta^{sym1}}\right]$.

The qualitative characteristics of this equilibrium is discussed in Section 3.3.4 in order to account for similarities and differences across the regimes derived in the following sections.

3.3.2 Symmetric advertising with market abstention (*sym2*)

Regime *sym2* represents the case in which $\bar{a} = 0$, which implies that there are no profit-increasing reputational effects from advertising per se. In this case, advertisers from the center of the distribution who have to incur high transportation costs due to the media outlets being located at either $x_A = 0$ or $x_B = 1$, prefer not to enter the

market. Put differently, regime *sym2* describes a situation in which market abstention of advertisers arises in equilibrium. The results provide an equal ground for comparing the symmetric case to the asymmetric case of the following subsection, where market abstention of advertisers arises because of an advertising ban.
The derivation of the equilibrium is along the line of the previous section. As the results do not vary qualitatively from those obtained above, the mathematical solution can be found in Section A1 of the Appendix.

3.3.3 Asymmetric advertising with an advertising ban on broadcaster B (*asym*)

Under regime *asym*, only the low quality medium is allowed to enter the advertising market. In the first stage of the game, both broadcasters set prices on the viewer market, and in the second stage, broadcaster A chooses his advertising price. The third stage is similar to the *sym2*-regime where advertisers decide whether to enter the advertising market by placing their advertisement in broadcast A, or to abstain from advertising, and viewers decide which channel to watch. Again, there is no additional gain from advertisement, i.e. $\bar{a} = 0$.
Analogically to the *sym1*-scenario, there is the possibility of setting $\bar{a}$ sufficiently high such that the advertising market is always covered. This scenario will arise, if the advertiser whose distance costs are minimized at the highest broadcasting quality $\gamma = 1$ prefers advertising on platform A over abstaining from the market.[20] If this is the case, broadcaster A's profits are strictly increasing in τ_A, and consumers' platform choice is determined exclusively by the prices and the quality of contents. We consider the assumption of full market coverage on the advertising market to be quite artificial in a scenario with only one platform to advertise on, as there is always an outside option for advertisers, such as billboards, or display advertising. We therefore exclude it from the analysis in this section, but nevertheless provide the derivation of the equilibrium in Section A2 of the Appendix.
In the situation where market abstention of advertisers is allowed ($\bar{a} = 0$), the marginal advertiser $\hat{\gamma}_A$ is indifferent between advertising on channel A and abstaining from advertising, if

$$\pi_A = 0 \qquad \Leftrightarrow \qquad \delta n_A^v - \tau_A - (\hat{\gamma}_A - x_A) = 0, \tag{14}$$

with $x_A = 0$.

[20]From Eq. (3) follows that $\bar{a} \geq 1 - \delta n_A^v + \tau_A$ for all advertisers to be located on platform A.

Accordingly, the fraction of of advertisers placing their advertisement on platform A is given by

$$n_A^{ad} = \hat{\gamma}_A = \delta n_A^v - \tau_A. \tag{15}$$

Inserting (15) and $n_B^{ad} = 0$ into Eq. (6), and solving for the the market share of medium A on the viewer market, we obtain

$$\begin{aligned} n_A^v (p_A, p_B, \tau_A) &= \hat{\vartheta} = \frac{\beta\tau_A - p_A + p_B}{1 + \beta\delta}, \\ n_B^v (p_A, p_B, \tau_A) &= 1 - n_A^v = \frac{1 + \beta(\delta - \tau_A) + p_A - p_B}{1 + \beta\delta}. \end{aligned} \tag{16}$$

With an advertising ban on broadcaster B, the profit functions are now:

$$\Pi_A^{asym} = n_A^{ad}\tau_A + n_A^v p_A, \qquad \Pi_B^{asym} = n_B^v p_B. \tag{17}$$

Plugging the demand functions of Eq. (15) and (16) into the profit function (17) of broadcaster A and maximizing it with respect to the optimal advertising price τ_A yields:

$$\tau_A (p_A, p_B) = \frac{(\beta - \delta) p_A + \delta p_B}{2}. \tag{18}$$

We insert (18) in the profit function (17), and maximize it with respect to the prices:[21]

$$\begin{aligned} p_A^{asym} &= \frac{2(1+\beta\delta)[2 - (\delta - \beta)\delta]}{\Delta^{asym}}, \qquad p_B^{asym} = \frac{2(1+\beta\delta)[4 - (\beta - \delta)^2]}{\Delta^{asym}}, \\ \tau_A^{asym} &= \frac{2(1+\beta\delta)(\beta + \delta)}{\Delta^{asym}}, \end{aligned} \tag{19}$$

where $\Delta^{asym} \equiv 12 - \beta\delta(12 - \beta^2 - \delta^2) - 2[\delta^2 - \beta^2(\delta^2 - 1)]$.

[21]Note that the second order conditions are fulfilled as $\frac{\partial^2 \Pi_A}{\partial p_A^2}\,|_{p_A^{asym}} = -\frac{4-(\beta-\delta)^2}{2(1+\beta\delta)} < 0$ and $\frac{\partial^2 \Pi_B}{\partial p_B^2}\,|_{p_B^{asym}} = -1 - \frac{1}{1+\beta\delta} < 0$.

This yields the following market shares:

$$n_A^{v,asym} = \frac{4(1+\beta\delta)}{\Delta^{asym}}, \qquad n_B^{v,asym} = 1 - \frac{4(1+\beta\delta)}{\Delta^{asym}}, \qquad n_A^{ad,asym} = \frac{2(1+\beta\delta)(\delta-\beta)}{\Delta^{asym}}. \tag{20}$$

With these results, we are able to compute the profits of the broadcasters:

$$\begin{aligned} \Pi_A^{asym} &= \frac{4\left[4-(\beta-\delta)^2\right](1+\beta\delta)^2}{(\Delta^{asym})^2}, \\ \Pi_B^{asym} &= \frac{2\left[(\beta-\delta)^2-4\right]^2(1+\beta\delta)(2+\beta\delta)}{(\Delta^{asym})^2}. \end{aligned} \tag{21}$$

3.3.4 Characterization of the equilibria

We now use the results derived so far to compare the equilibrium values for broadcasters A and B within the three regimes.

Proposition 4 *For all $\beta \in (0,1]$ and $\delta \in (0,1]$ with $\delta > \beta$, in equilibrium,*

- *the high quality broadcaster B has higher profits, sets higher prices on the viewer market, and serves a larger part of the viewer market than broadcaster A in all regimes.*
- *the high quality broadcaster B sets higher prices on the advertising market than broadcaster A in the symmetric regimes.*
- *the high quality broadcaster B has larger advertising market shares than broadcaster A under regime sym2, but may have lower advertising market shares than under regime sym1.*

Proof. See Section A3 of the Appendix. ■

The results of Proposition 4 are summarized in Table 3.1.

Table 3.1: Comparison within regimes

Regime:	Sym1	Sym2	Asym
Viewer prices	$p_A < p_B$	$p_A < p_B$	$p_A < p_B$
Advertising prices	$\tau_A < \tau_B$	$\tau_A < \tau_B$	$(\tau_A > 0)$
Viewer market shares	$n_A^v < n_B^v$	$n_A^v < n_B^v$	$n_A^v < n_B^v$
Advertising market shares	$n_A^{ad} \gtreqless n_B^{ad}$	$n_A^{ad} < n_B^{ad}$	$(n_A^{ad} > 0)$
Profits	$\Pi_A < \Pi_B$	$\Pi_A < \Pi_B$	$\Pi_A < \Pi_B$

Note: In this table, we compare equilibrium values of both broadcasters in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

As known from textbook models of vertical product differentiation in one-sided markets, selling the high quality product is an advantage that allows for setting higher prices and leads to higher profits.[22] In the symmetric regimes, the advantage of medium B offering high quality content to consumers is carried over from the viewer market to the advertising market. Since all consumers *ceteris paribus* prefer high over low quality, the high quality medium B attracts more viewers and thereby more advertisers, too. Consequently, B is able to set higher prices than the low quality medium A on both markets and earns higher profits.[23] The negative effect on B's viewer demand due to charging higher viewer prices than A is of second order.

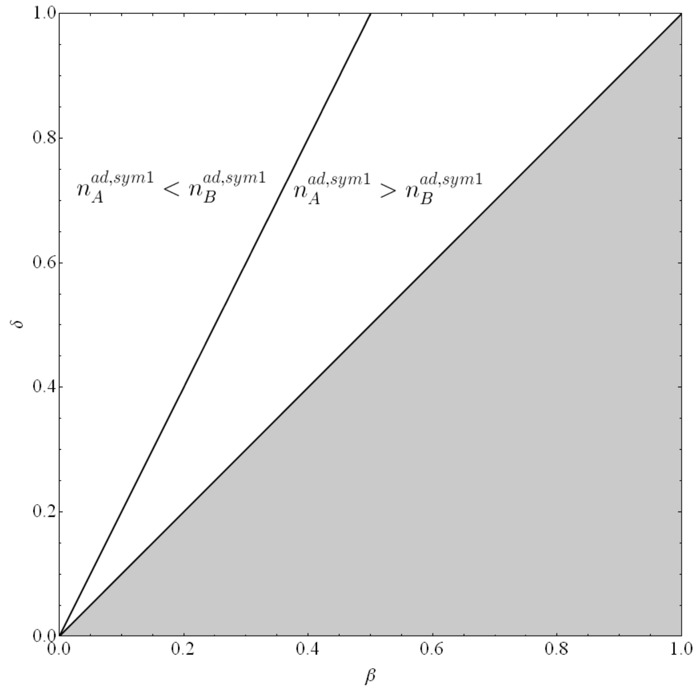
If there is no market abstention on the advertising market (regime *sym1*), and the potential gains from advertising as expressed by the ad effectiveness δ are small, advertisers switch from the more expensive platform B to A (see Figure 3.3). In this case,

[22]Hence, in a model with endogenous choice of quality, a Nash equilibrium with maximum vertical differentiation emerges as the solution of a coordination game similar to the famous *Battle of the Sexes*.

[23]Note that the results with respect to the broadcaster' profits are partly driven by the assumption that there are no quality costs in our framework.

A serves the larger part of the advertising market than B despite its disadvantage in the quality dimension.

Figure 3.3: Ad demand in regime sym1



Note: This figure illustrates the demand for advertising space in the equilibrium of the symmetric model without market abstention (regime *sym1*).

3.4 The role of the externalities

In this section, we conduct a comparative statics analysis with respect to the strength of the externalities. In Section 3.4.1, we analyze the impact of an increase in the negative externality of advertisements on viewer utility. The effects of an increase in the positive externality of the number of viewers on advertisers' profits is discussed in Section 3.4.2.

3.4.1 Effects of an increase in the negative externality β

Proposition 5 *As the size of the negative externality β increases, the equilibrium values evolve as follows:*

- ***Prices and profits***

  In all three regimes, both broadcasters set higher prices on both markets (where possible), and earn higher profits.

- ***Advertising market shares***

  sym1*: The low quality broadcaster A gains market shares at the expense of broadcaster B.*

  sym2*: The high quality broadcaster B loses market shares while the effects are ambiguous for broadcaster A.*

  asym*: The low quality broadcaster A loses market shares.*

- ***Viewer market shares***

  sym1*: For any given* $\delta \in (0, 1]$*, the low quality broadcaster A gains market shares at the expense of broadcaster B if and only if* $\beta < \hat{\beta}^{sym1}$*. The threshold level* $\hat{\beta}^{sym1}$ *is increasing in* δ*.*

  sym2*: The low quality broadcaster A gains market shares at the expense of the broadcaster B on the whole parameter range.*

  asym*: For any given* $\delta \in (0, 1]$*, the low quality broadcaster A gains market shares at the expense of broadcaster B if and only if* $\beta > \hat{\beta}^{asym}$*. The threshold level* $\hat{\beta}^{asym}$ *is increasing in* δ*.*

Proof. See Section A4 of the Appendix. ■

The results of Proposition 5 are summarized in Table 3.2.

An increase in the nuisance cost β alters the platform decision of viewers such that the relative importance of (ad-free) contents increases, and the relative importance of low viewer prices decreases. When competing for viewers, broadcasters now have a stronger incentive to reduce the number of advertisements but a weaker incentive to set low viewer prices. Put differently, since by assumption viewers do not abstain from the market, higher nuisance costs relax price competition on both sides of the market. On the advertising side of the market, broadcasters increase their prices in order to reduce the number of advertisements, whereas on the viewer side of the market, the fact that low prices are less important for consumers' decision allows for higher prices. Due to the relaxed price competition (on both sides of the market), the profits of both broadcasters increase.

Table 3.2: Increase in the negative externality

Partial derivative with respect to β

Regime:	Sym1		Sym2		Asym	
Broadcaster:	A	B	A	B	A	B
Viewer prices	$\frac{\partial p_A}{\partial \beta} > 0$	$\frac{\partial p_B}{\partial \beta} > 0$	$\frac{\partial p_A}{\partial \beta} > 0$	$\frac{\partial p_B}{\partial \beta} > 0$	$\frac{\partial p_A}{\partial \beta} > 0$	$\frac{\partial p_B}{\partial \beta} > 0$
Ad prices	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	—
Viewer market shares	$\frac{\partial n_A^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \beta} \gtreqless 0$
Ad market shares	$\frac{\partial n_A^{ad}}{\partial \beta} > 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} < 0$	—
Profits	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$

Note: This table illustrates the effects of an increase in the size of the negative externality on consumer utility, β. We compare the effects on equilibrium values of each broadcaster in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

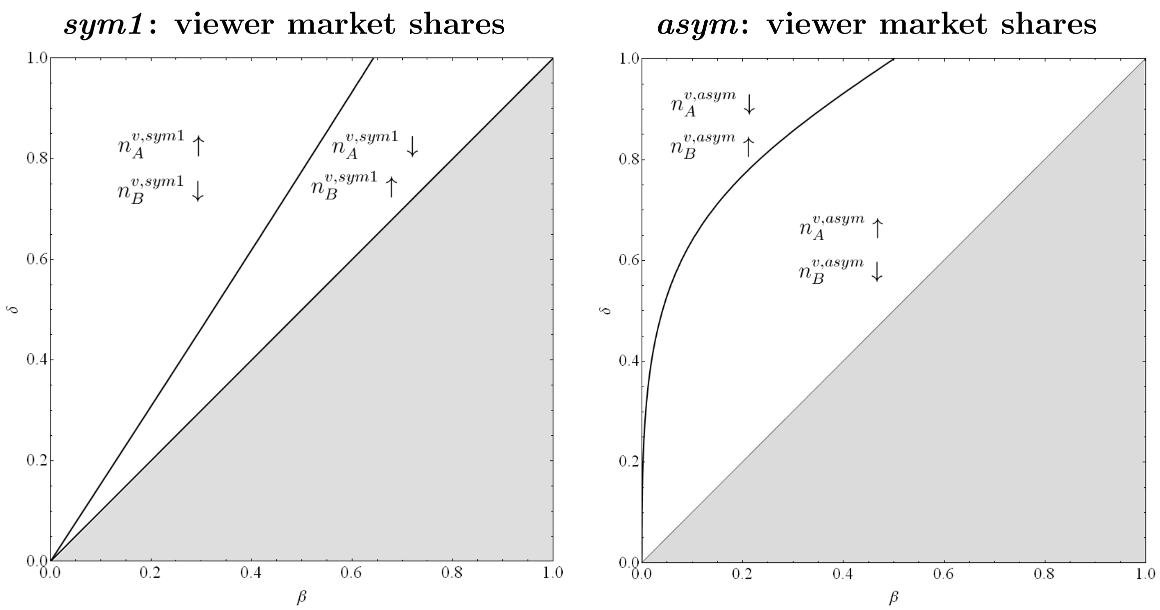
The price increase on the advertising market induces a shift in the identity of the pivotal advertiser such that the previous pivotal advertiser either switches to the cheaper platform A (regime *sym1*), or exits the market (*sym2* and *asym*). In the regimes with market abstention, both broadcasters lose advertising market shares on virtually the whole parameter range under regime *sym2*, and the advertising market shares of A decrease under regime *asym*.[24]

Starting from equilibrium, the previous marginal viewer in all scenarios *ceteris paribus* switches to the channel with the smaller number of advertisements, once β is raised. The scenarios vary, however, with respect to the platform containing the smaller number of advertisements. As we have seen in the previous section (see Table 3.1), broadcaster A provides the platform with the smaller number of advertisements under regime *sym2*. Under regime *sym1*, B contains less advertisements than A, if and only if β is

[24]The small parameter range in which advertising market shares of broadcaster A increase in β under regime *sym2* arises due to an increase of A's viewer market share countervailing the rising advertising price.

sufficiently large compared to δ.[25] Due to the advertising ban, A is the platform carrying more advertisements in the asymmetric scenario. In the cases where B is the platform containing less advertisements than A, there is, from the consumers' perspective, a trade-off between the lower number of advertisements and the higher price than on platform A.[26] This leads to ambiguous effects of an increase in β on viewer market shares, as illustrated in Figure 3.4. The intensity of this trade-off, however, changes as β increases. In the *sym1*-regime, for instance, B's consumer price increases in β, but the number of advertisements decreases. For a given δ, such a reduction of advertising volume attracts the more viewers the higher the nuisance parameter β (see the right panel of Figure 3.4). This effect is likely to dominate the evolution of viewer market shares if β is sufficiently large compared to δ.

Figure 3.4: Ambiguous effects of an increase in β



Note: This figure illustrates the effects of an increase in β on viewer market shares in regime *sym1* (left panel), and in regime *asym* (right panel). The area denoting combinations of β and δ for which $n_i^{v,r}$ is increasing (decreasing) in β is indicated by $n_i^{v,r} \uparrow$ ($n_i^{v,r} \downarrow$) with $i \in \{A, B\}$ and $r \in \{sym1, asym\}$.

[25] Figure 3.3 captures the exact movement of viewer market shares in this case.

[26] Note that B's price is not only higher than the price of platforms A, but also increasing in β.

3.4.2 Effects of an increase in the positive externality δ

An increase in the ad effectiveness δ can for instance be triggered by choosing popular instead of unknown testimonials for advertisements, by an increase in the screen size of the average TV set, by improving on the timing of advertisement slots (for instance by airing them at the same time as the advertisement slots of the competing channels), or by interactive forms of advertising (lottery games). In the following, we discuss how such an increase affects equilibrium values.

Proposition 6 *As the size of the positive externality δ increases, the equilibrium values evolve as follows:*

- ***Prices and profits***

  Under all regimes, both broadcasters set higher prices on the advertising market (where possible). The effects on viewer prices and profits are often ambiguous as depicted in Table 1.3.

- ***Advertising market shares***

  sym1*: The market shares of the low quality broadcaster A decrease while B's market shares increase.*

  sym2 and asym*: The market shares of both broadcasters increase.*

- ***Viewer market shares***

  sym1 and sym2*: For any given $\delta \in (0, 1]$, the high quality broadcaster B gains market shares at the expense of A if and only if $\beta < \tilde{\beta}^{sym1}$, or $\beta < \tilde{\beta}^{sym2}$, respectively. Both threshold levels are increasing in δ.*

  asym*: Broadcaster A gains market shares at the expense of broadcaster B on the whole parameter range.*

Proof. See Section A5 of the Appendix. ■

The results of Proposition 6 are summarized in Table 3.3.

Table 3.3: Increase in the positive externality

Partial derivative with respect to δ

Regime:	Sym1		Sym2		Asym	
Broadcaster:	A	B	A	B	A	B
Viewer prices	$\frac{\partial p_A}{\partial \delta} < 0$	$\frac{\partial p_B}{\partial \delta} < 0$	$\frac{\partial p_A}{\partial \delta} \gtreqless 0$	$\frac{\partial p_B}{\partial \delta} < 0$	$\frac{\partial p_A}{\partial \delta} < 0$	$\frac{\partial p_B}{\partial \delta} \gtreqless 0$
Ad prices	$\frac{\partial \tau_A}{\partial \delta} > 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	—
Viewer market shares	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} > 0$	$\frac{\partial n_B^v}{\partial \delta} < 0$
Ad market shares	$\frac{\partial n_A^{ad}}{\partial \delta} < 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	—
Profits	$\frac{\partial \Pi_A}{\partial \delta} < 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_A}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_A}{\partial \delta} > 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$

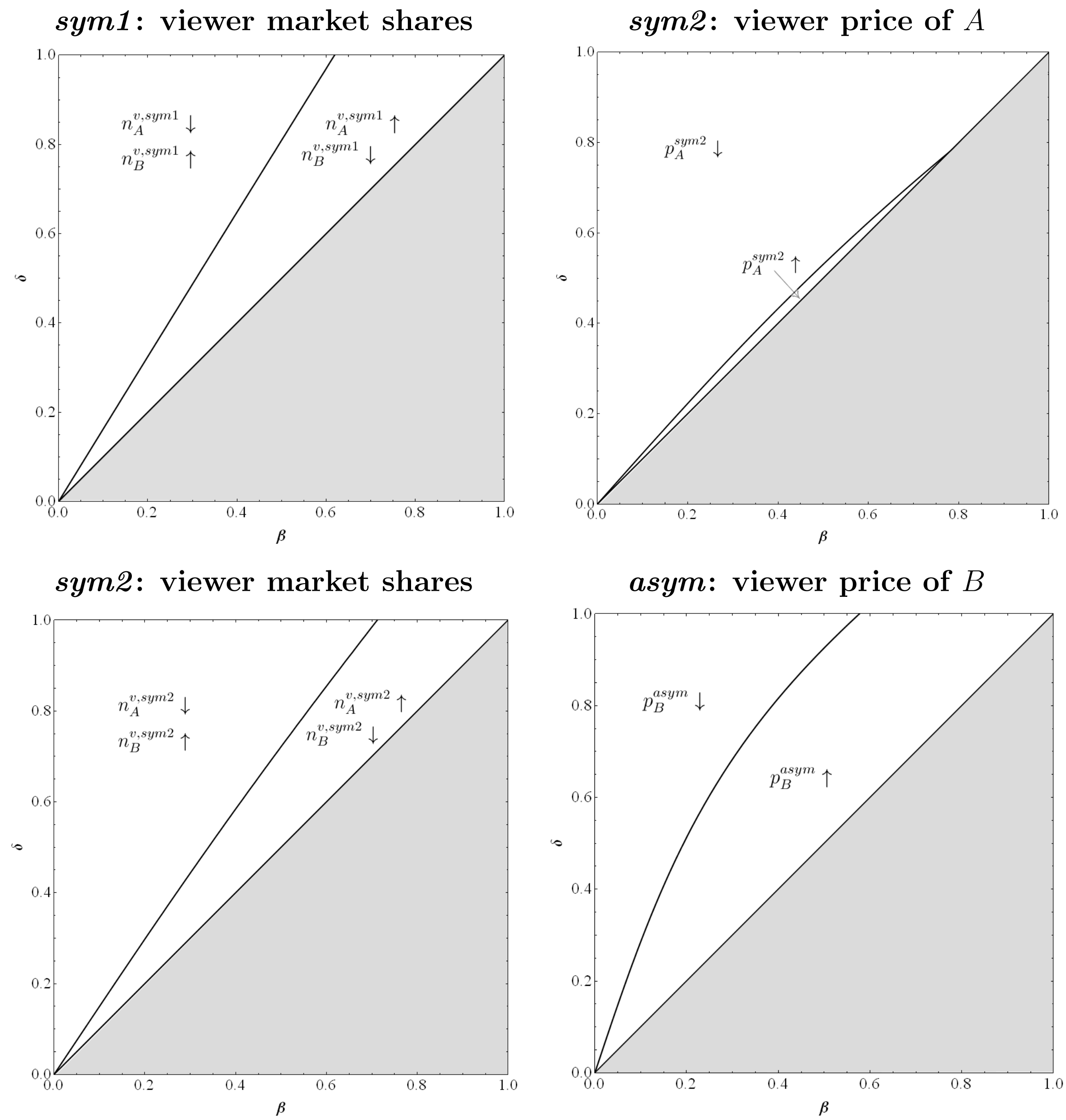
Note: This table illustrates the effects of an increase in the size of the size of positive externality the number of viewers exerts on advertisers' profits, δ. We compare the effects on equilibrium values of each broadcaster in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

An increase in the intensity of the positive externality δ affects the relative weights of the components in the profit function of advertisers such that the relative importance of the number of viewers increases whereas the relative importance of low ad prices decreases. For the broadcasters, this shift intensifies price competition in the viewer market, and weakens price competition in the advertising market. This affects the evolution of advertising and viewer prices as follows: Relaxed price competition in the market for advertisements and the incentive to attract more consumers leads to higher advertising prices. The latter also exerts downward pressure on viewer prices of the platform(s) carrying advertisements. Hence, in the asymmetric regime, the viewer price of medium B increases under regime *asym*, if β is sufficiently large relative to δ (see Figure 3.5). As A carries advertisements, and B does not, choosing A over B becomes more costly for consumers, since the number of advertisements on A is increasing in δ. This allows for B increasing his viewer price, if the nuisance from advertisements is sufficiently large. On all platforms that sell advertising space, however, the viewer

prices decrease in δ.[27]
Due to the number of viewers becoming more important for advertisers, the identity of the pivotal advertiser changes as δ increases. The previous marginal advertiser *ceteris paribus* switches to the channel that provides him with the larger number of consumer contacts (*sym1*), or enters the advertising market (*sym2* and *asym*), as the marginal return per advertisement has increased in δ. Since platform B hosts the larger number of consumers under regime *sym1* (see the first column of Table 3.1), the high quality broadcaster B gains shares in the ad market at the expense of channel A. Under the regimes with market abstention, the previous marginal advertisers now finds it profitable to advertise, which implies that all respective advertising market shares increase.
As there is no direct effect of an increase in δ on consumers' utility, the changes in their decision which channel to watch are determined by (i) the viewer prices, and (ii) the number of advertisements. In the asymmetric regime, the distribution of viewer market shares is unambiguous: The decrease in the viewer price of platform A overcompensates for A carrying advertisements such that B loses market shares on the viewer market as δ increases. This leads to A having higher profits whereas the effect on the profits of B are ambiguous. Under regime *sym1*, with both viewer prices decreasing, the number of advertisements becomes relatively more important for consumers than choosing the platform with the lowest price. The previous marginal viewer now switches to the channel with the lower number of advertisements. As known from the first column of Table 3.1, the channel with the smaller number of advertisements is broadcaster A, if and only if β is sufficiently small compared to δ. The exact relationship is shown in Figure 3.5. The figure also shows that the effects of an increase in δ on the viewer market shares under regime *sym2* are similar.

[27]Technically spoken, there is a very small parameter range in which A's viewer price under the *sym2*-regime increases. This is true for intermediate values of δ-β-combinations, as illustrated in Figure 3.5.

Figure 3.5: Ambiguous effects of an increase in δ



Note: This figure illustrates the effects of an increase in δ on viewer market shares in regime *sym1* (upper left panel) and in regime sym2 (lower left panel) as well as the effects on viewer prices of A in regime *sym2* (upper right panel), and on viewer prices of B in regime *asym* (lower left panel). The area denoting combinations of β and δ for which y is increasing (decreasing) in β is indicated by $y\uparrow$ ($y\downarrow$) with $y \in \{n_i^{v,r}, p_i^r\}$, $i \in \{A, B\}$ and $r \in \{sym1, sym2, asym\}$.

The effects of an increase in δ on broadcasters' profits is ambiguous with the exceptions of A's profits increasing under regime *asym* (see discussion above), and the loss in A's profits under *sym1*. Under the *sym1*-regime, for the low quality broadcaster A, lowering the viewer prices and losing advertising market shares always dominate the increase in the advertising price as well as an eventual gain in viewer market shares. For the high quality broadcaster B, there are gains on the advertising market due to higher prices and a higher market share on the one hand, but potential losses on the viewer market on the other hand, as prices decrease and the viewer market shares may fall as well. If and only if the negative externality β is sufficiently small, the gains from advertisements outweigh the losses on the viewer market, and B's profits increase in δ. A similar reasoning applies to the profits of B under the *sym2*-regime.

3.5 Effectiveness of an advertising ban

This section is devoted to evaluating the effectiveness of an advertising ban in the light of its main objective: making quality broadcasts more attractive to consumers by lowering the amount of advertisements and thus increasing the market shares of the quality medium.
There are three possible ways to restrict advertising: imposing a ban on advertisements in the high quality medium (which is what we analyze in this chapter), or on advertisements in the low quality medium.[28] Alternatively, one could impose a general advertising ban that applies to all broadcasters. The latter is not very realistic and would result in purely vertical competition for viewers, which yields the standard results of the high quality medium setting higher prices on the viewer market, serving the larger part of the market, and having higher profits.

In the following, we compare the equilibrium values of the regimes *sym2* and *asym*. For the comparison with *asym*, we choose *sym2* over *sym1*, because, under both regimes, market abstention of advertisers is allowed for, i.e. $\bar{a} = 0$.[29]

Proposition 7 *For all $\delta > \beta$, in equilibrium, an advertising ban on the high quality broadcaster B*

- *increases the viewer market shares of A at the expense of B.*

[28]Since this case is less realistic, it is not presented here in detail. Nevertheless, it yields some interesting results. If only the high quality medium is allowed to carry advertisements, in our model the advertising market will break down, i.e. in equilibrium, there will be no (positive demand for) advertising at all.

[29]Comparing the asymmetric regime to the *sym1*-regime would distort the results, see Section 3.3.3.

- *decreases the overall amount of advertisements.*

Proof. See Section A6 of the Appendix. ■

The effects of an advertising ban on all remaining equilibrium values are depicted in Table 3.4.

Table 3.4: Comparison across regimes (sym2 vs. asym)

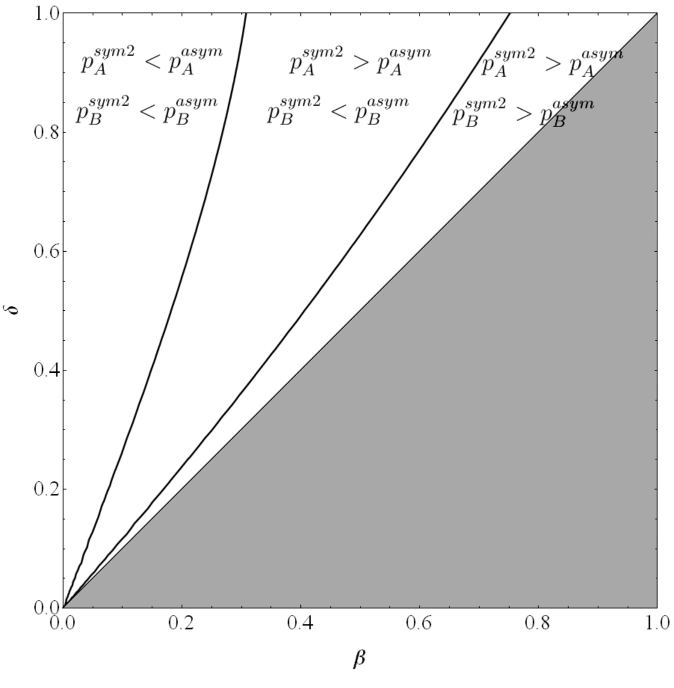
Broadcaster	A	B
Viewer prices	$p_A^{sym2} \gtreqless p_A^{asym}$	$p_B^{sym2} \gtreqless p_B^{asym}$
Advertising prices	$\tau_A^{sym2} < \tau_A^{asym}$	—
Viewer market shares	$n_A^{v,sym2} < n_A^{v,asym}$	$n_B^{v,sym2} > n_B^{v,asym}$
Advertising market shares	$n_A^{ad,sym2} + n_B^{ad,sym2} > n_A^{ad,asym}$	—
Profits	$\Pi_A^{sym2} \gtreqless \Pi_A^{asym}$	$\Pi_B^{sym2} > \Pi_B^{asym}$

Note: This table illustrates the effects of broadcaster B not being allowed to enter the advertising market by comparing the equilibria of the symmetric model with abstention (regime *sym2*) and the asymmetric model (regime *asym*).

While the result concerning the reduction of the overall amount of advertising is intuitive, it may be surprising that medium B loses viewers by reducing its advertising level to zero. The latter result is due to the twofold nature of broadcasters' incentives to attract viewers by low viewer prices: First, lowering viewer prices has a direct (positive) effect on viewer market shares. Second, there is an indirect (positive) effect on advertising market shares due to the positive externality the number of viewers exerts on the demand for advertising slots. Being prevented from advertising, the high quality medium B loses this second motive while the incentives of medium A remain unchanged. Hence, in the case of asymmetric advertising, the relative incentives to set low viewer prices are stronger for channel A than for channel B. Accordingly, in equilibrium, broadcaster A serves the larger part of the viewer market than B, which allows him to increase the advertising price.

Both broadcasters' price setting behavior on the viewer market is subject to two opposing effects. There is a negative effect on A's viewer prices due to the ad-free platform B becoming *ceteris paribus* more attractive to consumers, which leads to increased price competition that also puts downward pressure on B's viewer prices. The positive effect on B's viewer prices comes from B losing part of his incentives to attract viewers, which reduces price competition and thus enables both broadcasters to increase their prices. Whether the positive or the negative effect dominates the evolution of viewer prices depends on the relative strength of the externalities between the two sides of the market. As shown in Figure 3.6, we can distinguish between three cases: If, for any given level of the viewer externality δ, the nuisance cost of advertisement β is sufficiently low (high), both channels set a higher (lower) viewer price in the case of asymmetric advertising compared to the case of symmetric advertising; for an intermediate range of β, channel A lowers its viewer price while channel B raises it.

Figure 3.6: Comparison of both regimes (sym2 vs. asym)



Note: This figure illustrates the effects of an advertising ban for broadcaster B on equilibrium viewer prices by comparing the equilibria of the symmetric model with market abstention (regime *sym2*) and the asymmetric model (regime *asym*).

For broadcaster B, being prevented from entering the advertising market obviously is a disadvantage that lowers his profits. The analysis shows that for any given value of δ, the advertising ban on B is beneficial for broadcaster A if and only if the nuisance cost β is sufficiently small. If the nuisance β is high, the intensified price competition on the viewer market dominates from broadcaster A's perspective, and his profits decrease as well.

In our analysis, the levels of quality are exogenously fixed at maximum differentiation. Though analytically hardly tractable, the framework at hand also allows for modeling an endogenous decision on quality levels. The results with exogenous levels of quality may already give a hint on how these levels would react to an advertising ban on broadcaster B, if the decision on quality was endogenous. As we have emphasized above, broadcaster B loses a part of his incentives to attract viewers. The choice of an endogenous quality level is, besides viewer prices, a second instrument for attracting viewers. Hence, one might expect quality levels to evolve analogically to viewer prices: On the one hand, channel A has an incentive to raise its quality level in order to regain shares in the viewer market. This is due to the direct effect of no advertising at channel B making B *ceteris paribus* more attractive to viewers. An increase in A's quality levels intensifies competition in the quality dimension and exerts upward pressure on channel B's quality level. On the other hand, the indirect effect of not being obliged to please any customers on the advertising market lowers channel B's incentive to attract viewers by offering high quality. This mitigates quality competition in the viewer market and gives room for decreasing quality levels, even to channel A. Whether the direct or indirect effect dominates is again determined by the relative strength of the externalities between the two sides of the market.

3.6 Equilibria in free-to-air systems with and without an advertising ban

In this section, we discuss how accounting for free-to-air broadcasting affects equilibrium results, if television channels can be accessed by all consumers without any price or fee. If the platforms offer their services for free, the game is reduced to two stages: Advertisers and viewers simultaneously choose a platform in the second stage, and media outlets set advertising prices in the first stage. The profit function of media outlet j is given by

$$\tilde{\Pi}_j = n_j^{ad}\tau_j, \tag{22}$$

where tilde variables ~ denote the free-to-air regime. As consumer prices are zero, media outlets have no direct incentive to attract consumers, but only an indirect incentive via the positive externality of the number of consumers on the demand for advertising space.

3.6.1 Symmetric advertising without market abstention (*sym1*)

If both channels are offered free-to-air, the condition of the pivotal advertiser being indifferent between placing the advertisement on platform A or B does not vary from the third stage of the game in Section 3.3.1 (see Eq. 5). In the second stage of the game with free-to-air television, viewer $\hat{\vartheta}$ is indifferent between watching channel A and B if the following condition holds:

$$u_A = u_B \qquad \Leftrightarrow \qquad \hat{\vartheta}(x_B - x_A) = \beta(n_B^{ad} - n_A^{ad}). \tag{23}$$

As viewer prices are zero, only the quality of coverage and the number of advertisements is decisive for consumers' decisions. Consumers with $\vartheta \leq \hat{\vartheta}$ choose platform A, and the remaining consumers choose platform B. Solving Eq. (23) for $\hat{\vartheta}$ yields

$$n_A^v(n_A^{ad}, n_B^{ad}) = \hat{\vartheta} = \frac{\beta(n_B^{ad} - n_A^{ad})}{x_B - x_A}, \qquad n_B^{ad}(n_A^{ad}, n_B^{ad}) = 1 - \hat{\vartheta} = \frac{x_B - x_A - \beta(n_B^{ad} - n_A^{ad})}{x_B - x_A}. \tag{24}$$

Substituting Eq. (24) into Eq. (5), and solving for the viewer and advertising demands, we obtain the following results on the second stage of the game:[30]

$$n_A^v(\tau_A, \tau_B) = \frac{\beta(\delta + \tau_A - \tau_B)}{1 + 2\beta\delta}, \qquad n_B^v(\tau_A, \tau_B) = \frac{1 + \beta(\delta - \tau_A + \tau_B)}{1 + 2\beta\delta},$$

$$n_A^{ad}(\tau_A, \tau_B) = \frac{1 + 2\delta\beta - \delta - \tau_A + \tau_B}{2(1 + 2\beta\delta)}, \quad n_B^{ad}(\tau_A, \tau_B) = \frac{1 + 2\delta\beta + \delta + \tau_A - \tau_B}{2(1 + 2\beta\delta)}. \tag{25}$$

[30]Note that $x_A = 0$ and $x_B = 1$.

Maximizing Eq. (22) with respect to τ_j and substituting the results into Eq. (25) and (22) yields the following equilibrium:[31]

$$\tilde{\tau}_A^{sym1} = 1 + \frac{\delta(6\beta - 1)}{3}, \qquad \tilde{\tau}_B^{sym1} = 1 + \frac{\delta(6\beta + 1)}{3},$$

$$\tilde{n}_A^{v,sym1} = \frac{\beta\delta}{3(1+2\beta\delta)}, \qquad \tilde{n}_B^{v,sym1} = \frac{3 + 5\beta\delta}{3(1+2\beta\delta)},$$

$$\tilde{n}_A^{ad,sym1} = \frac{1}{2} - \frac{\delta}{6(1+2\beta\delta)}, \qquad \tilde{n}_B^{ad,sym1} = \frac{1}{2} + \frac{\delta}{6(1+2\beta\delta)},$$

$$\tilde{\Pi}_A^{sym1} = \frac{[\delta - 3(1+2\beta\delta)]^2}{18(1+2\beta\delta)}, \qquad \tilde{\Pi}_B^{sym1} = \frac{[\delta + 3(1+2\beta\delta)]^2}{18(1+2\beta\delta)}. \tag{26}$$

3.6.2 Symmetric advertising with market abstention (*sym2*)

In the scenario where market abstention on the advertising market can arise, i.e. where the fixed benefit from advertising $\bar{a}$ is zero, the demand for advertisement space in media outlet j is as in Eq. (A2) (see Section A1 of the Appendix). On the viewer side of the market, the demand for media outlet j is the same as in the previous section, such that Eq. (24) is substituted in Eq. (A2). Hence, the viewer and advertising market shares are:

$$n_A^v(\tau_A, \tau_B) = \frac{\beta(\delta + \tau_A - \tau_B)}{1+2\beta\delta}, \qquad n_B^v(\tau_A, \tau_B) = \frac{1 + \beta(\delta - \tau_A + \tau_B)}{1+2\beta\delta},$$

$$n_A^{ad}(\tau_A, \tau_B) = \frac{\beta\delta(\delta - \tau_A - \tau_B) - \tau_A}{2(1+2\beta\delta)}, \quad n_B^{ad}(\tau_A, \tau_B) = \frac{\delta(1 - \beta(\tau_A + \tau_B - \delta) - \tau_B}{2(1+2\beta\delta)}. \tag{27}$$

Substituting this result into the profit function Eq. (22), and maximizing it with respect to τ_j yields the following equilibrium:[32]

[31] Note that the second order conditions are fulfilled as $\frac{\partial^2 \Pi_A}{\partial \tau_A^2} |_{\tilde{\tau}_A^{sym1}} = -\frac{1}{1+2\beta\delta} < 0$ and $\frac{\partial^2 \Pi_B}{\partial \tau_B^2} |_{\tilde{\tau}_B^{sym1}} = -\frac{1}{1+2\beta\delta} < 0$.

[32] Note that the second order conditions are fulfilled as $\frac{\partial^2 \Pi_A}{\partial \tau_A^2} |_{\tilde{\tau}_A^{sym2}} = -1 - \frac{1}{1+2\beta\delta} < 0$ and $\frac{\partial^2 \Pi_B}{\partial \tau_B^2} |_{\tilde{\tau}_B^{sym2}} = -1 - \frac{1}{1+2\beta\delta} < 0$.

$$\tilde{\tau}_A^{sym2} = \frac{\beta\delta^2(1+\beta\delta)}{(2+\beta\delta)(2+3\beta\delta)}, \qquad \tilde{\tau}_B^{sym1} = 1 + \frac{\delta(2+\beta\delta(4+\beta\delta))}{(2+\beta\delta)(2+3\beta\delta)},$$

$$\tilde{n}_A^{v,sym2} = \frac{\beta\delta(1+\beta\delta)}{(2+\beta\delta)(1+2\beta\delta)}, \qquad \tilde{n}_B^{v,sym2} = \frac{2+\beta\delta(4+\beta\delta)}{(2+\beta\delta)(1+2\beta\delta)},$$

$$\tilde{n}_A^{ad,sym2} = \frac{\beta\delta^2(1+\beta\delta)^2}{(2+\beta\delta)(2+3\beta\delta)(1+2\beta\delta)}, \qquad \tilde{n}_B^{ad,sym2} = \frac{\delta(1+\beta\delta)(2+\beta\delta(4+\beta\delta))}{(2+\beta\delta)(1+2\beta\delta)(2+3\beta\delta)},$$

$$\tilde{\Pi}_A^{sym2} = \frac{\beta^2\delta^4(1+\beta\delta)^3}{(2+\beta\delta)^2(2+3\beta\delta)^2(1+2\beta\delta)}, \qquad \tilde{\Pi}_B^{sym2} = \frac{\delta^2(1+\beta\delta)(2+\beta\delta(4+\beta\delta))^2}{(2+\beta\delta)^2(2+3\beta\delta)^2(1+2\beta\delta)}. \tag{28}$$

Comparing equilibrium values of broadcaster A and B *within* a given regime (*sym1* or *sym2*) and financing scheme (free-to-air or pay-TV) shows that both of the symmetric equilibria derived in a free-to-air system have almost the same qualitative characteristics as their counterparts in the pay-TV regime: Broadcaster B sets higher advertising prices, serves the larger part of both markets, and consequently has higher profits than broadcaster A. The only variation from the pay-TV regime is that under the *sym1*-regime in a pay-TV system, broadcaster A may serve the larger part of the advertising market if consumers' ad aversion is sufficiently low, and the ad effectiveness is sufficiently high. This is never the case under free-to-air, as the distribution of viewer market shares is sufficiently unequal for B to be always more attractive to advertisers than A.

3.6.3 Comparison to pay-TV system

In the following, we analyze the effects of introducing free-to-air broadcasting instead of the pay-TV financing scheme of Section 3.3 by comparing their equilibrium values *across* financing schemes for a given regime. The section is structured such that first, the equilibria under pay-TV and free-to-air are compared for a given regime (*sym1* or *sym2*). In order to account for changes in the way how the network effects affect equilibrium outcomes, we then compare the comparative statics results with respect to the ad effectiveness δ and the nuisance parameter β across the two financing schemes for a given regime.

Comparison of *sym1*-equilibria under pay-TV and free-to-air

A free-to-air system leads to more consumers choosing the quality medium B than in a pay-TV regime. As the desired high quality is available at no costs besides the nuisance from advertisements, only the number of advertisements and the quality of the program are decisive for consumers' decisions. In a free-to-air system, consumer market shares of the high quality medium B are larger than under pay-TV, as consumers with a low valuation for quality who choose the cheaper medium A in the pay-per-view regime, now switch to medium B. This implies that B has an advantage over A by being able to provide more consumer contacts to advertisers. The monetary value of this advantage increases in the strength of the positive externality δ. B is able to capitalize on this advantage by increasing the advertising price compared to the pay-TV system if the ad effectiveness parameter δ is sufficiently large, or the nuisance from advertisements, β, is sufficiently small.[33]

In order to compensate for providing less consumer contacts to advertisers than in a pay-TV system, media outlet A lowers its advertising prices. Providing a larger number of consumer contacts to advertisers compared to the pay-TV system dominates the evolution of advertising market shares irrespective of the price-setting behavior of B, such that, in a free-to-air system, B always sells more advertising space than under pay-TV. As the advertising market is fully covered under regime *sym1*, A serves a smaller part of the advertising market than in a pay-TV system.

Broadcaster A faces a reduction in profits, because he serves a smaller part of both submarkets, and sets lower advertising prices than in a pay-TV regime. If δ is sufficiently large, B's profits are larger under free-to-air than under pay-TV despite the fact that there are no revenues from the consumer market. This is due to the difference in market shares of A and B being quite substantial and significantly larger than in the pay-TV system, which is driven by the assumption that advertisers cannot abstain from the market.

The comparative statics results are mainly driven by the number of advertisements playing a relatively bigger role for consumers' decision under free-to-air than under pay-TV. An increase in β has qualitatively the same implications as in the pay-TV system, since consumers' nuisance from advertisements becomes more important for their platform choice. Hence, in a regime where the advertising side of the market is

[33] Put differently, increasing B's advertising price may eventually lead to advertisers switching to platform A (*sym1*-regime) or abstain from the market (as in the *sym2*-regime discussed below) despite the smaller number of viewers. This is especially the case if the ad effectiveness δ is low, which implies that the positive externality has little effects on advertisers' profits.

inelastic (for instance due to a high reservation gain from advertising), the comparative statics results with respect to β do not change qualitatively across financing schemes. Some of the comparative statics results of an increase in the ad effectiveness parameter δ vary with respect to the financing scheme. If δ increases, the effects on viewer market shares are, in contrast to the pay-TV system, unambiguous: An increase in δ leads to A gaining shares in the viewer market at the expense of B which is due to the fact that B carries more ads when δ becomes larger, and the number of advertisements has become relatively more important to consumers in a system where there are no direct costs of media use. In the free-to-air system, an increase in δ may lead to higher profits of A, if the gain in shares on the advertising market is sufficiently large.

Comparison of *sym2*-equilibria under pay-TV and free-to-air

Comparing the equilibrium values of the *sym2*-regime under free-to-air to the equilibrium that arises in a pay-TV system yields qualitatively similar results to the comparison of the *sym1*-equilibria. Since the key characteristic of the *sym2*-regime is the increase in advertisers' demand elasticity, A's advertising market shares evolve differently compared to the *sym1*-regime. The price cuts compared to the pay-TV system tend to increase A's advertising shares, but the decrease in consumer market shares lowers A's shares on the ad market. In contrast to the pay-TV system, the latter effect dominates not for the whole parameter range, but only if δ is sufficiently large, i.e. if the positive externality of the number of consumers on the advertisers' revenues is sufficiently important. Otherwise, A's advertising shares are higher than in a pay-TV system. As the distribution of market shares on the advertising market is more similar for A and B, broadcaster B also makes lower profits than in a pay-TV system.
For the equilibrium advertising price, viewer market shares and profits of B, an increase in β yields qualitatively different results under free-to-air compared to pay-TV, if market abstention on the advertising market is allowed for. If advertisers can abstain from the market, attracting advertisers will gain importance relative to attracting consumers (who cannot abstain from the market). An increase in β under free-to-air induces B to decrease his advertising prices, which reduces his share on the viewer market, if β is sufficiently high. In this case, A's market shares increase in β. Still, the profits of B decrease in β due to the losses on the advertising submarket.
Most of the effects of an increase in δ are qualitatively the same as in the pay-TV regime. The only deviations from the effects in the pay-TV regime are that A gains market shares on the viewer market, if δ increases (which leads to a loss in market

shares for B), and that A's profits unambiguously increase.[34] The reason for δ to affect equilibrium values similarly in both financing systems is the following: In a free-to-air system, competition for advertisers is larger than in a pay-TV system, because advertisements are the only source of revenues for advertisers. If this is met by a system ins which advertisers can abstain from the market (which intensifies competition for advertisers compared to the scenario discussed above), an increase in the ad effectiveness δ goes in the same direction as introducing a free-to-air regime. In the *sym1*-regime of the free-to-air system, this effect is mitigated by the fact that market abstention on the advertising market is not allowed for, which weakens competition for advertisers, and leads to deviating results in the effects of an increase in δ.

3.6.4 Asymmetric advertising with an advertising ban on broadcaster B (*asym*)

The scenario with asymmetric advertising describes a situation in which the high quality broadcaster is financed exclusively via a lump sum transfer that is independent of his performance on the viewer market. The low quality medium is financed via advertisements such that the profit functions are $\tilde{\Pi}_A^{asym} = n_A^{ad}\tau_A$ and $\tilde{\Pi}_B^{asym} = T$, with T indicating the transfer for media outlet B.

The implications of the scenario with an advertising ban on the high quality medium are straightforward. With both platforms being offered free-to-air, all consumers choose the high-quality platform, which does not carry any advertisements. Advertisers can decide between placing an advertisement on platform A, or abstaining from the market, and do the latter since there is no exogenous benefit from advertising ($\bar{a} = 0$), and no positive spillovers from the consumer side of the market, as all consumers choose platform B. Hence, platform B serves the whole viewer market, but has zero revenues on the viewer market, as viewers cannot be charged for accessing the services. Broadcaster A makes no profits, as well, due to his viewer market share being zero.

This result hinges on a main assumption of the model: consumers' vertical quality preferences. If consumers' quality preferences were horizontal such that the notion of quality differs among consumers, it would be possible that some consumers with a sufficiently low preferred quality choose platform A despite the advertisements. Platform A has a positive market share, if the pivotal consumer's disutility from choosing platform B with the higher quality is larger than his nuisance induced by advertisements

[34] In the pay-TV regime, these effects were ambiguous.

on platform A. If this is the case, platform A is able to charge positive prices for advertisements, and makes profits. If consumers were ad-neutral rather than ad-averse, and quality preferences were horizontal, only the distance costs to the platforms would be decisive for consumers' decision, and platform A would serve an even larger part of the consumer market than in the case with ad-aversion.
Assuming horizontal instead of vertical product differentiation on the consumer market generates an interior solution on the consumer market even if an advertising ban on the quality platform is in place. The result that an advertising ban on platform B reduces demand for quality, as derived in the previous sections of this chapter, however, cannot be restored. We believe that the pay-TV regime is better suited to capture the effects of an advertising ban, as in most media markets, some price is levied from the consumers for instance in the form of a monthly license fee, or via technical access barriers that prevent viewers from accessing the services for free.[35] We follow Peitz and Valletti (2008), and argue that pay-per-view will become the dominant mode in broadcasting financing on the viewer side. Furthermore, the incentive structure of the high quality medium is captured more adequately if the performance on the viewer market has an effect on the profits of broadcaster B.

3.7 Concluding remarks

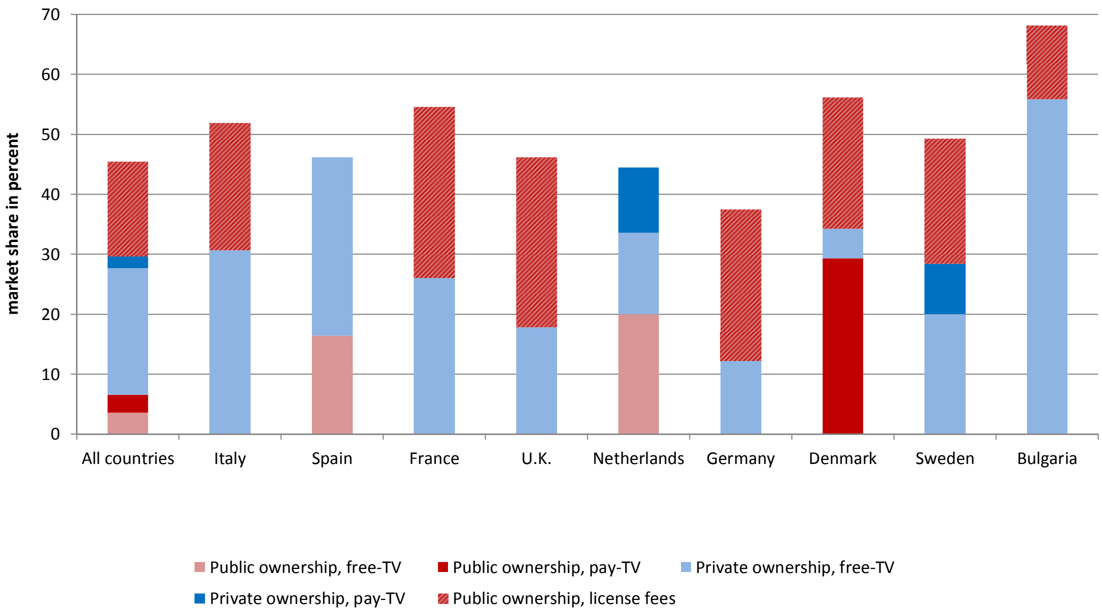
We have examined a two-sided markets model of two competing media outlets with maximum quality differentiation that offer content to ad-averse consumers and advertising space to advertisers. Content quality is a feature of vertical differentiation on the viewer market and a feature of horizontal differentiation on the advertising market. Our main result is that in pay-TV regimes, the high quality medium loses viewer market shares due to the introduction of an advertising ban. This result is valid under a set of strong assumptions: We assume that all consumers prefer high quality over low quality, and that all consumers are ad-averse. We show that even under such strict assumptions, an advertising ban that generates a high quality - no advertisement platform is not capable of increasing the demand for quality in the media.

This model primarily addresses regulation of public service broadcasters in television markets that are dominated by forms of pay-TV or television license fees (see also

[35] See Figure 1.3 in Chapter 1 for an overview on the share of pay-TV and free-TV channels in EU countries, as well as Figure 3.7 in Section 3.7 for the financing schemes of the three largest broadcasters in each of the countries.

Figure 1.3 in Chapter 1). Figure 3.7 illustrates the aggregate market shares of the three largest television channels on the country level sorted according to their ownership structure and way of financing.

Figure 3.7: Market concentration and ownership structures on EU television markets



Note: This figure illustrates the aggregate market shares of the three largest television channels of each country in 2009. Data source: MAVISE database, provided by the DG Communication of the European Commission, see European Audiovisual Observatory (2011), and Werben & Verkaufen (2009) (based on 1st and 2nd quarter of 2009) for the market share of RTL, Germany's largest private free-to-air channel, as well as Sweney (2010) for BBC1, the U.K's second largest public service broadcaster's market share.

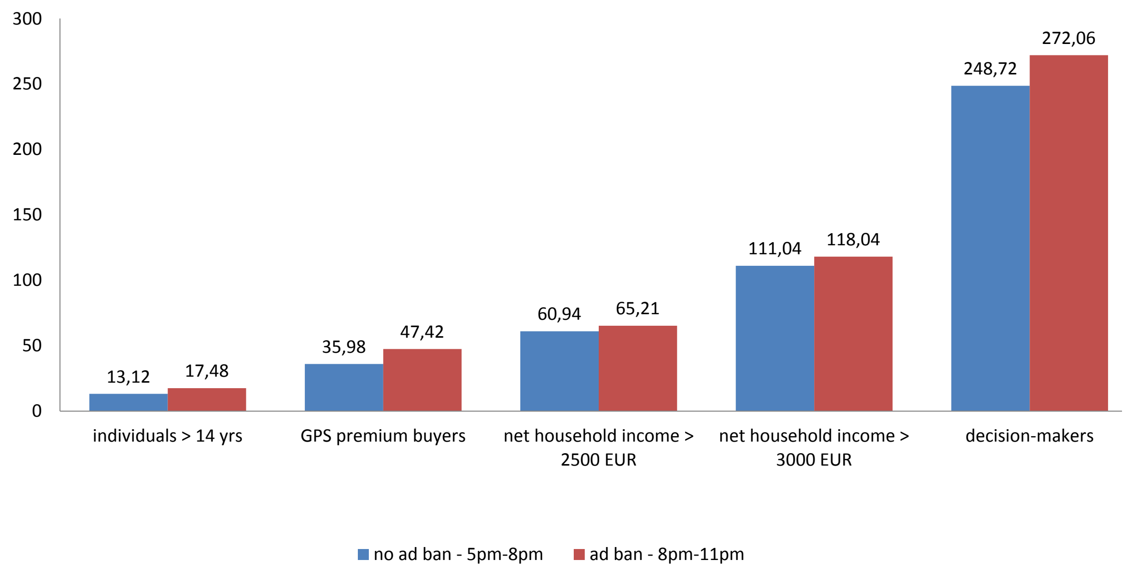
Judging the relevance of this model by the market shares of the broadcasters subject to the advertising ban, Figure 3.7 indicates that the implications of an advertising ban on public service broadcasters as derived in the pay-TV regime of our model apply to all countries with the exception of Spain, where the market is dominated by free-TV providers.[36] The U.K., Germany, the Netherlands and Sweden already discriminate against public service broadcasters in their way of advertising regulation, and in France, a full advertising ban on the public service broadcaster is the subject

[36]In the Netherlands, there is little market concentration, and many public broadcasters offer pay-TV services.

of a controversial discussion (see Table 1.2 in Chapter 1). Given our results, imposing a ban for advertisements on the public service broadcaster should be reconsidered because it gives rise to the following three issues: reduced competition on the market for advertising slots, a loss in the advertising rent of high quality producers, and the question of how to reimburse the restricted broadcaster for his loss on the advertising market.

The first issue is that advertising prices rise if an advertising ban is in place. Anecdotal evidence from comparing advertising prices of German commercial broadcasters in the time slot with and without an advertising ban confirms this suggestion (see Figure 3.8). The costs of reaching 1000 consumers with an advertisements (CPM) is significantly higher in the time slot from 8pm through 11pm than from 5pm through 8pm.[37]

Figure 3.8: Commercial broadcasters' CPM with and without an advertising ban



Note: The columns denote the average cost per mille (CPM) of an advertisement on the platforms of the three largest German commercial broadcasters, *RTL*, *SAT1*, and *PRO7*, in the respective time slots. *GPS premium buyers* represent a subset of individuals who primarily buy goods that are 5% more expensive than the good provided by the market leader. *Decision makers* are individuals who run intermediate to large businesses, higher officials, or managers. Data source: ZDF Werbefernsehen (2008).

[37]The effectiveness of advertisements in the 5pm to 8pm time slot is estimated to be higher than the ad effectiveness in the prime time slot from 8pm to 11pm. For evidence of the German television market, see ZDF Werbefernsehen (2005).

Advertisements on low quality platforms seem to be systematically cheaper when there is no advertising ban on the high quality broadcaster in place. This implies that reducing competition on the market for advertising space by imposing an advertising ban increases advertising prices which may be passed on to consumers via higher prices for the advertised good. However, an often quoted counterargument is that advertising prices before 8pm have been distorted in the first place: As advertising prices of commercial channels are higher than those of public service broadcasters in the same time segment as well, it may be possible that public service broadcasters use public funding to pursue a predatory pricing strategy on the advertising market (see Hargreaves-Heap, 2005, for an overview of complaints to the European Commission about price distortions induced by public service broadcasters).
The second issue is that some advertisers do not enter the market if there is no longer the chance to place their advertisement in a high-profile environment of quality broadcasting. This result has two implications: On the one hand, there is a loss in surplus on the advertising side of the market, since advertisers with a positive willingness to pay for advertisements cannot enter the market, which is also a result of our model. On the other hand, the quality broadcast becomes more attractive to consumers due to the lack of advertisements. As the latter does not lead to higher market shares of the quality channel in a pay-TV regime, the reduction of advertising volume only leads to the loss in advertisers' surplus.
The last and probably most problematic issue is that public service broadcasters have to be reimbursed for their revenue loss. In order to compensate for the loss in advertising revenues, per capita broadcasting fees in Germany, for instance, would have to increase by 1.42 EUR per month as estimated by the commission responsible for determining the broadcasting fees for public service broadcasters.[38] In France, taxing advertisements on commercial television more heavily to finance the revenue loss in public service broadcasting is currently under debate. This, however, will lead to additional distortions. A trend that is observable in all of the countries illustrated in Figure 3.7 is that public broadcasters seem to face a steady decline in market shares compared to private broadcasters.[39] Given that an advertising ban on the public service broadcaster in most countries does not yield the desired results of increasing the market shares of the quality broadcaster, the appropriate way of advertising regulation is an issue in need of further deliberation.

[38] see Kommission zur Ermittlung des Finanzbedarfs der Rundfunkanstalten (2009)

[39] For country level data see European Audiovisual Observatory (2011).

Appendix

A1: Equilibrium values under regime *sym2*

The derivation of the equilibrium is analogue to regime *sym1*. We define

$$
\begin{aligned}
\Omega_A^{sym2} &\equiv \beta[\delta(12+8\beta\delta-2\beta^2-3\delta^2)-\beta]+4, \\
\Omega_B^{sym2} &\equiv 8-2\beta^2+\beta\delta(26-5\beta^2)-2\delta^2(1-13\beta^3+\beta^4)+\beta\delta^3(8\beta^2-5)-3\beta^2\delta^4, \\
\Delta^{sym2} &\equiv [\beta\delta(\beta^2-6\beta\delta-10)-4][4\beta^4\delta^2+\beta^3\delta(9-16\delta^2)+4(\delta^2-3)] \\
&+ [\beta\delta(\beta^2-6\beta\delta-10)-4][2\beta\delta(5\delta^2-21)+\beta^2(4-46\delta^2+6\delta^4)], \\
\Phi^{sym2} &\equiv 4+\delta[\beta(10+5\beta\delta-3\delta^2)-2\delta], \\
\chi^{sym2} &\equiv 2\delta+\beta[2+\delta(5\delta+4\beta+\delta\beta^2+3\beta\delta^2)], \\
\Lambda^{sym2} &\equiv 16-4\beta^2-16\beta\delta(\beta^2-5)-4\delta^2(1-36\beta^2+5\beta^4) \\
&+ \beta\delta^3(110\beta^2-7\beta^4-16)+3\beta^2\delta^4(10\beta^2-7)-9\beta^3\delta^5
\end{aligned}
\tag{A1}
$$

There are two pivotal advertisers: The advertiser with a preferred broadcasting quality of $\hat{\gamma}_A$ is indifferent between placing his advertisement on platform A and abstaining from the market, and the advertiser with a preference of $\hat{\gamma}_B$ is indifferent between no advertising and advertising on platform B. Hence, the conditions in the third stage of the game are

$$
\begin{aligned}
\Pi_A = 0 \qquad &\Leftrightarrow \qquad \hat{\gamma}_A = x_A + \delta n_A^v - \tau_A \\
\Pi_B = 0 \qquad &\Leftrightarrow \qquad \hat{\gamma}_B = x_B - \delta n_B^v + \tau_B,
\end{aligned}
\tag{A2}
$$

with $n_A^{ad}(n_A^v, n_B^v) = \hat{\gamma}_A$ and $n_B^{ad}(n_A^v, n_B^v) = 1-\hat{\gamma}_B$. As the decision problem of viewers is unaffected, n_j^{ad} is substituted in Eq. (7) which yields the following demand functions:

$$
\begin{aligned}
n_A^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{p_B - p_A + \beta(\delta + \tau_A - \tau_B)}{1 + 2\beta\delta}, \\
n_B^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{1 + p_A - p_B + \beta(\delta - \tau_A + \tau_B)}{1 + 2\beta\delta}, \\
n_A^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{\delta(p_B - p_A + \beta(\delta - \tau_A - \tau_B)) - \tau_A}{1 + 2\beta\delta}, \\
n_B^{ad}(p_A, p_B, \tau_A, \tau_B) &= \frac{\delta(1 + p_A - p_B + \beta(\delta - \tau_A - \tau_B)) - \tau_B}{1 + 2\beta\delta}.
\end{aligned} \tag{A3}
$$

Substituting Eq. (A3) into the profit function of media outlet j and maximizing the profit function (1) with respect to the advertising price τ_j yields:

$$
\begin{aligned}
\frac{\partial \Pi_A}{\partial \tau_A} &= \frac{p_A(\beta - \delta) + p_B\delta - 2\tau_A + \beta\delta(\delta - 2\tau_A - \tau_B)}{1 + 2\beta\delta} \\
\frac{\partial \Pi_B}{\partial \tau_B} &= \frac{p_B(\beta - \delta) - 2\tau_B + \delta(1 + p_A + \beta(\delta - \tau_A - 2\tau_B))}{1 + 2\beta\delta}.
\end{aligned} \tag{A4}
$$

Setting Eq. (A4) equal to zero and solving for τ_j yields:

$$
\begin{aligned}
\tau_A(p_A, p_B) &= \frac{\delta[\beta\delta(1 + \beta\delta) + p_B(2 - \beta^2 + 3\beta\delta)] + p_A[\beta(2 + 2\beta\delta - 3\beta\delta) - 2\delta]}{(2 + \beta\delta)(2 + 3\beta\delta)}, \\
\tau_B(p_A, p_B) &= \frac{\delta[2 + \beta\delta(4 + \beta\delta) + p_A(2 - \beta^2 + 3\beta\delta)]}{(2 + \beta\delta)(2 + 3\beta\delta)} \\
&+ \frac{p_B[\beta(2 + 2\beta\delta - 3\beta\delta) - 2\delta]}{(2 + \beta\delta)(2 + 3\beta\delta)}.
\end{aligned} \tag{A5}
$$

Substituting Eq. (A5) into the profit function (1) and maximizing it with respect to the viewer prices p_j, we obtain:

$$
\begin{aligned}
\frac{\partial \Pi_A}{\partial p_A} &= \frac{2p_A[4(\beta^2-4)+16\beta\delta(\beta^2-5)+4\delta^2(1-36\beta^2+5\beta^4)}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2p_A[\beta\delta^3(16-110\beta^2+7\beta^4)+3\beta^2\delta^4(7-10\beta^2)+9\beta^3\delta^5]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2p_A(1+\beta\delta)[\beta\delta(1+\beta\delta)+p_B(2-\beta^2+3\beta\delta)][4+\delta(\beta(10+5\beta\delta-3\delta^2)-2\delta)]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2}, \\
\frac{\partial \Pi_B}{\partial p_B} &= \frac{2p_B[4(\beta^2-4)+16\beta\delta(\beta^2-5)+4\delta^2(1-36\beta^2+5\beta^4)}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2p_B[\beta\delta^3(16-110\beta^2+7\beta^4)+3\beta^2\delta^4(7-10\beta^2)+9\beta^3\delta^5]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&- \frac{2p_Bp_A(1+\beta\delta)(\beta^2-2-3\beta\delta)[4+\delta(\beta(10+5\beta\delta-3\delta^2)-2\delta)]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2p_B(1+\beta\delta)(2+\beta\delta(4+\beta\delta))[4+\delta(\beta(10+5\beta\delta-3\delta^2)-2\delta)]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2}. \qquad \text{(A6)}
\end{aligned}
$$

Solving Eq. (A6) for p_j, we obtain the following equilibrium prices:

$$
\begin{aligned}
p_A^{sym2} &= \frac{(1+\beta\delta)^2\Omega_A^{sym2}\Phi^{sym2}}{\Delta^{sym2}}, \qquad & p_B^{sym2} &= \frac{(1+\beta\delta)\Omega_B^{sym2}\Phi^{sym2}}{\Delta^{sym2}}, \\
\tau_A^{sym2} &= \frac{(1+\beta\delta)\Omega_A^{sym2}\chi^{sym2}}{\Delta^{sym2}}, \qquad & \tau_B^{sym2} &= \frac{\Omega_B^{sym2}\chi^{sym2}}{\Delta^{sym2}}. \qquad \text{(A7)}
\end{aligned}
$$

The corresponding market shares are:

$$
\begin{aligned}
n_A^{v,sym2} &= \frac{1}{2} - \frac{(\beta\delta(\beta^2-6\beta\delta-10)-4)^2}{2\Delta^{sym2}}, \\
n_B^{v,sym2} &= \frac{1}{2} + \frac{(\beta\delta(\beta^2-6\beta\delta-10)-4)^2}{2\Delta^{sym2}}, \\
n_A^{ad,sym2} &= \frac{(1+\beta\delta)^2(2\delta-\beta(2+2\beta\delta-3\delta^2))\Omega_A^{sym2}}{\Delta^{sym2}}, \\
n_B^{ad,sym2} &= \frac{(1+\beta\delta)(2\delta-\beta(2+2\beta\delta-3\delta^2))\Omega_B^{sym2}}{\Delta^{sym2}}. \qquad \text{(A8)}
\end{aligned}
$$

By substituting the above results into the profit function of the broadcasters (Eq. 1), we obtain:

$$\Pi_A^{sym2} = \frac{(1+\beta\delta)^3(\Omega_A^{sym2})^2\Lambda^{sym2}}{(\Delta^{sym2})^2}, \qquad \Pi_B^{sym2} = \frac{(1+\beta\delta)(\Omega_B^{sym2})^2\Lambda^{sym2}}{(\Delta^{sym2})^2}. \tag{A9}$$

The second order conditions are fulfilled as:

$$\begin{aligned}
\frac{\partial^2\Pi_A}{\partial\tau_A^2}\Big|_{p_A^{sym2}} &= \frac{2[4(\beta^2-4)+16\beta\delta(\beta^2-5)+4\delta^2(1-36\beta^2+5\beta^4)}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2[\beta\delta^3(16-110\beta^2+7\beta^4)+3\beta^2\delta^4(7-10\beta^2)+9\beta^3\delta^5]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} < 0, \\
\frac{\partial^2\Pi_B}{\partial\tau_B^2}\Big|_{p_B^{sym2}} &= \frac{2[4(\beta^2-4)+16\beta\delta(\beta^2-5)+4\delta^2(1-36\beta^2+5\beta^4)}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} \\
&+ \frac{2[\beta\delta^3(16-110\beta^2+7\beta^4)+3\beta^2\delta^4(7-10\beta^2)+9\beta^3\delta^5]}{(2+\beta\delta)^2(1+2\beta\delta)(2+3\beta\delta)^2} < 0. \quad \text{(A10)}
\end{aligned}$$

A2: Equilibrium values in a regime with an advertising ban on B and no market abstention of advertisers

From Eq. (3) follows that $\bar{a} \geq 1 - \delta n_A^v + \tau_A$. This yields $n_A^{ad} = 1$ and $n_B^{ad} = 0$ due to the advertising ban on B. Substituting the advertising demands into the demand functions of the viewers from Eq. (7) with $x_A = 0$ and $x_B = 1$ yields:

$$n_A^v = p_B - p_A - \beta, \qquad n_B^v = 1 - p_B + p_A + \beta. \tag{A11}$$

Substituting the demand functions into the profit function of broadcaster A (Eq. 17) and maximizing it with respect to τ_A shows that the profits are strictly increasing in τ_A:

$$\frac{\partial\Pi_A^{asym}}{\partial\tau_A} = 1 > 0. \tag{A12}$$

Maximizing Eq. (17) with respect to p_j and substituting the results into the above demand functions yields the following viewer prices and demands in equilibrium:

$$p_A^{asym1} = \frac{1}{3} + \beta, \qquad p_B^{asym1} = \frac{2}{3} + \beta,$$

$$n_A^{v,asym1} = \frac{1}{3}, \qquad p_B^{asym1} = \frac{2}{3}. \tag{A13}$$

Substituting Eq. (A13) into the condition derived above shows that advertisers' demand for advertising space is perfectly inelastic if

$$\bar{a} \geq 2 - \frac{\delta}{3}. \tag{A14}$$

A3: Proof of Proposition 4

Comparing equilibrium values in the *sym1*-regime with

$$\Delta^{sym1} = 27 + 38\beta\delta - 8(\beta^2 + \delta^2) > 0 \tag{A15}$$

yields:

$$\begin{aligned}
p_B^{sym1} - p_A^{sym1} > 0 \quad &\Leftrightarrow \quad \frac{9 + 14\beta\delta - 4\delta^2}{\Delta^{sym1}} > 0,\\
\tau_B^{sym1} - \tau_A^{sym1} > 0 \quad &\Leftrightarrow \quad \frac{2(\beta + \delta)(3 + 2\beta\delta)}{\Delta^{sym1}} > 0,\\
n_B^{v,sym1} - n_A^{v,sym1} > 0 \quad &\Leftrightarrow \quad \frac{9 + 4\beta(\beta + \delta)}{\Delta^{sym1}} > 0,\\
\Pi_B^{sym1} - \Pi_A^{sym1} > 0 \quad &\Leftrightarrow \quad \frac{27 - 4\beta^2(3 + \delta + 2\beta) - 6\delta^2 + 4\beta\delta(9 + \delta)}{3\Delta^{sym1}} > 0.
\end{aligned} \tag{A16}$$

For the sign of $n_B^{ad,sym1} - n_A^{ad,sym1}$, see Figure 3.3, where the results are simulated for any given combination of β and δ for the full parameter range of the model, i.e. for $\delta \in (0,1] \wedge \beta \in (0,1]$.

Analogically, for the *sym2*-regime, the following inequalities hold:

$$p_B^{sym2} - p_A^{sym2} > 0 \quad \Leftrightarrow \quad \frac{(1+\beta\delta)[4+\delta(\beta(10+5\beta\delta-3\delta^2)-2\delta)]}{\sum^{sym2}} > 0,$$

$$\tau_B^{sym2} - \tau_A^{sym2} > 0 \quad \Leftrightarrow \quad \frac{2\delta+\beta[2+\delta(5\delta+4\beta+\beta\delta(\beta+3\delta))]}{\sum^{sym2}} > 0,$$

$$n_B^{v,sym2} - n_A^{v,sym2} > 0 \quad \Leftrightarrow \quad \frac{4+\beta\delta(10-\beta^2+6\beta\delta)}{\sum^{sym2}} > 0,$$

$$n_B^{ad,sym2} - n_A^{ad,sym2} > 0 \quad \Leftrightarrow \quad \frac{(1+\beta\delta)[2\delta-\beta(2+2\beta\delta-3\delta^2)]}{\sum^{sym2}} > 0,$$

$$\Pi_B^{sym2} - \Pi_A^{sym2} > 0 \quad \Leftrightarrow$$

$$\frac{1}{4}\left(1+\frac{\beta^3\delta}{4+\beta\delta(10+6\beta\delta-\beta^2)}+\frac{2(1+\beta\delta)(2+\beta\delta)(1+2\beta\delta)}{\sum^{sym2}}\right) > 0, \tag{A17}$$

where

$$\Sigma^{sym2} \equiv 12+2\beta\delta(21-5\delta^2)+\beta^2[\beta\delta(16\delta^2-9)+46\delta^2-6\delta^4-4]-4\delta^2(1+\beta^4) > 0. \tag{A18}$$

Finally, for the *asym*-regime, the comparison of the equilibrium values yields:

$$p_B^{asym} - p_A^{asym} > 0 \quad \Leftrightarrow \quad \frac{2(2-\beta^2+\beta\delta)(1+\beta\delta)}{\Delta^{asym}} > 0,$$

$$n_B^{v,asym} - n_A^{v,asym} > 0 \quad \Leftrightarrow \quad 1-\frac{8(1+\beta\delta)}{\Delta^{asym}} > 0,$$

$$\Pi_B^{asym} - \Pi_A^{asym} > 0 \quad \Leftrightarrow$$

$$\frac{2(4-(\delta-\beta)^2)(1+\beta\delta)[6(1+\beta\delta)-\beta\delta(\beta^2+\delta^2)-2(\delta^2-\beta^2(\delta^2-1))]}{(\Delta^{asym})^2} > 0, \tag{A19}$$

with

$$\Delta^{asym} = 12+\beta\delta(12-\beta^2-\delta^2)-2(\beta^2(1-\delta^2)+\delta^2). \tag{A20}$$

All of the above inequalities hold for the full parameter range of the model, i.e. for $\delta \in (0,1] \land \beta \in (0,1]$.

■

A4: Proof of Proposition 5

Follows from simulating the first derivatives of the equilibrium values of all regimes with respect to β for any given combination of β and δ for the full parameter range of the model, i.e. for $\delta \in (0,1] \wedge \beta \in (0,1]$. The results are valid as there is a unique solution for each combination of β and δ.

■

A5: Proof of Proposition 6

Follows from simulating the first derivatives of the equilibrium values of all regimes with respect to δ for any given combination of β and δ for the full parameter range of the model, i.e. for $\delta \in (0,1] \wedge \beta \in (0,1]$. The results are valid as there is a unique solution for each combination of β and δ.

■

A6: Proof of Proposition 7

Comparing equilibrium values in the *sym2*-regime to the *asym*-regime with

$$\begin{aligned}
\Sigma^{comp} &\equiv 4(3+\delta^2) + 2\beta\delta(21-5\delta^2) \\
&- \beta^2[4(1+\beta^2\delta^2) - 2\delta^2(23-3\delta^2) + \beta\delta(9-16\delta^2)] > 0, \\
\Lambda^{comp} &\equiv 4 + \beta\delta(10-\beta^2+6\beta\delta) > 0, \\
\Xi^{comp} &\equiv \beta\delta(12-\beta^2-\delta^2) + 2(6-\delta^2) - 2\beta^2(1-\delta^2) > 0, \qquad \text{(A21)}
\end{aligned}$$

yields:

$$n_A^{v,asym} - n_A^{v,sym2} > 0 \qquad \Leftrightarrow \qquad \frac{1}{2}\left[\frac{8(1+\beta\delta)}{\Xi^{comp}} - \frac{\Lambda^{comp}}{\Sigma^{comp}} - 1\right] > 0,$$

$$n_A^{ad,sym2} + n_B^{ad,sym2} - n_A^{ad,asym} > 0 \qquad \Leftrightarrow$$

$$\frac{1}{4}\left[2\delta - \beta - \frac{\beta[4+\beta\delta(6+\beta^2)]}{\Lambda^{comp}} - \frac{8(1+\beta\delta)(\delta-\beta)}{\Xi^{comp}}\right] > 0. \tag{A22}$$

The results from Table 3.4 are derived as follows:

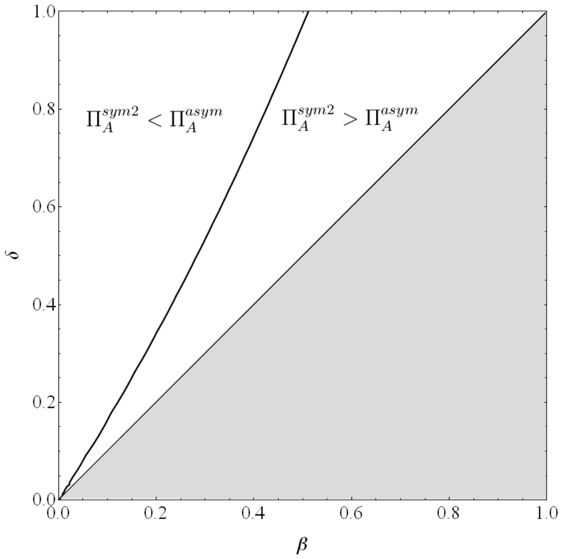
$$\tau_A^{v,asym} - \tau_A^{v,sym2} > 0 \qquad \Leftrightarrow$$

$$(1+\beta\delta)\left[\frac{2(\beta+\delta)}{\Xi^{comp}} + \frac{[2(\beta^3\delta+\delta^2-2)][2\delta+\beta(2+5\delta^2+\beta\delta(4+\beta\delta+3\delta^2))]}{\Lambda^{comp}(\Sigma^{comp}-4\beta^4\delta^2)}\right]$$
$$+ (1+\beta\delta)\left[\frac{[\beta^2(2-8\delta^2)+3\beta\delta(\delta^2-4)][2\delta+\beta(2+5\delta^2+\beta\delta(4+\beta\delta+3\delta^2))]}{\Lambda^{comp}(\Sigma^{comp}-4\beta^4\delta^2)}\right] > 0. \tag{A23}$$

All of the above inequalities hold for the full parameter range of the model, $\delta \in (0,1] \wedge \beta \in (0,1]$.

For the sign of $\Pi_A^{sym2} - \Pi_A^{asym}$, see the following figure, where the results are simulated for any given combination of β and δ for the full parameter range of the model.

Figure 3.9: Comparison of both regimes (sym2 vs. asym)



Note: This figure illustrates the effects of an advertising ban on the profits of broadcaster A by comparing the equilibria of the symmetric model with market abstention (regime *sym2*) to the asymmetric model (regime *asym*).

■

Chapter 4

The role of online platforms for media markets - multidimensional spatial competition in a two-sided market

4.1 Introduction

The advent of online media platforms has initiated a controversy on the implications for traditional offline platforms. While some media experts argue that "newspapers ... are not dying, they are committing suicide"[1] by providing their contents online, others expect online platforms to pick up the slack of their offline counterparts' dwindling profits. The increase in internet penetration undoubtedly has affected media consumption habits, since individuals are exposed to a variety of online sources that provide highly specialized contents.[2] The question I investigate in this chapter is why media outlets offer contents online although there seems to be mixed evidence on the profitability of online platforms.[3] I study in a multidimensional two-sided market framework how the introduction of online media has affected consumers, advertisers, and media outlets

[1] Samir A. Husni, professor at The Meek School of Journalism and New Media, University of Mississippi. See Glaser (2007) for full interview.

[2] The worldwide internet penetration is 28.7 % (based on an estimated world population of 6,845,906,960 people) with 77.4% (58.4%) of the total population in North America (Europe) having access to the internet. See Internet World Stats (2011).

[3] Roughly 80% of U.S. newspapers' revenues come from advertising, and only 10% of ad revenues are generated online (see Kirchhoff, 2010).

and I show that entering the online market is the result of a prisoner's dilemma game for media outlets.

Contributing to the literature on two-sided markets and spatial competition, this chapter combines two types of models: a multi-dimensional spatial competition model, and a two-sided market framework. So far, there exists literature either on multi-dimensional spatial competition, or on two-sided markets, but not on a combination of the two. Combining these two elements is crucial to studying online platforms: The distinction between content of different style (e.g. information and entertainment) can be observed online as well as offline and is not surprising, as the specialization into content of different style is a standard result of product differentiation models. However, for a given style of coverage, consumers may switch between online and offline platforms, depending on their preferred way of consuming a certain content. Capturing this switching behavior requires adding an additional dimension of horizontal product differentiation to the mix. Hence, in a duopolistic market with both media outlets being active on the online as well as the offline market, consumers differ with respect to their preferences for style of coverage (as in traditional models), as well as in their preferences for the type of medium, and they can choose from four different options: the online or the offline version of either of the two styles, entertainment or information.

Textbook reasoning would suggest the following: As products are differentiated in n horizontal dimensions (here: style of coverage and type of medium), firms cater to the preferences of consumers more specifically and are able to charge higher prices than in the case with differentiation in $(n-1)$ horizontal dimensions.[4] This leads to higher revenues. The results of this model, however, are different. Although consumer prices may be higher than in the one-dimensional case, which confirms the initial suggestion, the firms cannot capitalize (i.e. take advantage of their market power on the consumer market due to consumers' distance costs) on the additional dimension such that the net effect on revenues is zero. The advertising market plays a decisive role for this finding, as it intensifies media outlets' competition for consumer market shares. As entry to the online market causes positive fixed costs, profits are even lower. Entrance to the online market is due to a prisoner's dilemma situation, since an equilibrium in which no firm enters the online market is not stable. Hence, media outlets enter although they would have been better off if they could coordinate themselves such that both players make binding commitments not to enter.

[4]For a comprehensive overview of spatial competition models à la Hotelling, see for instance Tirole (1988), Martin (2002), or Carlton and Perloff (2000).

Related literature

This chapter relates to two strands of literature: the advertising and two-sided markets literature on the one hand, and the literature on multi-dimensional spatial competition on the other hand. In addition, there is some work on online platforms that is helpful for evaluating the results of this model.

The interaction of two sides of a market is analyzed in a number of studies such as Rochet and Tirole (2003, 2006); Dukes and Gal-Or (2003).[5] Caillaud and Jullien (2001, 2003) study competition between two platforms with the platforms being homogenous for the players on both sides of the market, and and the two sides of the market exerting positive spillover effects. Anderson and Coate (2005) set up a model of broadcasters competing on the consumer as well as the advertising market, and they introduce negative spillover effects from advertisers to consumers. There are various modifications and extensions to this model, as for instance Armstrong (2006) who analyzes competition between two pay-per-view broadcasters.

The analysis of multi-dimensional spatial competition equilibria started with Tabuchi (1994) who set up a model in which consumer preferences are uniformly distributed across two horizontal dimensions. Gabszewicz and Resende (2008) analyze how uncertainty about product quality affects equilibrium outcomes in a two-dimensional framework with preferences regarding one product characteristic being vertically differentiated (quality), and the other one being a horizontal component. Larralde et al. (2009) endogenize the location decision of firms in a two-dimensional spatial competition framework with quadratic transportation costs, and provide a numerical simulation to a game of n dimensions in which they show that the maximum differentiation result does not necessarily hold in all of the dimensions. In the model developed below, it is not necessary to endogenize the location stage in which the style of contents is being chosen as long as the equilibrium locations evolve symmetrically. In Section 4.5, I provide reasoning on why this is always the case.

The number of theoretical contributions on online platforms is still quite limited, and contributions mostly have a clear focus on the advertising side of the market. An exception is Gentzkow (2007) who analyzes both theoretically and empirically how the emergence of a new product (online newspapers) has affected existing products. He finds that online and offline platforms are substitutes, which is in line with the

[5] For a survey summarizing recent work on two-sided markets, see Anderson and Gabszewicz (2006).

findings of this chapter. Bergemann and Bonatti (2010) build a model of informative advertising with heterogeneous consumers where the targeting ability is subject to the media type. They show that an online platform decreases the revenues of the competitor's offline platform more than an additional offline platform would. These findings trace out two relevant ingredients of my model: An online platform affects competition between media outlets in a different way than an offline platform, and the targeting ability, which is just another interpretation of ad effectiveness, plays a crucial role for model outcomes. In contrast to the above papers, this chapter's analysis is mainly concerned with media outlets as providers of content and advertising space, rather than with advertisers.

There are a number of recent empirical studies on how online platforms have affected traditional offline media with contributions focussing either on the effect of online media on the consumer market of offline media, or on the advertising market of offline media. Filistrucci (2005) offers an explanation for online platforms starting to charge consumers for accessing their content, and he shows for the Italian media market that providing an online platform has negative effects on both the profits of the platform that went online but also on the profits of the competitor who did not. These empirical results are in line with the predictions derived in the following sections of this chapter. George (2008) analyzes how internet penetration has changed the composition of the audience of traditional media, and provides evidence for online platforms drawing consumers away from traditional newspapers. Her findings are in line with Simon and Kadiyali (2007) who estimate that a magazine's print circulation drops by about 3% when offering an online platform. Analyzing how the online advertising market affects offline advertising, Goldfarb and Tucker (2011c) compare the ad effectiveness of different media types and find that offline advertisements can to a certain degree be substituted by online ads conditional on the audience they intend to reach. These results are reinforced by a previous study of the same authors (Goldfarb and Tucker, 2011a) that shows that a ban on offline advertisements for cigarettes results in a higher ad effectiveness online. In this model, I also explore the asymmetry between the ad effectiveness across media types, and I show that it is an important determinant for the price setting behavior of media outlets. Seamans and Zhu (2011) show in a recent study that the circulation as well as the advertising price of local newspapers in the U.S. fall when "Craigslist"(an online provider of classified advertisements) enters the market. Seamans and Zhu (2011) study a special kind of advertisements, as it may be possible that consumers choose an offline platform *because* it provides classified advertisements, which may explain the drop in circulation rates due to the market entry of Craigslist. In the model developed in this chapter, on the contrary, consumers are ad-neutral, which describes best a situation where platforms carry any other form of advertisements than classified ads.

The chapter is structured as follows: In the next section, I outline the assumptions and the setup of the benchmark model in which both media outlets offer an online as well as an offline platform. The equilibrium of the benchmark model is described in Section 4.3. In Section 4.4, I discuss (i) the equilibrium without online platform, and (ii) the equilibrium that arises if there is only one provider of an online platform. Possible extensions to the model, and the robustness of the results are discussed in Section 4.5. Section 4.6 concludes.

4.2 Model setup

Usually, competition for consumers is one-dimensional (firms compete in prices and one horizontal dimension). Modeling the media market, a common characteristic to distinguish consumer preferences for different media is the style of coverage with respect to political slant or the distinction between "hard" and "soft" content.[6] I keep the *style of content* as a dimension of platform differentiation, as it determines the recognition value of a media outlet.[7] Apart from the style dimension, I introduce another dimension that has become increasingly important in recent years: the *type of medium*, as platforms may offer an online as well as an offline issue of their given content. Having a variety of different media platforms to choose from, consumers' choices are subject to their style and type preferences. These two traits of product differentiation interact as follows: Platforms of the same type (online or offline) are maximally differentiated in the style dimension which decreases their substitutability compared to a situation in which both firms offer content of the same style.
A second dimension of horizontal product differentiation does not only capture the features of media platforms observed on the market, but contributes also to analyzing a theoretical question: As the degree of horizontal product differentiation increases due to firms offering two platforms that are differentiated in an additional dimension, this setup provides an adequate framework for analyzing whether this enables firms

[6]Entertainment is typically referred to as "soft" content in contrast to political or economic news coverage which is "hard" content. See for instance Lehman-Wilzig and Seletzky (2010).

[7]The underlying assumption is that the online and the offline edition of the same media outlet typically does not vary much across styles.

to exert higher levels of monopoly power over consumers than in the situation where they offer less specialized goods.
There are three types of agents interacting on four (sub-)markets: the consumers, the advertisers, and two media outlets. Consumers enter the media market which is divided into submarkets for online and for offline media. The advertising market is subject to the same structure with advertisers not being restricted to either the online or the offline market which implies that they place an advertisement on a platform if the net benefit from advertising is positive. In contrast to consumers, advertisers have no direct preferences with respect to type and style of the platform they place their advertisements on, but they aim at maximizing their consumer contacts.

The timing of the game is as follows: In the first stage, media outlets A and B simultaneously set consumer prices. In the second stage, consumers decide between the four possible media platforms with the decision on the style of coverage they intend to consume (entertainment vs. information), and on the type of medium (online vs. offline) being simultaneous.[8]

Media outlets

In the benchmark model, two media outlets derive profits from advertising as well as from selling copies (or charging fees) to consumers. Each medium $i \in A, B$ provides contents of their respective style ($x_i \in x_A, x_B$) on platforms of different types ($\theta_t \in \theta_{ON}, \theta_{OFF}$).
The strategic variables of the two media outlets are the consumer prices they set on each market. Advertising prices are indirectly determined by the number of consumers the respective platform attracts. An alternative way of modeling the strategic behavior of the firms would be to introduce ad-aversion as additional costs for consumers as for instance in Anderson and Coate (2005), and Dukes and Gal-Or (2003). This would account for the fact that some media platforms such as television are free-to-air but charge consumers indirectly by exposing them to utility-reducing advertisements. However, there are two major drawbacks of this strategy. First, there is mixed evidence on consumers' ad-aversion.[9] Second, it would reduce the general applicability of this

[8]Any sequence in the second stage (style of coverage is selected before or after the type of medium) yields the same results as the simultaneous game. See Section 4.5 for a discussion of different sequences.
[9]See for instance Kaiser and Song (2009); Sonnac (2000) who find that consumers may even like advertisements.

model, as it would only be valid for free-to-air television stations. Allowing the firms to set positive prices as in Gabszewicz et al. (2006), Ambrus and Reisinger (2006), Kind et al. (2010), and Peitz and Valletti (2008) avoids these issues.[10] Peitz and Valletti (2008) argue that introducing positive prices for broadcasting services is essential as modern tracking techniques make it possible for media outlets to charge consumers for accessing their services and will be the predominating form of television financing on the viewer side in the years to come.[11]

I assume maximum differentiation in the style dimension such that A offers entertainment, and B offers information, which implies that $x_A = 0$ and $x_B = 1$, given that x_i captures the degree of information.[12] The type of medium θ_t (online or offline) is also maximally differentiated with $\theta_{ON} = 0$ and $\theta_{OFF} = 1$. The parameter θ_t stands for the characteristics that an offline medium has in contrast to an online medium, as for example accuracy and more detailed coverage.

On the advertising side of the market, media outlets charge for advertising space proportionally to the consumer contacts they provide the advertisers with.[13] Hence, inverse advertising demand is a function of consumer demand as in Anderson and Coate (2005), and Bergemann and Bonatti (2010).

The supply of advertising space per platform is exogenously fixed and normalized to unity ($n^a_{i,t} = 1$). This assumption accounts for the fact that media outlets face technological and/or legal restrictions that result in capacity constraints with respect to the amount of advertising space they can offer.[14] This yields for the profit function of media outlet i:

$$\Pi_i = \underbrace{\overbrace{n^c_{i,ON} p^c_{i,ON}}^{\text{consumer revenues}} + \overbrace{n^a_{i,ON} p^a_{i,ON}}^{\text{ad revenues}} - C_{ON}}_{\text{profits in online market}} + \underbrace{\overbrace{n^c_{i,OFF} p^c_{i,OFF}}^{\text{consumer revenues}} + \overbrace{n^a_{i,OFF} p^a_{i,OFF}}^{\text{ad revenues}} - C_{OFF}}_{\text{profits in offline market}}. \quad (1)$$

[10] See also Crampes et al. (2009) for a circular-city model à la *Salop* where n firms compete for ad-averse consumers and advertisers.

[11] See the annual report by the Pew Research Center (2011) for a detailed analysis of pricing tools available to and used by online platforms. For best practice of U.S. newspapers, see Seidenberg (2009).

[12] This assumption is used in a broad range of publications. See for instance Laffont et al. (1998a,b); Anderson and Coate (2005); Armstrong (2006); Gabszewicz et al. (2004). As long as both firms are symmetric, this assumption is without loss of generality.

[13] This corresponds to the *Cost Per Mille* (CPM). The price for advertising space is calculated by dividing the number of consumers reached by this platform by 1,000, and multiplying it by the market value of an ad impression.

[14] In Germany, for instance, advertising slots are limited to 12 minutes per hour. Alternatively, think of the page size or the number of pages being binding restrictions. For online media, the screen size (or the resolution of the screen) limit the number of ads.

The consumer (advertiser) demand for medium i,t is expressed by $n^c_{i,t}$ ($n^a_{i,t}$), and the associated price is $p^c_{i,t}$ ($p^a_{i,t}$). In order to simplify the model, I assume that unit costs are zero.[15] Both media types, however, have fixed costs for staff and technical equipment when taking up their service. This is accounted for by $C_t > 0$ which is the same for media outlets A and B but varies with respect to the type of medium. I assume that online platforms can only be provided if the same media outlet already runs an offline platform. Entering the online market requires investments in servers and some additional staff which adds to the fixed costs of operating the offline platform which consist of running (television) studios or printing facilities (newspapers).

Consumers

On the consumer market, preferences for style of coverage and type of medium are uniformly distributed in a two-dimensional space as in Tabuchi (1994). A continuum of m consumers is uniformly distributed on the unit interval with each consumer choosing exactly one of the four platforms on the market. Consumers vary in two dimensions: First, they have differentiated tastes for the style of contents (entertainment vs. information) which is captured by the uniformly distributed taste parameter $x^m \in [0,1]$. Second, consumers are of different media use types, since some consumers prefer offline over online media, and vice versa. This is modeled by a taste parameter $\theta^m_i \in [0,1]$ which is again uniformly distributed among the mass of consumers. The subscript i indicates that the taste for media types may differ across the style of coverage. However, in this setup this is never the case in equilibrium. The style parameter x^m is assumed to remain constant across media types. I discuss the latter assumption in more detail in Section 4.5. For instance, if a consumer prefers information over entertainment, x^m will be large. If this consumer is interested in being informed immediately rather than waiting for news to be aired or in the papers, he chooses online over offline coverage which is associated with a low value of θ^m_i. Hence, the utility function of a representative consumer m when consuming an i,t-platform is[16]

$$U^m_{i,t} = \bar{u} - p^c_{i,t} - k(x^m - x_i)^2 - \ell(\theta^m_i - \theta_t)^2. \tag{2}$$

[15] This assumption is a common feature of media economics models as it is valid for virtually all audiovisual media since an additional user of an online platform or an additional television viewer does not cause higher costs.

[16] This utility function is as in Tabuchi (1994), where consumers also face a three-dimensional decision problem (two product characteristics, and the price) in a one-sided market.

The reservation utility $\bar{u}$ is assumed to be sufficiently large, such that, in equilibrium, each individual consumes one medium at a price $p^c_{i,t}$. The importance of obtaining the "right" media product is captured by the weight of the disutility parameters $k, \ell \in [0,1]$.[17] The above equation shows that consumers face three different kinds of costs: disutility from not obtaining the right style of coverage as well as disutility from not obtaining the right type of medium, and the price they have to pay to the media outlet.

Advertisers

There is a mass of n producers each of which produces exactly one good. For simplicity, I normalize the number of producers to unity ($n = 1$). In order to get the attention of consumers, the producers place advertisements. In this setting, advertisers are price takers on the advertising market.[18] They receive a benefit of G if a consumer buys the product. Of all consumers who are exposed to an advertisement in the online medium, a fixed proportion of $\beta_{ON} \in [0,1]$ consumers decides to buy the advertised product.[19] For the offline medium, the fraction of buyers is $\beta_{OFF} \in [0,1]$, respectively. Hence, the return per advertisement on platform i is $G\beta_t n^c_{i,t}$.
An alternative interpretation of β_t is that it expresses the value of an ad impression[20] which represents the probability of consumers buying the advertised good. The assumption of β_t being type-specific implies that advertising is targeted only with respect to the type of medium, i.e. that each consumer of type-t-platform has the same effects on advertisers' profits. Advertisers have some expectation (β_t) about the sales initiated by an advertisement in a medium of a certain type, but they are not able to correctly predict whether an ad in medium A or B triggers more sales. So they adapt their willingness to pay for advertisements only with respect to media types. This assumption is in line with the empirical findings of Goldfarb and Tucker (2011c,a). Relaxing this assumption is discussed in Section 4.5.
For simplicity, I assume that $G = 1$ such that the marginal benefit from an advertisement simply is $\beta_t n^c_{i,t}$. The price per advertisement is $p^a_{i,t}$. Hence, the inverse demand function for advertisements is

$$p^a_{i,t} = \beta_t n^c_{i,t}. \tag{3}$$

[17]Both $k(x^m - x_i)^2$ and $\ell(\theta^m_i - \theta_t)^2$ correspond to the distance costs in a standard spatial competition model that arise from consumers not being able to purchase at a store closest to their respective location.

[18]Gabszewicz et al. (2002, 2004) also assume advertisers to be price takers, and model the demand for advertising space analogically.

[19]I only consider sales triggered by advertisements. Producers may as well sell goods without them being advertised for, but this part of total sales is of no interest to the question I intend to analyze.

[20]*Ad impression* is the term for a single advertisement being displayed to exactly one consumer.

4.3 Equilibrium of the game

The game is solved by backward induction beginning with the second stage in which consumers choose their preferred medium. To determine equilibrium market shares, the following four conditions must hold for the pivotal consumer:

- indifference between platforms of A: $U^{piv}_{A,ON} = U^{piv}_{A,OFF}$
- indifference between platforms of B: $U^{piv}_{B,ON} = U^{piv}_{B,OFF}$
- indifference between online platforms: $U^{piv}_{A,ON} = U^{piv}_{B,ON}$
- indifference between offline platforms: $U^{piv}_{A,OFF} = U^{piv}_{B,OFF}$

The preferred mix of style and type of the pivotal consumer is illustrated in Figure 4.1, where the intersection of the two lines indicates the preferred style-type-mix of the pivotal consumer, and the four quadrants reflect the market shares of each platform. Consumers are indifferent between the online or offline platform of medium i, if

$$\begin{aligned} U^{piv}_{i,ON} &= U^{piv}_{i,OFF} \\ \Leftrightarrow p^c_{i,ON} - p^c_{i,OFF} &= \ell(\theta^{piv}_i - \theta_{OFF})^2 - \ell(\theta^{piv}_i - \theta_{ON})^2. \end{aligned} \tag{4}$$

The consumer who is indifferent between online and offline media use for given medium $i \in A, B$ is denoted by θ^{piv}_i. Deciding between the online and the offline platform of a given style, the distance costs with respect to the style are equal for both choices. Hence, only the prices and the distance costs with respect to the type of medium are decisive for the decision of consumers. Solving for the preferred type of medium of the pivotal consumer yields

$$\theta^{piv}_i = \begin{cases} 1, & \text{if } \; 0 < \ell \leq -\Delta_i \;\wedge\; \Delta_i < 0, \\ \frac{1}{2} - \frac{\Delta_i}{2\ell}, & \text{if } \; |\Delta_i| < \ell < 1, \\ 0, & \text{if } \; 0 < \ell \leq \Delta_i \;\wedge\; \Delta_i > 0, \end{cases} \tag{5}$$

with $\Delta_i \equiv p^c_{i,ON} - p^c_{i,OFF}$. This implies for the interior solution that consumers with $\theta^m_i < \theta^{piv}_i$ choose the online issue of media outlet i, and the remaining consumers choose the offline option.

There are three possible outcomes in the type dimension: (i), online platforms set higher prices than offline platforms, and distance costs in the type dimension ℓ are sufficiently small; (ii), offline platforms set higher prices than online platforms, and ℓ is sufficiently small; and (iii), the distance cost parameter ℓ is larger than the price difference between online and offline platforms. Scenarios (i) and (ii) yield corner solutions in which either only offline or only online platforms are on the market. This may be the case if type preferences have little influence on consumers' utility (small ℓ), or if media outlets set a large price difference between their online and offline platforms (large $|\Delta_i|$). I focus on scenario (iii) where some consumers choose an offline platforms, and others choose an online platform. This represents situations where ℓ is sufficiently large such that, in equilibrium, the disutility from consuming the wrong media type is larger than the savings from switching to the other media type ($\ell \in (|\Delta_i|, 1]$).

The style preference of the consumer who is indifferent between media outlet A and B for given type t is denoted by x^{piv}. The pivotal style preference can be derived from the following condition:

$$\begin{aligned} U^{piv}_{A,t} &= U^{piv}_{B,t} \\ \Leftrightarrow p^c_{B,t} - p^c_{A,t} &= k(x^{piv} - x_A)^2 - k(x^{piv} - x_B)^2 + \ell(\theta^{piv}_A - \theta_t)^2 - \ell(\theta^{piv}_B - \theta_t)^2. \end{aligned} \quad (6)$$

Note that distance costs with respect to the type of medium are relevant here as well since I allow type preferences to vary across styles.[21] Style preferences, on the contrary, do not vary with the type of platform. Solving for the preferred style of coverage x^{piv} of the pivotal consumer and inserting θ^{piv}_i from Eq. (5) yields:

$$x^{piv} = \begin{cases} 1, & \text{if } \; 0 < k \leq \frac{-\Omega}{4\ell} \, \wedge \, \Omega < 0, \\ \frac{1}{2} - \frac{\Omega}{8kj}, & \text{if } \; |\frac{\Omega}{4\ell}| < k < 1, \\ 0, & \text{if } \; 0 < k \leq \frac{\Omega}{4\ell} \, \wedge \, \Omega > 0. \end{cases} \quad (7)$$

with $\Omega \equiv (p^c_{A,ON} - p^c_{A,OFF})^2 - (p^c_{B,ON} - p^c_{B,OFF})^2 - 2\ell(p^c_{A,ON} + p^c_{A,OFF} - p^c_{B,ON} - p^c_{B,OFF})$.

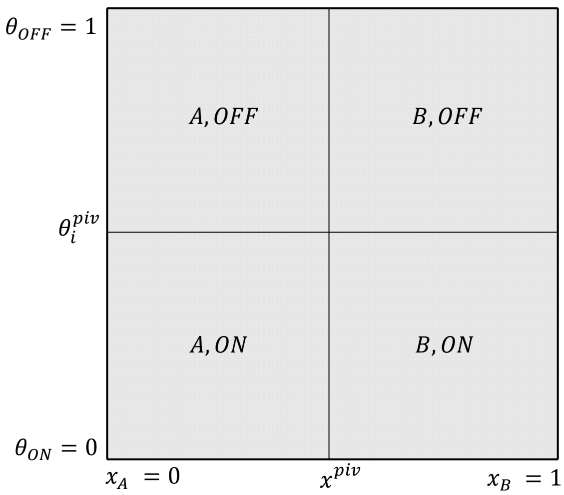
Again, there are three possible scenarios that follow a similar logic as discussed above: (i), the weight factor k of style preferences is sufficiently small, and the prices of the platforms of A are systematically lower than the prices of B ($\Omega < 0$), (ii), k is

[21] A possible interpretation of this assumption could be that consumers may have a higher preferences for online media when consuming information contents, as news are transmitted faster.

sufficiently small, and B sets systematically lower prices than A (i.e. $\Omega > 0$), and (iii), k is sufficiently large such that it determines consumers' platform choice. Scenarios (i) and (ii) describe corner solutions in which only A *or* B offers a media platform.[22] Only in Scenario (iii), both firms are active and an interior solution in the style dimension exists. This requires that price differences Ω may not be too large, and that the importance of obtaining the right style of coverage k may not be too small.

For the parameter range in which there are interior solutions in both dimensions $\big(|\Delta_i| < \ell < 1 \ \wedge \ |\frac{\Omega}{4\ell}| < k < 1\big)$, consumer demands are illustrated in Figure 4.1:

Figure 4.1: Consumer market shares



Note: This figure illustrates the consumer demand for a medium of type $t \in ON, OFF$ of media outlet $i \in A, B$.

The interpretation is as follows: Consumers with low values of θ_m choose online media (i.e. their preferred type-style mixes are located in one of the lower two quadrants). If, for instance, the preferred style x_m of a consumer out of this group takes a larger value than the preferred style of the pivotal consumer, he is located in the lower right quadrant and will choose the online platform of media outlet B. Hence, the mass of all consumers choosing an i,t-platform is reflected by the respective quadrant in the

[22] Note that the threshold value $|\frac{\Omega}{4\ell}|$ of k is a function of the prices only rather than a function of θ_i^{piv} and the prices because Eq. (5) has already been substituted into the reaction function $x^{piv}(\theta_i^{piv}) = \frac{1}{2} - \frac{p^c_{A,t}-p^c_{B,t}+\ell[(\theta_A^{piv})^2-(\theta_B^{piv})^2-2\theta_t(\theta_A^{piv}-\theta_B^{piv})]}{2k}$.

figure. This yields for the demand functions:

$$n^c_{A,ON} = \theta^{piv}_A x^{piv} \qquad n^c_{B,ON} = \theta^{piv}_B (1 - x^{piv}), \tag{8}$$
$$n^c_{A,OFF} = (1 - \theta^{piv}_A) x^{piv} \qquad n^c_{B,OFF} = (1 - \theta^{piv}_B)(1 - x^{piv}).$$

Facing the demands as expressed in Eq. (8), media outlets choose the profit maximizing prices according to their profit function (Eq. 1). This yields:

$$\begin{aligned} p^c_{i,ON} &= \underbrace{k}_{\text{market power}} - \underbrace{\frac{2\beta_{ON} + \beta_{OFF}}{3}}_{\text{advertising externality}} - \underbrace{\frac{\Delta^2_\beta}{9\ell}}_{\text{asymmetry}}, \\ p^c_{i,OFF} &= \underbrace{k}_{\text{market power}} - \underbrace{\frac{\beta_{ON} + 2\beta_{OFF}}{3}}_{\text{advertising externality}} - \underbrace{\frac{\Delta^2_\beta}{9\ell}}_{\text{asymmetry}}, \end{aligned} \tag{9}$$

with $\Delta_\beta \equiv \beta_{OFF} - \beta_{ON}$.

Equilibrium market shares and advertising prices are obtained by substituting Eq. (9) into (5), (7)-(8) and (3):

$$n^c_{i,ON} = \frac{1}{4} - \frac{\Delta_\beta}{12\ell}, \qquad n^c_{i,OFF} = \frac{1}{4} + \frac{\Delta_\beta}{12\ell}, \tag{10}$$
$$p^a_{i,ON} = \frac{\beta_{ON}}{4} - \frac{\beta_{ON}\Delta_\beta}{12\ell}, \qquad p^a_{i,OFF} = \frac{\beta_{OFF}}{4} + \frac{\beta_{OFF}\Delta_\beta}{12\ell}.$$

Substituting the above results into Eq. (1) yields the following profits:

$$\begin{aligned} \Pi_i &= n^c_{i,ON}(p^c_{i,ON} + \beta_{ON}) + n^c_{i,OFF}(p^c_{i,OFF} + \beta_{OFF}) - C_{ON} - C_{OFF} \\ &= \left(\frac{1}{4} - \frac{\Delta_\beta}{12\ell}\right)\left(k - \frac{\Delta^2_\beta}{9\ell} - \frac{\Delta_\beta}{3}\right) \\ &+ \left(\frac{1}{4} + \frac{\Delta_\beta}{12\ell}\right)\left(k - \frac{\Delta^2_\beta}{9\ell} + \frac{\Delta_\beta}{3}\right) - C_{ON} - C_{OFF} \\ &= \frac{1}{2}k - C_{ON} - C_{OFF}. \end{aligned} \tag{11}$$

The equilibrium of the benchmark model has the following characteristics:

Proposition 1 *If offline advertisements are more effective than online advertisements, i.e.* $\Delta_\beta > 0$, *and the importance of type preferences is sufficiently large* $\left(|\frac{\Delta_\beta}{3}| < \ell \leq 1\right)$,[23]

- *offline media serve a larger part of the consumer market than online media.*
- *offline consumer prices are lower than online consumer prices.*
- *the advertising prices and revenues are higher in the offline market.*

These relations are reversed if $\Delta_\beta < 0$.

Proof. See Section A1 of the Appendix. From $\partial^2\Pi_{i,t}/\partial(p^c_{i,t})^2 < 0$ follows that the profit function is locally concave at the equilibrium. ■

4.3.1 The impact of the *type-dimension*

The consumer prices can be structured into three distinct effects: a *market power effect*, an *advertising externality*, and an *asymmetry effect.* The market power effect increases consumer prices and represents the incentive of media outlets to capitalize on consumers' distance costs. The advertising externality and the asymmetry effect reduce consumer prices and are related to the two-sided nature of the market.
The *first term* of the consumer prices (Eq. 9) expresses the standard result of spatial competition models where consumers incur a disutility from not obtaining the right product: The larger the importance k of obtaining the right style of coverage (the higher the costs of not obtaining the right style), the higher the price. Even though k may be sufficiently high such that, in equilibrium, consumer prices are positive, media outlets may still have losses in the consumer sector when accounting for fixed costs.[24]
For the spatial competition effect, only the distance cost parameter k with respect to

[23] Note that the restriction on k for an interior solution to exist is always fulfilled, as, in equilibrium, $|\frac{\Omega}{4\ell}| = 0$.

[24] Technically, negative consumer prices ($1 \geq \beta_t \geq k \geq 0$) can still be an equilibrium as long as the revenues in the advertising market compensate for the losses in the consumer market. For instance, some media outlets provide free services to consumers and base their profits solely on advertising revenues. An example for this business model are free newspapers or commercial television.

the style (which varies between A and B) is relevant. The distance cost parameter ℓ with respect to the type does not increase prices.

The effect of the advertising externality is represented by the *second term* of Eq. (9) and comes from the positive externality of consumer demand on the revenues from the advertising side of the market. This effect is a special trait of two-sided markets and reduces consumer prices. A novel feature of this model is that media outlets can shift revenues from the less profitable to the more profitable advertising market by setting consumer prices such that more consumers are allocated in the market with the higher ad effectiveness (which is subject to the sign of Δ_β). The negative ad externality effect is a weighted average of the ad effectiveness parameters: Regarding online prices, for instance, the influence of β_{ON} on the advertising externality effect is twice as large as the influence of β_{OFF}. Therefore, the online price is lower than the offline price if $\beta_{ON} > \beta_{OFF}$.

The *third term* of Eq. (9) represents the ad asymmetry effect that has equal effects on online and offline prices. Since advertising prices are a linear function of consumer demand, and advertising space is normalized to 1, the advertising market in the offline medium is more (less) profitable for media outlets than the advertising market in the online medium, if $\Delta_\beta > 0$ ($\Delta_\beta < 0$). If advertisements were equally effective, the incentive to attract consumers would be equally strong for both platforms, and the marginal return from attracting a consumer is equal for both platforms of media outlet i. Starting from a situation in which the ad effectiveness is equal for both types of platforms, media outlets do not care which platform specifically to attract consumers to. If, however, there is an asymmetry in the ad effectiveness, both media outlets compete harder for a subset of consumers with high θ_i^m, if offline advertisements are more effective, or with low θ_i^m, otherwise. The larger the difference Δ_β in the ad effectiveness, the larger is both media outlets' incentive to attract consumers to the more profitable platform, which results in lower prices. As the consumer price of the platform with the higher ad effectiveness is reduced, the platform of the other type becomes relatively less attractive to consumers. Hence, media outlets have to decrease consumer prices on their online as well as their offline platform to prevent consumers from switching to a platform of the competing media outlet. This result may already be a pointer that media outlets might not be able to capitalize on the additional media types dimension.

4.3.2 Comparative statics

In this section, I analyze how an increase in the ad effectiveness β_t, or an increase in the importance ℓ of type preferences affect equilibrium outcomes. An increase in β_t reflects the effects of the advertising market becoming more important to media outlets:

Proposition 2 *Starting from the interior equilibrium where $|\frac{\Delta_\beta}{3}| < \ell \leq 1$, a marginal increase in the ad effectiveness β_t yields the following effects:*

- *Consumer prices of a given type decrease in their own type's ad effectiveness. The effect of an increase in the other type's ad effectiveness is ambiguous for $\Delta_\beta \gtrless 0$, and depends on the sign of Δ_β, as well as on the intensity of type preferences, ℓ.*
- *Consumer market shares and advertising prices increase in their own type's ad effectiveness, and decrease in the ad effectiveness of the other type.*

Proof. See Section A2 of the Appendix. ■

In a two-sided markets setup where a firm provides two platforms with one being more valuable to consumers from one side of the market than the other platform, one would expect firms to shift consumer demand from the less profitable to the more profitable platform by unilaterally lowering consumer prices. In this model, however, this is not the case. The first derivatives of consumer prices with respect to the ad effectiveness β_t show that consumer prices do not only decrease in their own type's ad effectiveness, but may also decrease in the other type's ad effectiveness.[25] More specifically, for the case of offline platforms yielding the higher return on the advertising market than online platforms ($\Delta_\beta > 0$), online consumer prices decrease in β_{OFF}, if and only if $\ell > \frac{2\Delta_\beta}{3}$, i.e. if consumers' utility from obtaining their preferred type is sufficiently large. If the online ad effectiveness is larger than the offline ad effectiveness ($\Delta_\beta < 0$), online consumer prices decrease in β_{OFF} on the whole parameter range.[26]

This is due to the evolution of consumer prices being determined by a direct and two indirect effects. In the following, I briefly sketch the mechanism for the example of $\Delta_\beta > 0$.[27] If β_{OFF} increases, offline prices go down due to the direct effect of consumer

[25]For $\Delta_\beta = 0$, consumer prices of a platform of a given type unambiguously decrease in the ad effectiveness of the other type.

[26]Analogically, if $\Delta_\beta > 0$, offline consumer prices decrease in β_{ON} on the whole parameter range. If $\Delta_\beta < 0$, prices decrease in β_{ON}, if and only if $\ell > \frac{2\Delta_\beta}{3}$.

[27]Note that offline prices are always lower than online prices, if $\Delta_\beta > 0$.

contacts selling at a higher price to advertisers than consumer contacts on the platform with the lower ad effectiveness. Furthermore, Δ_β becomes larger, which implies that the average return per consumer increases. This leads to the online prices decreasing as well, which is captured by the negative indirect effect. If, however, β_{ON} increases, there is again a negative direct effect on online prices, but two indirect effects on offline prices, that work in different directions. An increase in β_{ON} implies (i) that the average return per consumer increases, which is the negative indirect effect on offline prices, and (ii) Δ_β becomes smaller such that it is less important for media outlets which platform to attract consumers to. This results in a positive indirect effect of an increase in β_{ON} on offline prices. The positive indirect effect only dominates the evolution of offline prices, if consumers' type preferences ℓ are sufficiently small. However, for the largest part of the parameter range, an increase in the ad effectiveness of any media type has negative effects on consumer prices.[28]

The reaction of consumer market shares to an increase in β_t is such that online market shares increase in β_{ON}, and decrease in β_{OFF}, and vice versa for offline market shares. This is due to the direct (negative) effect dominating the indirect (negative) effect on consumer prices: The incentive to lower consumer prices consists of two components, out of which only one remains if the ad effectiveness of the other media type increases. Hence, given that β_{OFF} increases, the incentive to lower prices in the offline market is twofold, as the marginal return of advertisements increases, and price competition increases. For the online platform, in contrast, only the competition effect plays a role. This leads to offline platforms making larger price cuts than online platforms, and thus becoming *ceteris paribus* more attractive to consumers.

With respect to the profits, conventional wisdom would suggest that overall revenues of media outlets increase if advertising space can be sold at a higher price (due to an increase in β_t). This, however, is not the case. The reason is that revenues are shifted between the advertising and the consumer market such that the net effect of an increase in the profitability of the advertising sector is zero. If advertisers are completely inelastic, media outlets can extract the maximum surplus from them. Therefore, the incentive to attract consumers is sufficiently strong such that, in equilibrium, the gains from advertising revenues are mitigated by the price cuts and the resulting loss on the consumer market.

[28]This is due to the losses from reducing the price for the intra-marginal units being lower than the losses due to a reduction of the market shares if prices remained higher.

After having analyzed the effects of the advertising market of a type-t-platform becoming more important to media outlets, the following part is devoted to analyzing an increase in the importance ℓ of type preferences. The higher ℓ, the higher the costs consumers have to bear when switching to their less preferred media type. One-dimensional models would predict the following: If consumers' distance costs increase, firms capitalize on these distance costs, and will thus increase prices, which, in turn, will lead to higher profits. Again, this is not the case, because this framework accounts for additional effects that cannot be captured in one-dimensional models.

Proposition 3 *Starting from the interior equilibrium where* $|\frac{\Delta_\beta}{3}| < \ell \leq 1$ *and* $\Delta_\beta \gtreqless 0$*, a marginal increase in the importance* ℓ *of type preferences for consumer utility (increase in distance costs) yields the following effects:*

- *Consumer prices increase.*
- *Market shares as well as advertising prices of the offline platforms increase (decrease), if* $\Delta_\beta < 0$ *(*$\Delta_\beta > 0$*). For online platforms, these relations are the reverse.*

If $\Delta_\beta = 0$*, an increase in* ℓ *does not affect the equilibrium results.*

Proof. See Section A3 of the Appendix. ∎

As ℓ increases, the relative importance of low prices for consumers' decision which platform to choose, diminishes. This allows media outlets to increase the prices on all of their platforms.[29] The increase in the importance of type preferences weakens the effect of media outlet i setting different prices on their platforms of a given style. If, for instance, $\Delta_\beta > 0$, the ad effectiveness of offline platforms is higher than the ad effectiveness of online platforms, which implies that media outlet i sets lower consumer prices in the offline market than in the online market. Since the lower price of the offline platform attracts less consumers as ℓ increases, the offline market shares decrease, if $\Delta_\beta > 0$. Following a similar logic, the market shares of online platforms decrease in ℓ, if $\Delta_\beta < 0$. The main reason for the effects of an increase in ℓ to deviate from standard models is that any reaction to an increase in ℓ is subject to the ad effectiveness deviating across media types.

[29]This argument is similar to one-dimensional spatial competition models where firms increase their prices, if consumers' demand elasticity decreases.

As profits only depend on the intensity k of style preferences, any effects induced by a change in type preferences or ad effectiveness only lead to redistribution between the online and offline profits, or between the profits from advertising or from consumers, respectively. This, however, is profit-neutral for media outlets. An increase in the distance cost parameter in the style dimension, k, induces the same effect as in standard models: An increase in k leads to higher prices of both firms, as well as to higher profits.[30] Hence, a key result of this section is that adding an additional dimension to a spatial competition framework does not lead to higher profits, which contradicts the intuition gained from one-dimensional models.

4.4 Why do firms offer online platforms?

This section is devoted to analyzing *why* firms enter the online market by deriving (i) the equilibrium in which there are only offline platforms, and (ii) the equilibrium in which only one firm provides an online platform in addition to the offline platforms.

4.4.1 The world without online platforms

A first step is to derive the equilibrium without an online market where both media outlets offer only an offline platform to consumers and advertisers, which obviously yields the standard result of one-dimensional two-sided market models.[31]

In this setting, consumers only have to decide between the offline platforms of A and B. Hence, the pivotal consumer is indifferent between the offline platforms of both media outlets if $U^{piv}_{A,OFF} = U^{piv}_{B,OFF}$.[32] In the following, the equilibrium values of the scenario without online platforms are denoted by ~. Solving for $\tilde{x}^{piv}$ yields

$$\tilde{n}^c_{A,OFF} = \tilde{x}^{piv} = \frac{1}{2} + \frac{p^{c,n}_{B,OFF} - p^{c,n}_{A,OFF}}{2k}, \qquad \tilde{n}^c_{B,OFF} = 1 - \tilde{x}^{piv}. \tag{12}$$

[30] Note that the derivatives with respect to k are as follows: $\frac{\partial p^c_{i,t}}{k} = 1$, and $\frac{\partial \Pi_i}{k} = \frac{1}{2}$.

[31] Allowing for market abstention of individuals with a high preference for online media would yield a different equilibrium. Since such an equilibrium would not provide equal grounds for a comparison of the models, I maintain the assumption of each consumer buying exactly one medium.

[32] Note that the distance costs in the type dimension do not affect consumers' decision which platform to choose, as consumers are assumed to single-home.

The profit function now simplifies to:[33]

$$\tilde{\Pi}_i = \tilde{p}^c_{i,OFF}\tilde{n}^c_{i,OFF} + \tilde{p}^a_{i,OFF}. \tag{13}$$

Deriving the equilibrium is as in Section 4.3 and yields the following results:

$$\begin{aligned} \tilde{p}^c_{i,OFF} &= k - \beta_{OFF}, & \tilde{n}^c_{i,OFF} &= \frac{1}{2}, \\ \tilde{p}^a_{i,OFF} &= \frac{\beta_{OFF}}{2}, & \tilde{\Pi}_i &= \frac{1}{2}k - C_{OFF}. \end{aligned} \tag{14}$$

The equilibrium of the game without online entry reflects the standard result of spatial competition in a two-sided market. The incentive to set prices above marginal costs is reduced by the negative externality of consumer prices on advertising revenues. The higher the ad-effectiveness, the lower are consumer prices. As prices and the disutility from deviating from the preferred style of coverage are equal for both platforms, both firms serve half of the market. Again, media profits are increasing in consumers' disutility k from obtaining the wrong style of coverage. Comparing Eq. (11) to Eq. (14) shows immediately that profits are at least as high as in a situation in which both firms enter the online market. Hence, there is no obvious reason why media outlets would choose to enter the online market in the first place.

Proposition 4 *If and only if $\Delta_\beta < 0$, i.e. online advertisements are more effective than offline advertisements, and the condition $|\frac{\Delta_\beta}{3}| < \ell \leq 1$ for an interior equilibrium on the market with online and offline platforms is fulfilled, all consumer prices decrease compared to the situation without online platforms. As there are positive fixed costs of entering the online market ($C_{ON} > 0$), coordinately committing to not entering the online market yields higher profits than entering on the whole parameter range of the interior equilibrium.*

Proof. See Section A4 of the Appendix. ■

Comparing the equilibrium without online platforms to the equilibrium where both firms enter the online market, the evolution of prices is more complex than the initial suggestion of prices increasing if consumers' preferences can be met more accurately

[33] Note that the demand for advertising space is again normalized to 1.

through offering more specialized goods (online platforms). As discussed in the previous section, media outlet i sets prices such that more consumers are allocated on the platform with the higher ad effectiveness. The size of this effect is subject to the *weighted average* of the ad effectiveness parameters β_t (see second term of Eq. 9).[34]

I now analyze whether average consumer prices are higher or lower in a two-dimensional market of online and offline platforms compared to a one-dimensional market in which there are only offline platforms. The result critically depends on the size of the advertising externality, which, in turn, is subject to the sign of Δ_β. There are two cases: First, online platforms have a higher ad effectiveness than offline platforms (average ad effectiveness increases), and second, online platform have a lower ad effectiveness than offline platforms (average ad effectiveness decreases).

In the first case where $\beta_{ON} > \beta_{OFF}$ (which implies $\Delta_\beta < 0$), the advertising effect is stronger on the online platforms (follows from comparing the second terms of the consumer prices in Eq. 9). Hence, if the advertising effect on the offline platform is stronger in a two-dimensional than in a one-dimensional market, offline as well as online consumer prices are lower in a two-dimensional market. This implies that average consumer prices decrease due to the introduction of online platforms. This is illustrated by the following example: If $\beta_{ON} = \beta_{OFF} + \epsilon$, with $0 < \epsilon < 1 - \beta_{OFF}$, the advertising externality on offline prices in the two-dimensional case yields:

$$\underbrace{\frac{\beta_{OFF} + \epsilon + 2\beta_{OFF}}{3}}_{\text{ad effect if } \Delta_\beta < 0} = \beta_{OFF} + \frac{\epsilon}{3} > \underbrace{\beta_{OFF}}_{\text{ad effect, no online}}, \quad \iff \quad p^c_{i,OFF} < \widetilde{p}^c_{i,OFF}. \tag{15}$$

This equation shows that the negative effect of the advertising externality on consumer prices is larger in the two-dimensional than in the one-dimensional case.

As $p^c_{i,ON} < p^c_{i,OFF}$, if $\Delta_\beta < 0$, average prices decrease when online platforms are introduced.[35] In other words, competition for consumers has increased as advertisements can *on average* be sold at a higher price. In the second case of $\Delta_\beta > 0$, however, the average ad effectiveness has decreased which leads to an increase in consumer prices.[36]

Comparing equilibrium consumer prices with and without online platforms, there is an upward shift in offline consumer prices, as the negative effect of the advertising

[34]Note that consumer prices in the case of both firms entering the online market are $p^c_{i,ON} = k - \frac{2\beta_{ON}+\beta_{OFF}}{3} - \frac{\Delta^2_\beta}{9\ell}$ and $p^c_{i,OFF} = k - \frac{\beta_{ON}+2\beta_{OFF}}{3} - \frac{\Delta^2_\beta}{9\ell}$.

[35]Note that the ad asymmetry effect (third term of Eq. 9) always reduces prices in the two-dimensional case.

[36]Note that online prices are higher than offline prices if offline advertisements are more effective than online advertisements.

externality is weaker than in the one-dimensional case without online platforms. The (negative) effect of the advertising externality is dominated by the (positive) effect of the advertising market taking less influence on the firms' profits, and average consumer prices increase. This illustrates two key findings of the model: (i) The average level of the ad effectiveness is decisive for the pricing decision of media outlets, and (ii) consumers may benefit from the introduction of online platforms as prices decrease.
The media outlets, however, cannot benefit if both firms enter the online market. When comparing media profits in the regime without an online market to the profits where both firms enter, it becomes obvious that they are again only a function of the distance cost parameter k, and the fixed costs. This confirms the intuition of the benchmark model that any gain in the advertising market is compensated for by a loss in the consumer market, and vice versa. This shows unequivocally that the type dimension is irrelevant for media profits. As $C_{ON} > 0$, profits are lower in the case of both media outlets entering the online market.

4.4.2 The benefits of unilaterally deviating from the equilibrium without online platforms

Given that entry on the online market lowers media profits, a possible explanation for market entry is that there are gains from unilaterally deviating from the no-entry strategy. In this context, complying means that a media outlet offers only an offline platform, and deviating means that a media outlet enters the online market. The profits of the deviating firm are denoted by Π_i^{deviate}, if the other firm complies, and the profits of the complying firm are denoted by Π_i^{comply}, if the other firm deviates. Recall that the profits when both firms comply are $\tilde{\Pi} = \frac{k}{2} - C_{OFF}$, and the profits if both firms deviate are $\Pi = \frac{k}{2} - C_{ON} - C_{OFF}$. Figure 4.2 illustrates the payoff matrix of the game:

Figure 4.2: PAYOFF MATRIX

		B	
		deviate	*comply*
A	*deviate*	$\frac{k}{2} - C_{ON} - C_{OFF},$ $\frac{k}{2} - C_{ON} - C_{OFF}$	$\Pi_i^{deviate},$ Π_i^{comply}
	comply	$\Pi_i^{comply},$ $\Pi_i^{deviate}$	$\frac{k}{2} - C_{OFF},$ $\frac{k}{2} - C_{OFF}$

Note: Media outlet A (B) is player 1 (2). Π_i^{deviate} and Π_i^{comply} are as in Eq. (23) and (24).

For market entry on the online market to be the result of a prisoner's dilemma, the following three conditions must hold:

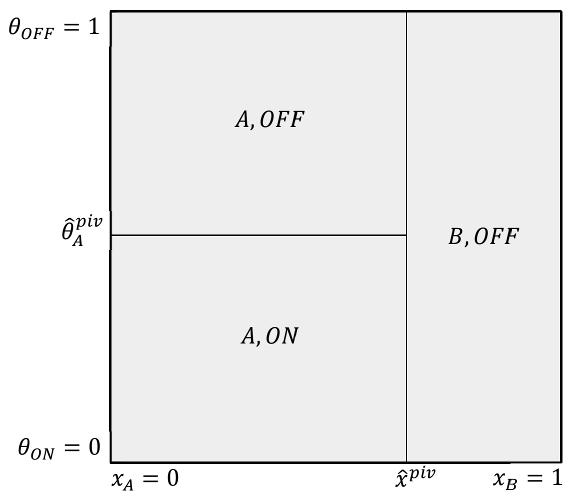
- *Condition 1:* Aggregate profits from both firms complying are larger than aggregate profits if both firms deviate.
- *Condition 2:* The gains from deviating from the equilibrium where no firm offers an online platform must be positive for the firms that enters the online market: $\Pi_i^{\text{deviate}} > \tilde{\Pi}_i$ (instability of equilibrium where no firm offers online platform).
- *Condition 3:* The profits from being the only firm not offering an online platform must be lower than the profits when both firms are active on both markets: $\Pi_i^{\text{comply}} < \Pi_i$ (stability of equilibrium where both firms offer online and offline platforms).

It is immediately obvious from comparing equilibrium profits in Eq. (11) to Eq. (14) that *Condition 1* is fulfilled for any positive level of fixed costs of online platforms:

$$\frac{k}{2} - C_{OFF} > \frac{k}{2} - C_{ON} - C_{OFF} \qquad \Leftrightarrow \qquad C_{ON} > 0. \tag{16}$$

The remaining conditions require some more deliberation. I now discuss the case where media outlet A is the one to deviate from offering only an offline platform. Any results are identical if B was the deviating firm, since both firms are symmetric ex ante.
If media outlet A is the only provider of advertising space, consumers can only choose between the offline platform of B or any platform of A. This implies that consumers with a high preference for both online media (low θ^m) and content of style (high x^m) have the highest costs. Following the logic of the previous sections, market abstention of consumers is not allowed for. Consumer demands can be illustrated as in Figure 4.3:

Figure 4.3: Consumer market shares, unilateral deviation



Note: This figure illustrates the consumer demand for a medium of type $t \in ON, OFF$ of media outlet $i \in A, B$.

In the second stage, consumers choose their preferred platform out of the three options. For the pivotal consumer whose preferred style-type mix is at the intersection of the functions in Figure 4.3, the following three conditions must hold:

- indifference between platforms of A: $U_{A,ON}^{piv} = U_{A,OFF}^{piv}$
- indifference between offline platforms: $U_{A,OFF}^{piv} = U_{B,OFF}^{piv}$
- indifference between $A's$ online and $B's$ offline platform: $U_{A,ON}^{piv} = U_{B,OFF}^{piv}$

The cutoff-level of type preferences (first condition) is as in Section 4.3:

$$\hat{\theta}_A^{piv} = \begin{cases} 1, & \text{if} \quad 0 < \ell \leq -\Delta_A \wedge \Delta_A < 0, \\ \frac{1}{2} - \frac{\Delta_A}{2\ell}, & \text{if} \quad |\Delta_A| < \ell < 1, \\ 0, & \text{if} \quad 0 < \ell \leq \Delta_A \wedge \Delta_A > 0, \end{cases} \tag{17}$$

with $\Delta_A = p^c_{A,ON} - p^c_{A,OFF}$, and hat variables ˆ indicating the equilibrium where only one firm enters the online market. Again, the argument is as in Section 4.3: If the price difference is decisive for consumers' decision, they will choose the cheaper medium. Hence, for an interior equilibrium to occur, type preferences must be sufficiently strong. Again, the location of the preferences for style and type where the pivotal consumer is indifferent between the three available platforms is denoted by the intersection of the two lines in Figure 4.3. After having defined the horizontal line in Eq. (17), the vertical line is defined as follows: The pivotal consumer is indifferent between any platform of A and the offline platform of B, if

$$\begin{aligned} \hat{U}_A^{piv} &= \hat{U}_B^{piv} \\ \Leftrightarrow &\ \theta_A^{piv} \left[p^c_{A,ON} + k(x^{piv} - x_A)^2 + \ell(\theta_A^{piv} - \theta_{ON})^2\right] \\ + &\ (1 - \theta_A^{piv}) \left[p^c_{A,OFF} + k(x^{piv} - x_A)^2 + \ell(\theta_A^{piv} - \theta_{OFF})^2\right] \\ = &\ p^c_{B,OFF} + k(x^{piv} - x_B)^2 + \ell(0.5 - \theta_{OFF})^2. \end{aligned} \tag{18}$$

For the pivotal consumers, the distance costs with respect to the type dimension when choosing a platform of B is the mean of the standard uniform distribution underlying consumers' type preferences ($\theta_i^m = 0.5$). Solving for the cut-off level of style preferences yields:

$$\hat{x}^{piv} = \begin{cases} 1, & \text{if} \quad 0 < k \leq \frac{-\Psi}{4\ell} \wedge \Psi < 0, \\ \frac{1}{2} - \underbrace{\frac{(p^c_{A,ON} - p^c_{A,OFF})^2}{8\ell k}}_{>0} + \underbrace{\frac{2p^c_{B,OFF} - p^c_{A,ON} - p^c_{A,OFF}}{4k}}_{\lesseqgtr 0}, & \text{if} \quad |\frac{\Psi}{4\ell}| < k < 1, \\ 0, & \text{if} \quad 0 < k \leq \frac{\Psi}{4\ell} \wedge \Psi > 0, \end{cases} \tag{19}$$

with $\Psi \equiv (p^c_{A,ON} - p^c_{A,OFF})^2 - 2\ell(2p^c_{B,OFF} - p^c_{A,ON} - p^c_{A,OFF})$.

Again, the cut-off style preference (denoted by the preferred style of the pivotal consumer) is such that consumers with $x^m < \hat{x}^{piv}$ choose any of the platforms A has to offer whereas consumers with $x^m > \hat{x}^{piv}$ choose the offline platform of B.
In contrast to the basic model, A and B do not necessarily share the market equally (see Eq. 18). In fact, this is only the case if all media platforms set the same prices. Following the argument from the previous section of how the advertising effectiveness parameters affects pricing, one can expect prices to differ for $\Delta_\beta \neq 0$, which leads to A and B no longer sharing the market equally.
For an interior solution in both the style as well as the type dimension as in Figure 4.3, consumer demands are calculated as follows:

$$\hat{n}^c_{A,ON} = \hat{\theta}^{piv}_A \hat{x}^{piv}, \qquad \hat{n}^c_{A,OFF} = (1 - \hat{\theta}^{piv}_A)\hat{x}^{piv}, \qquad \hat{n}^c_{B,OFF} = 1 - \hat{x}^{piv}. \tag{20}$$

The first stage of the game where media outlets set prices is as in Section 4.3. The profit functions are now:

$$\begin{aligned} \hat{\Pi}_A &= \hat{p}^c_{A,ON}\hat{n}^c_{A,ON} + \hat{p}^a_{A,ON}\hat{n}^a_{A,ON} + \hat{p}^c_{A,OFF}\hat{n}^c_{A,OFF} + \hat{p}^a_{A,OFF}\hat{n}^a_{A,OFF} - C_{ON} - C_{OFF}, \\ \hat{\Pi}_B &= \hat{p}^c_{B,OFF}\hat{n}^c_{B,OFF} + \hat{p}^a_{B,OFF}\hat{n}^a_{B,OFF} - C_{OFF}. \end{aligned} \tag{21}$$

Maximizing Eq. (21) with respect to $\hat{p}_{i,t}$ yields:

$$\begin{aligned} \hat{p}^c_{A,ON} &= k - \frac{\beta_{ON} + \beta_{OFF}}{2} - \frac{\Delta^2_\beta}{12\ell}, \qquad \hat{p}^c_{A,OFF} = k - \frac{\beta_{ON} + 5\beta_{OFF}}{6} - \frac{\Delta^2_\beta}{12\ell}, \\ \hat{p}^c_{B,OFF} &= k - \frac{\beta_{ON} + 5\beta_{OFF}}{6} - \frac{\Delta^2_\beta}{36\ell}. \end{aligned} \tag{22}$$

As in the basic model, the difference between the prices of the platforms of media outlet A is $\hat{p}^c_{A,ON} - \hat{p}^c_{A,OFF} = \frac{\Delta_\beta}{3}$, which is also the minimum value of ℓ for an interior solution to occur.[37] The interpretation of the prices of the basic model applies also in the unilateral deviation case and is therefore not replicated in this section.
Computing the profits is as in Section 4.3 and yields:

[37] Note that $\Delta_\beta = \beta_{OFF} - \beta_{ON}$.

$$\hat{\Pi}_A \quad = \quad \Pi_i^{\text{deviate}} = \underbrace{\frac{k}{2} - C_{OFF}}_{\tilde{\Pi}_i} + \underbrace{\frac{\Theta(72\ell k + \Theta)}{2592\ell^2 k} - C_{ON}}_{\text{gain from deviating}}, \tag{23}$$

$$\hat{\Pi}_B \quad = \quad \Pi_i^{\text{comply}} = \underbrace{\frac{k}{2} - C_{OFF}}_{\tilde{\Pi}_i} - \underbrace{\frac{\Theta(72\ell k - \Theta)}{2592\ell^2 k}}_{\text{loss from complying}}, \tag{24}$$

with $\Theta \equiv \Delta_\beta(\Delta_\beta - 6\ell)$.

Proposition 5 *If the condition for an interior equilibrium in the market with online and offline platforms is fulfilled, i.e. if* $|\frac{\Delta_\beta}{3}| < \ell \leq 1$*, and the ad effectiveness in the online market is higher than in the offline market (*$\Delta_\beta < 0$*), there are two alternative cases in which an equilibrium with no firm entering the online market is not stable, and where there is no incentive to deviate from the equilibrium of both firms being active on both markets:*

- *The fixed costs* C_{ON} *of entering the online market are sufficiently small, and* k *is sufficiently small; or*
- C_{ON} *is sufficiently small,* k *is large, and* ℓ *is sufficiently large as well.*

Proof. See Section A5 of the Appendix. ■

The argument why fixed costs of entry to the online market need to be small is straightforward: If fixed costs of entry to the online market were prohibitively high, there would be no incentive for any firm enter the online market (which implies that the equilibrium where no firm enters would be a stable one). The restriction on C_{ON} becomes stricter the smaller the ad effectiveness in the online market (the larger Δ_β). This result is very intuitive: If advertising revenues generated on the online market are not very large, the gains from deviating are not very large as well, and fixed costs need to be small for entry to the online market to be profitable. Similarly, fixed costs of entry to the online market need to be small if the influence of type preferences on consumer utility is low. For low ℓ, consumers have a lower willingness to pay for obtaining their preferred type of medium and are more easily swayed by price cuts in the competing platforms. This implies that entering the online market is less profitable for firms and only makes sense if fixed costs are small.

Small k implies that consumers are not strongly attached to any style of coverage which means that providing only one type of platform is a huge disadvantage for a firm since the lack of an online platform cannot be compensated for by specifically targeting the style preferences of consumers. As this is the case, there is an incentive to deviate from the equilibrium where no firm offers an online platform. If k is large, however, consumers care more about receiving the right style of coverage, and the type of medium becomes relatively less important. This mitigates the incentive to deviate. If, however, type preferences ℓ are also high, the incentive to deviate is sufficiently strong for each of the firms to deviate.
The restriction on Δ_β, however, confirms the results of the basic model: Any gains generated on the online market are offset by the redistribution of revenues between the online and the offline platforms such that overall revenues are unaffected. If this is the case, firms can only benefit from deviating, if the average return on advertising is higher than the return on advertising on offline platforms. Hence, the ad effectiveness on the new online platform must be higher. As the advertising price is a function of consumer demand, the only requirement for firms to achieve a high price is to lower consumer prices in order to increase consumer demand. This only makes sense if the gains from lowering consumer prices in the new medium are higher than in the old medium. As the *average* ad effectiveness determines the size of the gains from deviating, there is no incentive to enter the online market, if the return a consumer on the online platform yields on the advertising market is *ceteris paribus* lower than the return per consumer on the offline platform.

Overall, however, the parameter range in which firms are in a prisoner's dilemma is quite substantial. This may explain why one can observe firms having entered the online market although their total profits did not increase. I rule out equilibria in which firms cooperatively commit to non-entry into the online market, as both firms gain from deviating. As the content has already been generated offline, it is plausible to assume that the fixed costs of going online are not prohibitively high. Furthermore, it may be the case that media outlets cannot correctly anticipate the gains from deviating, and may overestimate them. As each firm may have different expectations of the profitability of online platforms, cooperation between the platforms is difficult.

4.5 Discussion

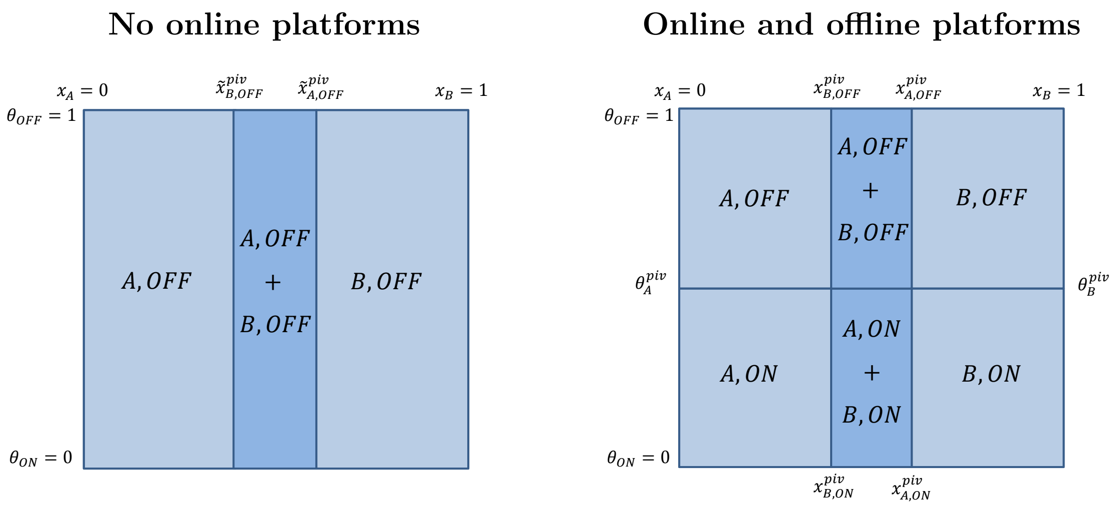
In this section, I discuss how relaxing some of the model's underlying assumptions affects the key results. One of the equilibrium outcomes that may strike as odd is that the market size has not increased due to the introduction of the online market. If the market had become larger, prices and profits would presumably have evolved differently, and the entrance on the online market might not have been profit-reducing after all. In order to capture the effects of alternative demand structures on the consumer side of the market, I analyze *multi-homing* and *market abstention* of consumers. Without analytically deriving the equilibrium for the market-abstention scenario, I give some intuition on how market outcomes change. Furthermore, I discuss whether a change in the sequence of moves in the first and second stage of the game leads to different outcomes, and how introducing asymmetry between the media outlets A and B alters the results.

Multi-homing consumers

Multi-homing of consumers implies that consumers may choose more than one platform at a time. As the assumption that consumers do not consume content of the same style twice still holds, multi-homing consumers can only choose the online or the offline platform of A combined with a platform of B. A consumer only decides to multi-home, if consuming each of the two platforms yields a positive net utility.[38] When online platforms are introduced, consumers sort into online platforms according to their type preferences, as illustrated in Figure 4.4.

[38] As the platforms are located at the margins of the style distribution, multi-homing only arises, if the consumer with the median style preferences decides to multi-home, since for all other consumers, the distance to the "second-best" platform is larger.

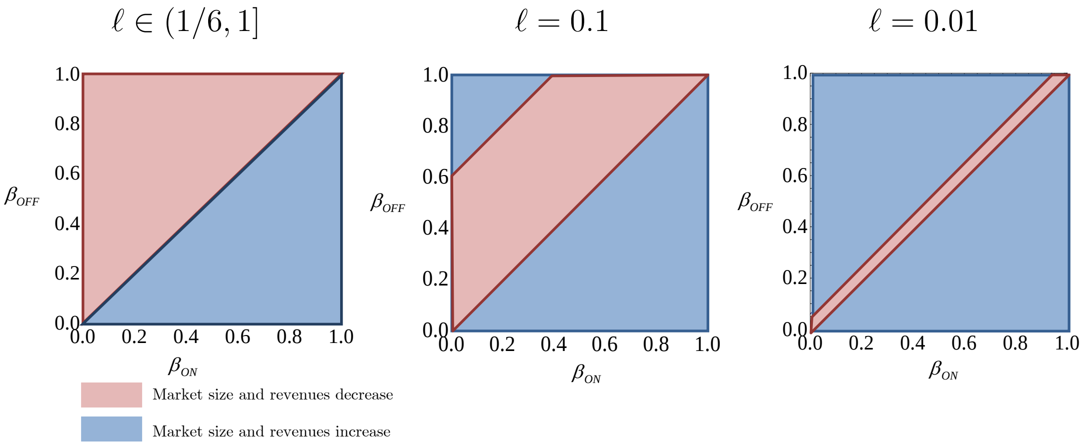
Figure 4.4: Market shares with multi-homing consumers



Note: This figure shows one possible distribution of market shares when online platforms are introduced. $\tilde{x}^{piv}_{B,OFF}$ indicates the preferred style of the consumer who, in the case without online platforms, is indifferent between consuming both platforms and consuming only the offline platform of media outlet A ($U^{piv}_{A,OFF} = U^{piv}_{A,OFF} + U^{piv}_{B,OFF}$). The same reasoning applies to the other cutoff-levels of style preferences.

It may be the case that aggregate market shares (i.e. the market shares of media outlets A and B of each of their platforms) do not change due to the introduction of online platforms. For such a situation to occur, the number of multi-homing consumers must not change compared to the situation without online platforms. In this case, the net effect of online platforms on media outlets' revenues is zero as in the benchmark model of this chapter. When online platforms are introduced, consumers *ceteris paribus* maintain their choice in the style dimension (platform A or B or both platforms), but choose the type of the platforms such that their distance costs are minimized. As, however, the introduction of online platforms not only alters the distance costs but also the prices of the platforms, in equilibrium, the above condition may be violated, such that the market size changes: If average consumer prices increase, the number of multi-homing consumers becomes smaller, and vice versa for decreasing prices.
Figure 4.5 illustrates for different levels of the type dimension's importance ℓ and for the full range of β_t how market size and aggregate profits of media outlets change when online platforms are introduced. The mathematical derivation of the multi-homing equilibria can be found in Section A6 of the Appendix.

Figure 4.5: Market size and revenues under multi-homing



Note: This figure illustrates the change in market size on the consumer market as well as the change in media outlets' revenues, if online platforms are introduced, for given level of style preferences $k = 1$ and different levels of type preferences ℓ. The parameter ranges in which the market size as well as the revenues increase due to the introduction of online platforms are denoted by the blue areas. The red areas indicate a drop in market size and revenues.

In the case where online markets exist, the market size consists of the aggregate market shares of both media outlets on the online as well as the offline market. The market size in the case with (without) online platforms is denoted by n^c_{MH} ($\tilde{n}^c_{MH}$). Following the same logic, aggregate media revenues in the case with (without) online platforms are indicated by Π_{MH} ($\tilde{\Pi}_{MH}$). Deriving the market size as well as the revenues before and after the introduction of online platforms from numerical simulations confirms two main features of the benchmark model with single-homing: (i), Revenues only change if the market size changes, i.e. $sign(\Delta_{n,MH}) = sign(\Delta_{\Pi,MH})$, with $\Delta_{n,MH} \equiv n^c_{MH} - \tilde{n}^c_{MH}$ and $\Delta_{\Pi,MH} \equiv \Pi^c_{MH} - \tilde{\Pi}^c_{MH}$, and (ii), the level k of style preferences is irrelevant for the change in revenues, i.e. the locus of parameter combinations where the sign of $\Delta_{n,MH}$ and $\Delta_{\Pi,MH}$ changes is independent of k. It is important to note that the simulation displays media outlets' revenues rather than their profits (e.g. $C_{ON} = C_{OFF} = 0$).[39] Hence, as $C_{ON} > 0$, the parameter range of the multi-homing scenario yielding qualitatively the same results with respect to the profits of media outlets as the single-homing scenario is larger than displayed in Figure 4.5.

[39]In the single-homing benchmark, the revenues do not change after introducing online platforms.

There are two possible scenarios in which multi-homing of consumers leads to an increase in market size and thus to an increase in media outlets' revenues:

- The ad effectiveness in the online market is higher than in the offline market, i.e. $\Delta_\beta < 0$.[40]
- The importance ℓ of type preferences is small, and $\Delta_\beta > 0$ and sufficiently large.

The change in market size can be explained in two steps: First, I discuss how the identity of the pivotal consumer shifts for a given change in consumer prices, and second, I provide reasoning for the plausibility of consumer prices evolving as suggested.
The evolution of the market size follows a simple mechanism: If average consumer prices increase due to the introduction of online platforms, the market size decreases, and the qualitative results with respect to the profitability of online platforms are as in the benchmark model with single-homing. If, however, average prices decrease because online platforms are introduced, more consumers multi-home, which increases the market size and leads to higher profits. For instance, in the case of increasing average consumer prices, the two previous pivotal consumers with style preferences $\tilde{x}^{piv}_{A,OFF}$ and $\tilde{x}^{piv}_{B,OFF}$ who could afford to multi-home before the introduction of online platforms, now decide to single-home, which implies that $x^{piv}_{A,OFF} < \tilde{x}^{piv}_{A,OFF}$ and $x^{piv}_{B,OFF} > \tilde{x}^{piv}_{B,OFF}$ (see Figure 4.4). Hence, each media outlet loses market shares (the dark blue area in the right panel of Figure 4.4 becomes smaller than in the left panel), and the aggregate market size decreases.
There is some reason to assume that consumer prices evolve analogically to the single-homing scenario. If online advertisements are more effective than offline advertisements, average consumer prices decrease, as media outlets' incentive to set low consumer prices has become stronger.[41] This explains the decrease in prices for $\Delta_\beta < 0$. If ℓ is high, consumers can less easily switch between online and offline platforms, and media outlets are thus able to charge higher prices. Consequently, if ℓ is small, consumers can more easily afford to multi-home, i.e. the benefit from consuming an additional platform is larger than the costs which leads to an increase in market size and revenues. Furthermore, if $\Delta_\beta > 0$ and sufficiently large, which is the case at the

[40] The parameter range in which $\Delta_\beta < 0$ is indicated by the area below the line through the origin in each panel of Figure 4.5.

[41] This is due to the incentive to set low consumer prices consisting of two parts: the direct incentive to attract more consumers, and the indirect incentive to generate higher revenues from advertising, as the advertising price p_i^a increases in the number of consumers. The latter incentive becomes stronger if the average ad effectiveness increases, which is the case for $\Delta_\beta < 0$.

upper left corners of each panel in Figure 4.5, media outlets compete harder for the subset of consumers on the platform that yields higher advertising prices than in the case of $\Delta_\beta \to 0$. If this coincides with low levels of ℓ, consumer prices decrease as online platforms are introduced. The lower ℓ, the less pronounced must the difference in the level of ad effectiveness be for prices to decrease. Overall, for some parameter combinations, it might be the case that allowing for multi-homing consumers alters the results of the benchmark model with single-homing such that the introduction of online platforms leads to higher profits.

When discussing a scenario with multi-homing, it is essential to account for the implications for the advertising market. Given the benchmark setup of one multi-homing side (advertisers), and one single-homing side (consumers) as in Section 4.3, one might expect the additional surplus media outlets extract from the advertisers to be partially passed on to the consumers. Having multi-homing consumers *and* multi-homing advertisers is a scenario that is difficult to justify when modeling the interaction of media outlets and advertisers. If a single advertisement was sufficient to reach all consumers, there would be no competitive bottleneck allowing the provider of the platform to extract an additional surplus from the advertisers. Hence, there would be no network effects between the sides of the market.[42] As there is convincing empirical evidence for the existence of these network effects, the simplifying assumption of single-homing consumers as in Manduchi and Picard (2010) is introduced.[43]

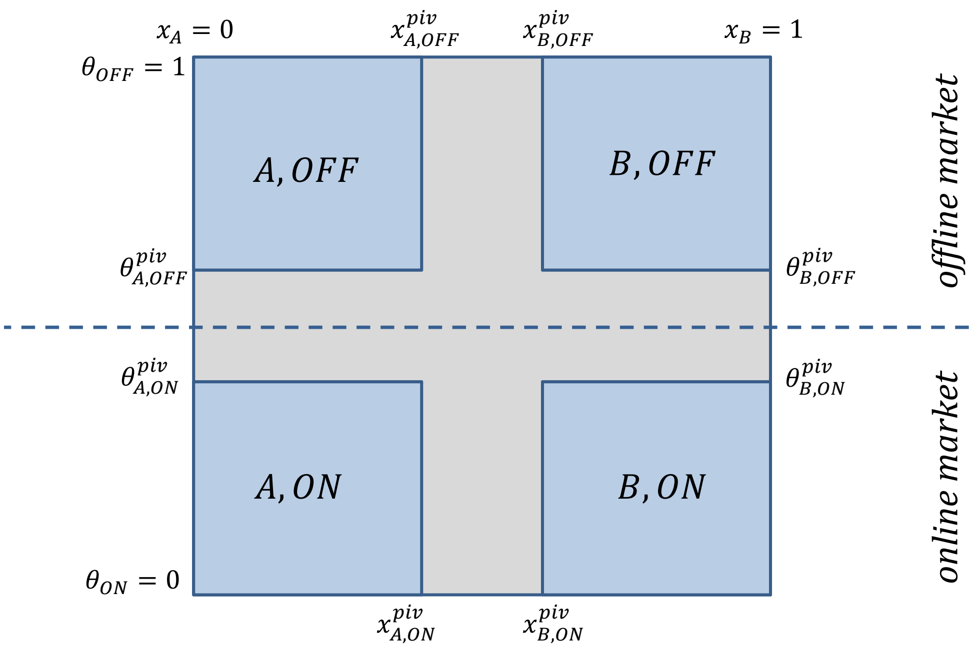
Market abstention of consumers

In a market abstention-scenario, consumers with type preferences below a certain threshold have not been on the market when there were only offline platforms. Providing an analytical solution to this scenario is beyond the scope of this model, but I give some intuition for the effects that may arise in equilibrium. The following figure illustrates how consumer market shares could evolve in equilibrium, if consumers abstained from the market before online platforms were introduced.

[42] See for instance Armstrong (2006) for a discussion of the network effects between the market sides, or Ambrus and Reisinger (2006) for a discussion of the effects of introducing multi-homing viewers in a framework with ad-averse consumers.

[43] For empirical evidence on the spillover effects between the sides of the market, see for instance Wilbur (2008).

Figure 4.6: Market abstention of consumers



Note: This figure illustrates the market shares of the online as well as the offline platforms of A and B if the reservation utility of consumers is sufficiently low for market abstention to occur in equilibrium. The part of the figure above the dashed line represents the situation before online markets are introduced, and the whole figure illustrates the equilibrium market shares for both online and offline platforms.

In the case where only offline platforms are available (upper part of Figure 4.6), consumers with a high preference for online media with $\theta_m < \theta^{piv}_{i,OFF}$ do not enter the market, and neither do individuals who have intermediate style preferences that lead to large distance costs in the style dimension. The cutoff-levels in the style as well as the type dimension for a type-t platform are calculated by setting $U_{i,t} = 0$ and solving for $x^{piv}_{i,t}$ and $\theta^{piv}_{i,t}$, respectively. Hence, the cutoff-levels in the offline market remain the same when online platforms are introduced. For aggregate market shares to increase due to the introduction of online platforms, it must either be the case that $\theta^{piv}_{A,ON}, x^{piv}_{A,ON} \in (0, 1]$ which implies that the market shares of A increase, or $\theta^{piv}_{B,ON}, (1 - x^{piv}_{B,ON}) \in (0, 1]$, for B's market shares to increase.
Given that one or both of these conditions are fulfilled, and the market size goes up due to the introduction of online platforms, media outlets' profits increase, if the gain on the online platform of media outlet i is larger than the fixed costs C_{ON}. Under these

circumstances, the results of the benchmark model that entry to the online market lowers media outlets' profits, cannot be restored.

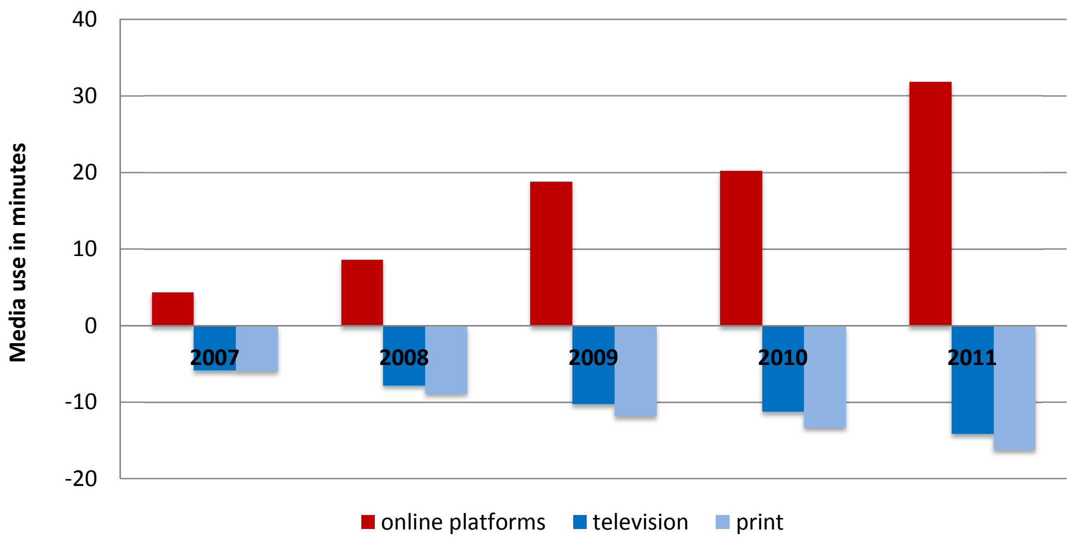
Still, empirical evidence suggests that the central assumption of consumers abstaining from the market is difficult to justify as it is highly unlikely for an individual not to be exposed to any kind of media. George (2008), for instance, shows in an empirical study of the newspaper market that consumers have switched from the offline to the online market, which strongly supports the framework of this model. For television, the fraction of frequent viewers comprises almost the entire population. For instance, a study by the European Interactive Advertising Association and Mediascope Europe (2010) finds that 94% of the European population watches television in a given week. The fraction of individuals claiming to read a newspaper is 62%, and 53% of the individuals use an online platform.[44]

Given the empirical evidence, the most plausible assumption is that individuals who choose online media have previously participated in the market, which implies that the switching-scenario of the main model is valid where gains in market shares on the online market are compensated for by losses on the offline market. A recent study of the Pew Project for Excellence in Journalism for the American media market also confirms the audience switch from offline to online media: Online platforms' audience has increased by 17.1% from 2009 to 2010. In the same period, print media (newspapers and magazines) have experienced a drop in audience of 13.9%, and audio-visual media lost 24.6% of their audience.[45] Figure 4.7 depicts a similar scenario for German media markets:

[44]Data based on a survey among 12,554 individuals, > 16 years old. Data source: European Interactive Advertising Association and Mediascope Europe (2010).

[45]See Pew Project for Excellence in Journalism (2011b).

Figure 4.7: Percentage change in media use per day, Germany 2006-2011



Note: This figure illustrates how media use per platforms in minutes per day has changed from 2006 to today. Data for 2011 are based on a forecast. Data source: eco - Verband der deutschen Internetwirtschaft e.V. (2010).

The figure shows that, starting from a 100-% level in 2006, the minutes per day of traditional offline media use (television and print) has decreased steadily. It even is the case that the sum of the losses of the offline media roughly equals the gain of the online media which clearly indicates that there has been some switching from offline to online media.[46] This empirical observation is perfectly in line with the effects of an increase in the importance of type preferences on the demand for online and offline platforms (Eq. 10), as denoted by ℓ.

Relevance of Prisoner's dilemma

The parameter range derived in Section 4.4 in which firms are in a prisoner's dilemma shows that the ad effectiveness needs to be higher in the online market. This result is confirmed by a number of empirical studies that show that novel targeting technologies have in fact increased ad effectiveness above the level of traditional advertisements (Ratliff and Rubinfeld, 2010; Evans, 2009; Chandra and Kaiser, 2011; Athey and Gans,

[46] See also Figure 1.4 of Chapter 1 for an illustration of the primary news source of individuals in the U.S..

2010; Athey et al., 2011). The reasoning is that in the online market, targeting technologies are far more accurate than in the offline market, which guarantees that each consumer is exposed to advertisements that are in line with his preferences deducted from the contents he has previously consumed in the web.
However, targeting and tracking technologies run the risk of becoming regulated: Goldfarb and Tucker (2011b) show that once targeting technologies are subject to regulation due to breaching the privacy of media users, the ad effectiveness in the online markets goes down. Regulation is currently in place in the EU, and chances are that more countries are yet to follow. It may still be hard for the legislator to meet the pace of technological progress, but online platform certainly may have to keep focussing on other techniques to increase consumers' awareness.

Asymmetry

Another thought experiment that might generate interesting insights is to allow for A and B being asymmetric. So far, there has only been asymmetry between the online and the offline market which induced the media outlets to subsidize the platform with the higher ad effectiveness by setting lower consumer prices. There are, however, several other ways to introduce asymmetry between the two media outlets: They operate with different cost functions, consumers' distance costs vary with respect to the platform, or the ad effectiveness is different across media styles instead of types. An additional way of introducing asymmetry would be to change the location of platforms.
The scenario with asymmetric costs of content production is only relevant if there were variable cost of media use. As an additional consumer causes essentially no costs online or when watching television, and the costs of paper and ink are quite low, the assumption of variable costs of zero has been established in the literature and is essentially uncontested. So media outlets may only vary in the fixed costs of generating content which are already accounted for in this model, and which do not affect equilibrium prices and quantities.[47] As long as media outlets have positive fixed costs of entry to the online market, entering lowers their profits. In the prisoner's dilemma game, the media outlet with the lower fixed costs of entry to the online market has the larger incentive to deviate from the offline-only equilibrium.
A scenario with asymmetric distance costs will lead to an equilibrium where one medium sets higher prices on both platforms, serves the larger market and has higher

[47]See Chapter 2 for a model of endogenous choice of the style of coverage, with the media outlets operating with different cost functions of content productions.

profits.[48] Still, the distribution of market shares between A and B remains unaffected by the introduction of online platforms. As the analysis in Section 4.3 has shown, there are no gains from offering two instead of one platforms of a given type. If both firms are technically able to enter the online market and cannot be prevented from doing so, the qualitative effect with respect to the profits will remain the same.

The only scenario that can affect the results is the one where each of the four platforms has a different ad effectiveness. For some specific configuration there exists an equilibrium where one media outlet benefits from both firms offering online platforms. This can only be the case if the firm ex ante serving the larger part of the market serves the smaller part of the market after introducing online platforms. If, for instance, $\beta_{A,OFF} > \beta_{B,OFF}$, then $p^c_{A,OFF} < p^c_{B,OFF}$ and $n_{A,OFF} > n_{B,OFF}$ before the introduction. If the ordering of the ad effectiveness parameters after the introduction of online platforms is $\beta_{B,ON} > \beta_{A,OFF} > \beta_{B,OFF} > \beta_{A,ON}$, the relation of aggregate market shares between A and B will be reversed. This holds only if the gain in the online market overcompensates the loss in the offline market, which leads to firm A being the net beneficiary from introducing online media.
However, there are some severe reservations about the plausibility of this scenario. For this scenario to hold, online advertisements must be more effective than offline ads but only for firm A. For B, offline advertisements are more effective. There may be some arguments in favor of advertisements in B being less effective than in A. One might for instance expect users of B to be more consumption-critical than in A. Still, it is hard to rationalize why the effectiveness of offline and online advertisements is conditional on the style of coverage. There may be some example that justify this way of modeling but a consistent ranking of the ad effectiveness parameters (for instance, $\beta_{A,t} > \beta_{B,t} \wedge \beta_{i,OFF} > \beta_{i,ON}$) seems way more plausible.
As long as the ranking of the ad effectiveness parameters is consistent, it is sufficient to model asymmetry in only one dimension. An asymmetry such that medium i has an advantage over his competitor (which implies that i's online as well as offline platform has a higher ad effectiveness than the competitor's platforms) would just lead to i serving the larger part of the market in both of the scenarios, and the net effect of online platforms being zero.

[48]See Chapter 2 for the analysis of a scenario where the distance costs to one of the two media platforms changes. The media outlet with the lower distance costs charges higher prices in equilibrium, and serves the larger part of the market which, in turn, leads to higher profits.

In the scenario with β_t varying only with respect to the type of platform as in the benchmark model, there is one additional way of introducing asymmetry between the media outlets, which has not yet been discussed: Media outlets may locate asymmetrically on the Hotelling line when choosing their style of coverage. As discussed previously, any deviation from maximum differentiation in the style dimension would only affect the results, if this asymmetric equilibrium was stable. An asymmetric equilibrium, however, cannot be stable in this setup, as the following thought experiment illustrates: If, for instance, there was only maximum differentiation in the type dimension ($\theta_{ON} = 0$ and $\theta_{OFF} = 1$ as in this model), and some deviation from maximum differentiation in the style dimension (say, for instance, $x_A = 0 + a$ and $x_B = 1 - b$), overall market shares would be equal if $a = b$. So there would be an incentive for both media outlets to choose a style closer to the center of the distribution than the competitor if $a \lesseqgtr b$, and thus to gain market shares which obviously increases their profits. This eventually leads to minimum differentiation in the style dimension. The model results, however, are exactly the same as the market is splitted evenly between A and B. I assume maximum differentiation in the style dimension, since it is unlikely for media outlets to offer identical platforms. Many models have shown that maximum differentiation arises in a one-dimensional spatial competition model.[49] As there has obviously been a world before online media in which product differentiation was one-dimensional, there is no reason to assume that platforms have substantially changed in their style of coverage, since the style of coverage is the central recognition value of a media platform. The model results are not at all affected by assuming maximum differentiation in both dimensions, which is why I stick to the assumption of maximum differentiation in the style dimension. Furthermore, it is way more realistic than assuming a dramatic shift in the style of platforms after introducing the online market.

Stackelberg game in the first stage and sequential consumer decisions in the second stage

Taking a look at the timing of the game in the benchmark model, one might suppose that model results change if there was a sequence of decisions in the second stage. This, however, is not the case.

In this model, media outlets A and B are symmetric in a sense that none of them has higher costs than the opponent, or provides a different amount of advertising space.

[49] See the strand of literature following (D'Aspremont et al., 1979).

Due to this simplifying assumption, the following holds: Given that types are chosen prior to styles, the consumer with pivotal type preferences will be located slightly below (above) $\theta^{piv} = 0.5$, if $\Delta_\beta > 0$ ($\Delta_\beta < 0$).[50] If the decision with respect to the style of coverage is made in the second stage of the game for given type preferences, the market will be split evenly between A and B. It is, however, important to note that the sequence is only irrelevant if A and B do not differ systematically. The same argument holds if styles were chosen prior to types.

Regarding the evolution of online platforms one might suggest that a simultaneous entry game is not realistic as some media outlets seem to have entered before their competitors. Modeling a game in with sequential entry, however, yields qualitatively the same results as the simultaneous move game. Furthermore, the standard result of Bertrand Stackelberg games of the first-mover having lower profits than the second-mover is still valid in a multi-dimensional two-sided market. The leader sets higher prices and serves the smaller part of the market than the follower, and his profits are lower, but still higher than in the case of simultaneous entry:

$$p^{c,s}_{B,t} > p^{c,s}_{A,t} > p^{c}_{i,t}, \qquad n^{c,s}_{A,t} > n^{c}_{i,t} > n^{c,s}_{B,t}, \qquad \Pi^s_A > \Pi^s_B > \Pi_i, \tag{25}$$

with superscript s denoting the sequential game. The revenues of both media outlets do not change when introducing online platforms, but due to the fixed costs, the profits are lower if firms enter the online market. This result is exactly the same as in the simultaneous move game. The derivation of the sequential equilibrium is as in Section 4.3 and can be found in Section A7 of the Appendix.

4.6 Conclusion

This chapter explains why media outlets enter the online market, despite the fact that entering does not increase their profits. Although online platforms are better suited than offline platforms to meet the preferences of some consumers, they do not provide grounds for reaping higher profits. Even in the case of consumers prices increasing due to the introduction of online platforms, media outlets are unable to capitalize on this

[50] The intuition is as in Section 4.3: If for instance $\Delta_\beta > 0$, offline advertising space can be sold at a higher price, which leads to lower offline consumer prices. Given that A and B are not systematically different, consumers are biased towards the cheaper medium s.t. the pivotal consumer's type preference $\theta^{piv} < 0.5$, which implies a bias towards the cheaper medium.

price increase. This key finding is robust to a variety of model modifications.
The model predicts that any gains in the online ad market are neutralized by price cuts in the consumer markets. As consumers are not likely to consume two varieties (online and offline) of a medium of the same style at a given time, media outlets are always reducing their share of the cake by providing two types of the same style. Still, there is a way to circumvent consumers' inclination to single-home: It may be possible to offer access to the online platform conditional on choosing the offline platform as well. This works only if there is an additional type-specific benefit for consumers from consuming both platforms.[51] A possible example may be adding local services, as weather forecasts, traffic alerts, or local news which are equally appreciated by consumers of different style preferences. Recent estimations by the Pew Internet & American Life Project suggest that already around 20% of the total population in the U.S. uses mobile devices like e-readers (12%) and tablets (8%).[52] Furthermore, 39% of the total U.S. population is estimated to own a smartphone. Hence, there surely is some potential for bundling strategies to increase the offline platforms' profits. The requirements for profits to increase due to this instrument are that multi-homing of content of the same style is allowed in combination with a binding commitment to consume the offline platform, and that prices are set such that consumers do not switch to a platform of the competitor. Still, if distance costs or consumer prices are sufficiently low, consumers may not only consume the bundle of media outlet i but also a platform of the competitor. This may lead to a break-down of the advertising side of the market as less advertisements are required to reach all consumers (no competitive bottleneck as discussed in Section 4.5). Hence, the additional negative externality of introducing a bundle of online and offline platforms on revenues from advertising has to be taken into account when media outlets choose their prices.
In theory, there are various instruments online platforms can use to compensate the drop in offline revenues:[53] by offering online subscriptions, subscriptions on e-readers as the iPad or Amazon's Kindle, mobile phone apps,[54] or by e-replica editions (offering exactly the same content online, as studied in this chapter). Which one of these different

[51]Some offline media already offer package deals for their users: Take for example the German tabloid *"BILD Zeitung"* which offers a tablet version of its offline content to its subscribers. As this instrument has been introduced only recently, the profitability could not yet be evaluated. An example on the television market is the pay-TV-channel *CNN* who offers online live streams to offline subscribers.

[52]estimate based on a survey of 2277 individuals. See Purcell (2011).

[53]According to a recent study by the Pew Research center, newspaper ad revenues in the U.S. have dropped by 25% from 2008 to 2009, and paid newspaper circulation has dropped by 10.6% (U.S.) and 5.6% (Europe) in the same time period. See Santhanam and Rosenstiel (2011) for full report.

[54]software application that allows mobile devices to access online contents

types of online platforms will eventually dominate the market, or whether there will be several types coexisting will become clear in the years to come. It seems as if media outlets, especially the major media holdings, are still experimenting with a variety of different online platforms. Some larger news corporation as *CNN* and *The Chicago Tribune* already offer several forms of online platforms: apps for the Apple app store, Android apps for Google, and e-replica for their own websites.[55] So it may finally be the size of the corporation that determines who will dominate the online market as some smaller media outlets simply lack the financial means to enter the competition for market shares.

By choosing the appropriate form of making content accessible online, it is essential to take into account how competition between and within media outlets is affected. Once all the externalities are accounted for, the possibilities are limited but may lead to online platforms eventually increasing media profits.

[55]See Olmstead et al. (2011) for a recent survey by the Pew Project for Excellence in Journalism.

Appendix

A1: Proof of Proposition 1

Comparing the equilibrium values from Eq. (9) - (10) yields

$$p^c_{i,OFF} - p^c_{i,ON} = \frac{\Delta_\beta}{6\ell}, \qquad n^c_{i,OFF} - n^c_{i,ON} = \frac{\Delta_\beta}{3},$$
$$p^a_{i,OFF} - p^a_{i,ON} = \frac{\Delta_\beta(3\ell + \beta_{ON} + \beta_{OFF})}{12\ell}. \tag{A1}$$

Note that revenues from the advertising market are a linear transformation of consumer market shares. For $\Delta_\beta > 0$ ($\Delta_\beta < 0$), Eq. A1 are positive (negative).

■

A2: Proof of Proposition 2

The first derivatives of the equilibrium values (Eq. 9 - 10) with respect to β_t are:

$$\frac{\partial p^c_{i,ON}}{\partial \beta_{ON}} = \frac{2\Delta_\beta}{9\ell} - \frac{2}{3}, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{OFF}} = -\frac{2\Delta_\beta}{9\ell} - \frac{2}{3},$$
$$\frac{\partial p^c_{i,ON}}{\partial \beta_{OFF}} = -\frac{2\Delta_\beta}{9\ell} - \frac{1}{3}, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{ON}} = \frac{2\Delta_\beta}{9\ell} - \frac{1}{3},$$
$$\frac{\partial n^c_{i,ON}}{\partial \beta_{ON}} = \frac{1}{12\ell}, \qquad \frac{\partial n^c_{i,ON}}{\partial \beta_{OFF}} = -\frac{1}{12\ell},$$
$$\frac{\partial p^a_{i,ON}}{\partial \beta_{ON}} = \frac{1}{4} - \frac{\Delta_\beta + \beta_{ON}}{12\ell}, \qquad \frac{\partial p^a_{i,ON}}{\partial \beta_{OFF}} = -\frac{\beta_{ON}}{12\ell},$$
$$\frac{\partial p^a_{i,OFF}}{\partial \beta_{OFF}} = \frac{1}{4} + \frac{\Delta_\beta + \beta_{OFF}}{12\ell}, \qquad \frac{\partial p^a_{i,OFF}}{\partial \beta_{ON}} = -\frac{\beta_{OFF}}{12\ell}. \tag{A2}$$

Note that $|\frac{\Delta_\beta}{3}| < \ell \leq 1$.

- If $\Delta_\beta > 0$,

  $\frac{\partial p^c_{i,ON}}{\partial \beta_{ON}} < 0, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{OFF}} < 0,$

  $\frac{\partial p^c_{i,ON}}{\partial \beta_{OFF}} < 0, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{ON}} < 0 \;\; \forall \;\; \frac{2\Delta_\beta}{3} < \ell \leq 1 \;\; \wedge \;\; \frac{\partial p^c_{i,OFF}}{\partial \beta_{ON}} > 0 \;\; \forall \;\; \frac{\Delta_\beta}{3} < \ell \leq \frac{2\Delta_\beta}{3},$

  $\frac{\partial n^c_{i,ON}}{\partial \beta_{ON}} > 0, \qquad \frac{\partial n^c_{i,ON}}{\partial \beta_{OFF}} < 0,$

  $\frac{\partial p^a_{i,ON}}{\partial \beta_{ON}} > 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \beta_{OFF}} > 0, \qquad \frac{\partial p^a_{i,ON}}{\partial \beta_{OFF}} < 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \beta_{ON}} < 0.$

- If $\Delta_\beta < 0$,

  $\frac{\partial p^c_{i,ON}}{\partial \beta_{ON}} < 0, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{OFF}} < 0,$

  $\frac{\partial p^c_{i,ON}}{\partial \beta_{OFF}} < 0 \;\; \forall \;\; -\frac{2\Delta_\beta}{3} < \ell \leq 1 \;\; \wedge \;\; \frac{\partial p^c_{i,ON}}{\partial \beta_{OFF}} > 0 \;\; \forall \;\; -\frac{\Delta_\beta}{3} < \ell \leq -\frac{2\Delta_\beta}{3}, \qquad \frac{\partial p^c_{i,OFF}}{\partial \beta_{ON}} < 0,$

  $\frac{\partial n^c_{i,ON}}{\partial \beta_{ON}} > 0, \qquad \frac{\partial n^c_{i,ON}}{\partial \beta_{OFF}} < 0,$

  $\frac{\partial p^a_{i,ON}}{\partial \beta_{ON}} > 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \beta_{OFF}} > 0, \qquad \frac{\partial p^a_{i,ON}}{\partial \beta_{OFF}} < 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \beta_{ON}} < 0.$

Note that if the online (offline) consumer market shares increase in β_t, the offline (online) market shares decrease, as the consumer market is always covered.

■

A3: Proof of Proposition 3

The first derivatives of the equilibrium values (Eq. 9 - 10) with respect to β_t are:

$$\frac{\partial p^c_{i,ON}}{\partial \ell} = \frac{\Delta_\beta^2}{9\ell^2}, \qquad \frac{\partial p^c_{i,OFF}}{\partial \ell} = \frac{\Delta_\beta^2}{9\ell^2},$$
$$\frac{\partial n^c_{i,ON}}{\partial \ell} = \frac{\Delta_\beta}{12\ell^2}, \qquad \frac{\partial n^c_{i,OFF}}{\partial \ell} = -\frac{\Delta_\beta}{12\ell^2},$$
$$\frac{\partial p^a_{i,ON}}{\partial \ell} = \frac{\Delta_\beta \beta_{ON}}{12\ell^2}, \qquad \frac{\partial p^a_{i,OFF}}{\partial \ell} = -\frac{\Delta_\beta^2 \beta_{OFF}}{12\ell^2}. \tag{A3}$$

Note that $|\frac{\Delta_\beta}{3}| < \ell \leq 1$.

- If $\Delta_\beta > 0$,

  $\frac{\partial p^c_{i,ON}}{\partial \ell} > 0, \qquad \frac{\partial p^c_{i,OFF}}{\partial \ell} > 0,$

  $\frac{\partial n^c_{i,ON}}{\partial \ell} > 0, \qquad \frac{\partial n^c_{i,OFF}}{\partial \ell} < 0,$

  $\frac{\partial p^a_{i,ON}}{\partial \ell} > 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \ell} < 0.$

- If $\Delta_\beta < 0$,

  $\frac{\partial p^c_{i,ON}}{\partial \ell} > 0, \qquad \frac{\partial p^c_{i,OFF}}{\partial \ell} > 0,$

  $\frac{\partial n^c_{i,ON}}{\partial \ell} < 0, \qquad \frac{\partial n^c_{i,OFF}}{\partial \ell} > 0,$

  $\frac{\partial p^a_{i,ON}}{\partial \ell} < 0, \qquad \frac{\partial p^a_{i,OFF}}{\partial \ell} > 0.$

■

A4: Proof of Proposition 4

Note that $|\frac{\Delta_\beta}{3}| < \ell \leq 1$.

$$p^c_{i,ON} - \tilde{p}^c_{i,ON} = k - \frac{2\beta_{ON} + \beta_{OFF}}{3} - \frac{\Delta_\beta^2}{9\ell} - k + \beta_{ON} = -\frac{\Delta_\beta(3\ell - \Delta_\beta)}{9\ell},$$

$$p^c_{i,OFF} - \tilde{p}^c_{i,OFF} = k - \frac{\beta_{ON} + 2\beta_{OFF}}{3} - \frac{\Delta_\beta^2}{9\ell} - k + \beta_{OFF} = -\frac{\Delta_\beta(3\ell - \Delta_\beta)}{9\ell},$$

$$\Pi_i - \tilde{\Pi}_i = \frac{1}{2}k - C_{ON} - C_{OFF} - \frac{1}{2}k + C_{OFF} = -C_{ON}. \tag{A4}$$

As $\Delta_\beta < 0$ and $C_{ON} > 0$, Eq. A4 is negative.

■

A5: Proof of Proposition 5

This proof shows that there exists a well-defined parameter range in which firms face a prisoner's dilemma. The first step towards determining this parameter range is to recall the necessary conditions as in Section 4.5:

Condition II: Show that unilateral deviation from offering only offline content is profitable.

$$
\begin{aligned}
\Pi_i^{\text{deviate}} &= \tilde{\Pi}_i \\
\Leftrightarrow \quad & \frac{k}{2} - C_{OFF} + \frac{\Theta(72jk + \Theta)}{2592\ell^2 k} - C_{ON} > \frac{k}{2} - C_{OFF} \\
\Leftrightarrow \quad & C_{ON} < \frac{\Theta(72jk + \Theta)}{2592\ell^2 k}. \qquad \text{(A5)}
\end{aligned}
$$

Condition III: Show that unilateral deviation from an equilibrium where both firms offer online as well as offline platforms is not profitable.

$$
\begin{aligned}
\Pi^{\text{comply}} &= \Pi_i \\
\Leftrightarrow \quad & \frac{k}{2} - C_{OFF} - \frac{\Theta(72jk - \Theta)}{2592\ell^2 k} < \frac{k}{2} - C_{ON} - C_{OFF} \\
\Leftrightarrow \quad & C_{ON} < \frac{\Theta(72jk - \Theta)}{2592\ell^2 k}. \qquad \text{(A6)}
\end{aligned}
$$

Note that $\Theta \equiv \Delta_\beta(\Delta_\beta - 6\ell)$, as well as $\Delta_\beta \equiv \beta_{OFF} - \beta_{ON}$.

In the following, it has to be proven that these conditions are fulfilled, recalling that there are some additional assumptions regarding the model parameters:
$0 < k \leq 1, \quad \frac{\Delta_\beta}{3} < \ell \leq 1, \quad 0 < \beta_{ON} \leq 1, \quad 0 < \beta_{OFF} \leq 1.$
Furthermore, fixed costs of market entry on online market are defined to be strictly positive s.t.

$$
\frac{\Theta(72jk + \Theta)}{2592\ell^2 k} > 0 \qquad \wedge \qquad \frac{\Theta(72jk - \Theta)}{2592\ell^2 k} > 0. \qquad \text{(A7)}
$$

If Eqs. (A5), (A6), and (A7) hold, media firms are in a prisoner's dilemma. In the following, I show for which parameter range this is the case.

The denominators of Eqs. (A7) are always positive. Hence, the numerator of both terms must also be positive for the whole term to be positive. The following two cases show parameter ranges within which the nominators are positive.

Case 1: $\Theta > 0 \quad \wedge \quad (72jk + \Theta) > 0 \quad \wedge \quad (72jk - \Theta) > 0$

For $\Theta = \Delta_\beta(\Delta_\beta - 6\ell) > 0$, one of the following conditions must hold:

- $\Delta_\beta > 0 \quad \wedge \quad (\Delta_\beta - 6\ell) > 0.$
  Positive Δ_β requires that $\ell < \frac{\Delta_\beta}{6\ell}$. This condition is never fulfilled, as it is not in the parameter range of an interior solution on Stage 3 of the game (see eq. 17: $\ell > \frac{\Delta_\beta}{3}$).

- $\Delta_\beta < 0 \quad \wedge \quad (\Delta_\beta - 6\ell) < 0.$
  Negative Δ_β requires $\ell > \frac{\Delta_\beta}{6}$, which is always fulfilled in the relevant parameter range.
  Hence, $\Theta > 0$, and it has to be shown that the two additional conditions also hold. While this is immediately obvious for $(72jk + \Theta) > 0$, the second part of $(72jk - \Theta) > 0$ can be rearranged as follows, with $\Theta = \Delta_\beta(\Delta_\beta - 6\ell)$:

$$72jk > \Delta_\beta(\Delta_\beta - 6\ell) \quad \Leftrightarrow \quad \ell > \frac{\overbrace{\Delta_\beta^2}^{>0}}{\underbrace{6(12k + \Delta_\beta)}_{\gtrless 0}} \tag{A8}$$

If the denominator is negative ($k < \frac{|\Delta_\beta|}{12}$), this condition is always fulfilled, as the interior equilibrium only exists if ℓ is sufficiently large (the lower bound of the parameter range is $\frac{\Delta_\beta}{3}$). This implies that, for small k, there is no restriction on ℓ. So the only critical case is when the denominator is positive, which implies that $k > \frac{|\Delta_\beta|}{12}$. For large k, ℓ must be sufficiently large.
The next step is to check how large this threshold is relative to the lower bound of the parameter range for an interior solution:

$$\frac{\Delta_\beta^2}{6(12k + \Delta_\beta)} < \frac{\Delta_\beta}{3} \quad \Leftrightarrow \quad \frac{\Delta_\beta}{12k + \Delta_\beta} > 2 \tag{A9}$$

As this condition is never fulfilled, there are two possible parameter ranges, for which all of the necessary conditions for a prisoner's dilemma are fulfilled:

1. $\Delta_\beta < 0 \;\wedge\; C_{ON} < \frac{\Theta(72jk-\Theta)}{2592\ell^2 k} \;\wedge\; k < \frac{|\Delta_\beta|}{12}$ or
2. $\Delta_\beta < 0 \;\wedge\; C_{ON} < \frac{\Theta(72jk-\Theta)}{2592\ell^2 k} \;\wedge\; k > \frac{|\Delta_\beta|}{12} \;\wedge\; \ell > \frac{\Delta_\beta^2}{6(12k+\Delta_\beta)}$.

Case 2: $\Theta < 0 \qquad \wedge \qquad (72jk + \Theta) < 0 \qquad \wedge \qquad (72jk - \Theta) < 0$

For $\Theta = \Delta_\beta(\Delta_\beta - 6\ell) < 0$, one of the following conditions must hold:

- $\Delta_\beta > 0 \qquad \wedge \qquad (\Delta_\beta - 6\ell) < 0.$
  In the case of positive Δ_β, the condition of $\ell > \frac{\Delta_\beta}{6}$ is always fulfilled in the relevant parameter range.
  Since $\Theta < 0$, for the nominator to be positive, $(72jk+\Theta) < 0$ and $(72jk-\Theta) < 0$ must also hold. The latter condition, however, can never be fulfilled:

$$72 \underbrace{jk}_{\ell,k\in(0,1]} < \underbrace{\Theta}_{<0}. \tag{A10}$$

- $\Delta_\beta < 0 \qquad \wedge \qquad (\Delta_\beta - 6\ell) > 0.$
  The last case has negative Δ_β, which requires $\ell < \frac{\Delta_\beta}{6}$. As this is not in the relevant parameter range, this cannot be a solution.

Hence, only for the parameter ranges under Case 1 fixed costs are positive, the equilibrium where both firms comply is unstable, and there is no incentive to deviate from the equilibrium where both firms offer an online as well as an offline platform.

■

A6: Derivation of equilibrium with multi-homing

Equilibrium with online and offline platforms

The derivation of the pivotal type-preferences is as in Section 4.3, where, for $|\frac{\Delta_\beta}{3}| < \ell \leq 1$,

$$\theta_i^{piv} = \frac{\ell + p_{i,OFF}^c - p_{i,ON}^c}{2\ell}. \tag{A11}$$

From setting $U_{i,t}^{piv} = 0$ and solving for $x_{i,t}^{piv}$ follows:

$$
\begin{aligned}
n^c_{A,ON} &= \theta^{piv}_A x^{piv}_{B,ON} + \theta^{piv}_A (x^{piv}_{A,ON} - x^{piv}_{B,ON}) \\
&= \frac{(\ell + p^c_{A,OFF} - p^c_{A,ON})\sqrt{1 - \frac{(\ell + p^c_{A,OFF} - p^c_{A,ON})^2}{4\ell}} - p^c_{A,ON}}{2\ell\sqrt{k}} \\
n^c_{B,ON} &= \theta^{piv}_B (1 - x^{piv}_{A,ON}) + \theta^{piv}_B (x^{piv}_{A,ON} - x^{piv}_{B,ON}) \\
&= \frac{(\ell + p^c_{B,OFF} - p^c_{B,ON})\sqrt{1 - \frac{(\ell + p^c_{B,OFF} - p^c_{B,ON})^2}{4\ell}} - p^c_{B,ON}}{2\ell\sqrt{k}} \\
n^c_{A,OFF} &= (1 - \theta^{piv}_A) x^{piv}_{B,OFF} + (1 - \theta^{piv}_A)(x^{piv}_{A,OFF} - x^{piv}_{B,OFF}) \\
&= \frac{(\ell - p^c_{A,OFF} + p^c_{A,ON})\sqrt{1 - \frac{(\ell - p^c_{A,OFF} + p^c_{A,ON})^2}{4\ell}} - p^c_{A,OFF}}{2\ell\sqrt{k}} \\
n^c_{B,OFF} &= (1 - \theta^{piv}_B)(1 - x^{piv}_{A,OFF}) + (1 - \theta^{piv}_B)(x^{piv}_{A,OFF} - x^{piv}_{B,OFF}) \\
&= \frac{(\ell - p^c_{B,OFF} + p^c_{B,ON})\sqrt{1 - \frac{(\ell - p^c_{B,OFF} + p^c_{B,ON})^2}{4\ell}} - p^c_{B,OFF}}{2\ell\sqrt{k}}. \qquad \text{(A12)}
\end{aligned}
$$

Note that the demand functions for each media outlet are as illustrated in the right panel of Figure 4.4. Substituting Eq. (A12) into the profit function Eq. (1) and maximizing it with respect to $p^c_{i,t}$ yields the following equilibrium:

$$
\begin{aligned}
p^{c,MH}_{i,ON} &= \frac{2 - \beta_{ON}}{3} - \frac{3\ell^2 + \Delta_\beta}{18\ell}, \\
p^{c,MH}_{i,OFF} &= \frac{2 - \beta_{OFF}}{3} - \frac{3\ell^2 + \Delta_\beta}{18\ell}, \\
n^{c,MH}_{i,ON} &= \frac{3\ell - \Delta_\beta}{36\ell k}\sqrt{\frac{k[\Delta^2_\beta + 6\ell(2 + \beta_{ON} + \beta_{OFF}) - 3\ell^2]}{\ell}}, \\
n^{c,MH}_{i,OFF} &= \frac{3\ell + \Delta_\beta}{36\ell k}\sqrt{\frac{k[\Delta^2_\beta + 6\ell(2 + \beta_{ON} + \beta_{OFF}) - 3\ell^2]}{\ell}}, \\
\Pi^{MH}_i &= \frac{1}{108k^2}\left[\frac{k[\Delta^2_\beta + 6\ell(2 + \beta_{ON} + \beta_{OFF}) - 3\ell^2]}{\ell}\right]^{3/2} - C_{ON} - C_{OFF}, \qquad \text{(A13)}
\end{aligned}
$$

with superscript ^{MH} indicating the multi-homing scenario.

The advertising prices are $p^a_{i,t} = \beta_t n^{c,MH}_{i,t}$ as in Section 4.3. The aggregate consumer demand (market size) is:

$$n^c_{MH} = n^{c,MH}_{A,ON} + n^{c,MH}_{A,OFF} + n^{c,MH}_{B,ON} + n^{c,MH}_{B,OFF} = \frac{1}{3k}\sqrt{\frac{k[\Delta^2_\beta + 6\ell(2 + \beta_{ON} + \beta_{OFF}) - 3\ell^2]}{\ell}}. \tag{A14}$$

Equilibrium without online platforms

In contrast to Section 4.4, the level of the disutility from obtaining the wrong type of medium does affect the results. As the number of multi-homing consumers is determined by the net utility from choosing a platform (reservation utility minus prices and distance costs), less consumers decide to multi-home, if the distance costs from the type dimension are large. Due to type preferences being uniformly distributed, the pivotal consumer has the following utility from consuming the offline platform of media outlet i, with ~ denoting the equilibrium without online platforms,

$$\tilde{U}^{piv,MH}_{i,OFF} = \bar{u} - p^c_{i,OFF} - k(x^{piv} - x_i)^2 - \ell(0.5 - \theta_{OFF})^2. \tag{A15}$$

From setting $\tilde{U}^{piv,MH}_{i,OFF} = 0$ and solving for $\tilde{x}^{piv}_{i,OFF}$ follows:

$$\begin{aligned} n^c_{A,OFF} &= x^{piv}_{B,OFF} + (x^{piv}_{A,OFF} - x^{piv}_{B,OFF}) = \frac{\sqrt{4(1 - p^c_{A,OFF}) + \ell}}{2\sqrt{k}}, \\ n^c_{B,OFF} &= (1 - x^{piv}_{A,OFF}) + (x^{piv}_{A,OFF} - x^{piv}_{B,OFF}) = \frac{\sqrt{4(1 - p^c_{B,OFF}) + \ell}}{2\sqrt{k}}. \end{aligned} \tag{A16}$$

Substituting Eq. (A16) into the profit function $\tilde{\Pi}_i = \tilde{p}^c_{i,OFF}\tilde{n}^c_{i,OFF} + \tilde{p}^a_{i,OFF}$, and maximizing it with respect to $p^c_{i,OFF}$ yields:

$$\tilde{p}^{c,MH}_{i,OFF} = \frac{2-\beta_{OFF}}{3} - \frac{\ell}{6},$$

$$\tilde{n}^{c,MH}_{i,OFF} = \frac{\sqrt{4(1+\beta_{OFF})-\ell}}{2\sqrt{3}\sqrt{k}},$$

$$\tilde{\Pi}^{MH}_{i} = \frac{[4(1+\beta_{OFF})-\ell]^{3/2}}{12\sqrt{3}\sqrt{k}} - C_{OFF}. \tag{A17}$$

Again, the advertising prices are $\tilde{p}^{a}_{i,OFF} = \beta_{OFF} \quad \tilde{n}^{c,MH}_{i,OFF}$ as in Section 4.3. The aggregate consumer demand (market size) is:

$$\tilde{n}^{c}_{MH} = \tilde{n}^{c,MH}_{A,OFF} + \tilde{n}^{c,MH}_{B,OFF} = \frac{\sqrt{4(1+\beta_{OFF})-\ell}}{\sqrt{3}\sqrt{k}}. \tag{A18}$$

The panels in Figure 4.5 are obtained by simulating $\Delta_{n,MH} \equiv n^{c}_{MH} - \tilde{n}^{c}_{MH}$ and $\Delta_{\Pi,MH} \equiv \Pi^{c}_{MH} - \tilde{\Pi}^{c}_{MH}$ for different values of k and ℓ, whereas the results do not change in k.

A7: Derivation of sequential game equilibrium

The timing of the game is similar to the simultaneous game with the exception of one medium setting prices prior to the other one. I assume without loss of generality that B is the Stackelberg leader. As the second stage remains unchanged, the disutility ℓ from consuming the wrong media type needs to be sufficiently high ($\frac{\Delta_\beta}{3} < \ell \leq 1$) for an interior solution to occur. I suppose that this is the case. The derivation of the equilibrium is as in Section 4.3, and the equilibrium is characterized as follows:

$$p^{c,s}_{A,ON} = p^{c}_{A,ON} + \frac{1}{4}k, \qquad p^{c,s}_{A,OFF} = p^{c}_{A,OFF} + \frac{1}{4}k,$$

$$p^{c,s}_{B,ON} = p^{c}_{B,ON} + \frac{1}{2}k, \qquad p^{c,s}_{B,OFF} = p^{c}_{B,OFF} + \frac{1}{2}k,$$

$$n^{c,s}_{A,ON} = \frac{5}{16} - \frac{5\Delta_\beta}{48\ell}, \qquad n^{c,s}_{A,OFF} = \frac{5}{16} + \frac{5\Delta_\beta}{48\ell}, \tag{A19}$$

$$n^{c,s}_{B,ON} = \frac{3}{16} - \frac{3\Delta_\beta}{48\ell}, \qquad n^{c,s}_{B,OFF} = \frac{3}{16} + \frac{3\Delta_\beta}{48\ell},$$
$$\Pi^s_A = \Pi_A + \frac{9}{32}k, \qquad \Pi^s_B = \Pi_B + \frac{1}{9}k, \tag{A20}$$

with $\Pi_i = \frac{k}{2} - C_{ON} - C_{OFF}$. In this setting, the Stackelberg follower (media outlet A) has a *second-mover advantage* as in Gal-Or (1985). Medium A is able to attract consumers from both submarkets of medium B such that the overall market shares are no longer divided equally, but in favor of medium A: $n^{c,s}_{A,ON} + n^{c,s}_{A,OFF} = \frac{5}{8}$ and $n^{c,s}_{B,ON} + n^{c,s}_{B,OFF} = \frac{3}{8}$.

Deriving the equilibrium without online platforms is as in Section 4.4 and yields:

$$\tilde{p}^{c,s}_{A,OFF} = \tilde{p}^{c}_{A,OFF} + \frac{1}{4}k, \qquad \tilde{p}^{c,s}_{B,OFF} = \tilde{p}^{c}_{B,OFF} + \frac{1}{2}k,$$
$$\tilde{n}^{c,s}_{A,OFF} = \frac{5}{16} + \frac{5\Delta_\beta}{48\ell}, \qquad \tilde{n}^{c,s}_{B,OFF} = \frac{3}{16} + \frac{3\Delta_\beta}{48\ell},$$
$$\tilde{\Pi}^s_A = \tilde{\Pi}_A + \frac{9}{32}k, \qquad \tilde{\Pi}^s_B = \tilde{\Pi}_B + \frac{1}{9}k. \tag{A21}$$

with $\tilde{\Pi}_i = \frac{k}{2} - C_{OFF}$. If aggregate market shares as well as the revenues do not change compared to a situation without an online market, the predictions of the baseline model hold also in a sequential game. These conditions are fulfilled as aggregate market shares are $n_A = \frac{5}{8}$ and $n_B = \frac{3}{8}$.

Chapter 5

Outlook

This dissertation has analyzed three major trends on the media market. In the following, I will give some intuition on how these trends reinforce one another, and how they will continue to shape the media markets.
Chapter 2 has illustrated how media outlets change their style of coverage, if consumers' preferences are biased towards audio-visual media platforms. In the case of a bilateral shift in preferences, newspapers as well as television channels include more "soft" news to their news coverage. Especially for newspapers, one of the main challenges in the years to come is to balance hard and soft news. Providing entertaining contents is essential for keeping the consumers on board, but if contents become too shallow, newspapers run the risk of being replaced by free services.[1] Shifts in the style of coverage may be one way how newspapers try to hold on to their audience, while they are experimenting with ways of extracting revenues from consumers with a high preference for online contents. Hence, the trend towards tabloidization in news coverage is closely connected to the rise of online platforms as discussed in Chapter 4.
The analysis of advertising regulation in Chapter 3 has illustrated how prone to failure unilateral advertising bans are, if the financing structure the regulated broadcaster operates with is not taken into account. Especially in the light of many countries' attempts to re-adjust their advertising regulation, it may be worthwhile to dive deeper into the economic consequences of a unilateral advertising ban. The problem of inef-

[1] A study of the Center for Digital Future suggests that it is about time for newspapers and television channels to improve their quality and integrity of coverage. When asked to rank internet sources, television and newspapers with respect to reaching key goals associated with quality coverage, the majority of the survey participants preferred the internet over the other platforms in eight out of twelve categories. Data source: Random and representative sample of American households, N=2,000. See Center for the Digital Future (2011).

fective regulation on television markets will become more severe in the years to come, as some indicators suggest that the importance of pay-TV for television markets will continue to increase steadily. As digital technology has lowered the access barriers to all kinds of media types, and has allowed consumers to access the services when and where they want, on-demand services will eventually become the primary source of media financing on the consumer side. Furthermore, in the wake of the recent economic downturn, consumers' willingness to pay for home entertainment has increased, and paid broadcasting services will gain importance.[2] Advertising regulation has to account for these changes in order to yield the desired outcomes.

The trend towards paid broadcasting services can partly be attributed to the rise of online platforms, which bridges the gap to Chapter 4 of this dissertation: As the advertising budget allocated to offline television platforms decreases, broadcasters have to rely more on the revenues from the consumer side of the market. Some insiders even claim that free-TV is slowly coming to an end, as many major broadcasters cannot afford free-to-air programming anymore (see for instance Vanacore, 2011, who names the impact of the recession years as one of the main reasons for declining advertising expenditures in the U.S.).

Running a profitable online platform is eminently important for media outlets, since the economic downturn has reduced the size of corporate advertising budgets.[3] Evidence indicates that especially print media may be a casualty of the fast-growing online market. The signs of consolidations on the U.S. newspaper market are already clearly visible: From 2008 to 2010, eight large U.S. publishers[4] have filed for bankruptcy, while some of them were purchased by hedge funds and have emerged from bankruptcy (Kirchhoff, 2010). Whether online platforms are able to cushion the downturn in media revenues will depend on using adequate pricing instruments on both sides of the market. The model developed in Chapter 4 has shown that conventional pricing instruments like the Cost Per Mille combined with levying access fees from consumers do not seem to work in the right direction. For the U.S. newspaper market, a survey of the Center for Digital Future among a representative sample of 2,000 American households shows

[2]Consumers' spending more time and money at home is symptomatic of a declining economy, as consumers cut back on the expenses of going out. While 52% of individuals in the U.S. cut back on going out to eat, and 53% do less shopping due to the current economic condition, 35% watch more television at home, and only 3% claim that they are likely to cancel their cable TV service to save costs. See Cable & Telecommunications Association for Marketing (2009).

[3]The advertising budget allocated to U.S. newspapers has dropped from $48,670 million to $22,795 million from 2000 to 2010. See Newspaper Association of America (2011).

[4]The Tribune Co., Philadelphia Newspapers LLC, Sun-Times Media Group, Star Tribune Holdings Co., Journal-Register Co., American Community Newspapers, Creative Loafing, and MediaNews Group Inc.

that 22% of the study participants have already replaced their subscription to a newspaper by online contents (Center for the Digital Future, 2009). Hence, it is essential to explore how media outlets can evade the problem that arises from consumers' substituting offline by online contents, for instance by employing novel ways of pricing platform contents like for instance bundling pricing as suggested in Section 4.6. On the advertising side of the market, it may be interesting to analyze novel pricing tools, as for instance auctioning individual consumer contacts to potential advertisers. These pricing tools will presumably gain importance in the years to come, as consumers can easily be tracked in their web activities, which enables the platforms to provide each potential advertiser with a close match to his target group. Still, the analysis in Chapter 4 has shown that the prerequisite for media outlets to run their online platform profitably is that they not only raise their online ad effectiveness but also increase their market size by attracting new consumers.

Recent revenue figures from 2010 show that there is a silver lining on the horizon (Rosenstiel and Mitchell, 2011). Still, a major challenge for traditional media outlets is to adapt to the new multimedia environment by searching for new business models, and to establish a clear-cut profile in the way how they report the news on their offline platform that prevents them from being replaced by online contents.

Bibliography

Ahrens, F. (2009). The accelerating decline of newspapers. *http://www.washingtonpost.com/wp-dyn/content/article/2009/10/26/AR2009102603272.html*. Accessed 09/14/2011.

Alger, D. (1998). *Megamedia: How giant corporations dominate mass media, distort competition, and endanger democracy.* Rowman & Littlefield Publishers.

Ambrus, A. and M. Reisinger (2006). Exclusive vs overlapping viewers in media markets. *Munich Discussion Paper 25.*

American Society of Magazine Editors (2011). Editorial fact sheets. *http://www.magazine.org/asme/editorial_trends/index.aspx*. Accessed 09/14/2011.

Anderson, S. (2007). Regulation of television advertising. In P. Seabright (Ed.), *The economic regulation of broadcasting markets*, pp. 189–224. Cambridge University Press.

Anderson, S. and S. Coate (2005). Market provision of broadcasting: A welfare analysis. *Review of Economic Studies 72*, 947–972.

Anderson, S., A. De Palma, and Y. Nesterov (1995). Oligopolistic competition and the optimal provision of products. *Econometrica 63*, 1281–1301.

Anderson, S. and J. Gabszewicz (2006). The media and advertising: A tale of two-sided markets. In V. Ginsburgh (Ed.), *Handbook of the economics of art and culture*, pp. 567–614. Elsevier.

Anderson, S., J. Goeree, and R. Ramer (1997). Location, location, location. *Journal of Economic Theory 77*, 102–127.

ARD (2010). ARD-Jahrbuch - Grundversorgung. *http://www.ard.de/intern/organisation/rechtsgrundlagen/grundversorgung/-/id=54408/1cm440t/index.html*. Accessed 09/14/2011.

Armstrong, M. (2006). Competition in two-sided markets. *RAND Journal of Economics 37*, 668–691.

Athey, S., E. Calvano, and J. Gans (2011). The impact of advertising on advertising markets for news media. *Mimeo*. Harvard University, Universita' Bocconi, and University of Melbourne.

Athey, S. and J. Gans (2010). The impact of targeting technology on advertising markets and media competition. *American Economic Review 100(2)*, 608–613.

Barnett, S., E. Seymour, and I. Gaber (2000). *From Callaghan to Kosovo: Changing trends in British television news 1975–1999.* Harrow: University of Westminster.

Barros, P. (2008). Television news scheduling revisited. *Economics Bulletin 12*, 1–4.

Baumeister, R., E. Bratslavsky, C. Finkenauer, and K. Vohs (2001). Bad is stronger than good. *Review of General Psychology 5*, 323–370.

BBC (2011). Royal charter and agreement. *http://www.bbc.co.uk/aboutthebbc/ purpose/charter/*. Accessed 09/14/2011.

Berg, K. and C. Ridder (2002). *Massenkommunikation IV. Eine Langzeitstudie zur Mediennutzung und Medienbewertung 1964-2000.* Nomos.

Bergemann, D. and A. Bonatti (2010). Targeting in advertising markets: Implications for offline vs. online media. *Cowles Foundation Discussion Paper No. 1758R.*

Besley, T. and R. Burgess (2002). The political economy of government responsiveness. *Quarterly Journal of Economics 117*, 1415–1452.

Besley, T. and A. Prat (2006). Handcuffs for the grabbing hand? Media capture and government accountability. *American Economic Review 96*, 720–736.

Bird, S. (2008). *International encyclopedia of communication*, Chapter Tabloidization, pp. 4947–4952. Blackwell.

Blair, R. and R. Romano (1993). Pricing decisions of the newspaper monopolist. *Southern Economic Journal 59*, 721–732.

Blecher, E. (2008). The impact of tobacco advertising bans on consumption in developing countries. *Journal of Health Economics 27(4)*, 930–942.

Brown, T. J. and M. L. Rothschild (1993). Reassessing the impact of television advertising clutter. *Journal of Consumer Research 20*, 138–146.

Cable & Telecommunications Association for Marketing (2009). Where consumers are cutting back. *http://www.rbr.com/media-news/research/13681.html*. Accessed 09/18/2011.

Caillaud, B. and B. Jullien (2001). Competing cybermediaries. *European Economic Review 45(4-6)*, 797–808.

Caillaud, B. and B. Jullien (2003). Chicken and egg: Competition among intermediation service providers. *RAND Journal of Economics 34(2)*, 309–328.

Cancian, M., A. Bills, and T. Bergstrom (1995). Hotelling location problems with directional constraints: An application to television news scheduling. *The Journal of Industrial Economics 43*, 121–124.

Carlton, D. and J. Perloff (2000). *Modern industrial organization.* Addison Wesley Longman, Inc.

Center for the Digital Future (2009). 2009 Digital future report. *http://www.digitalcenter.org/pdf/2009_Digital_Future_Project_Release_Highlights.pdf*. Accessed 09/20/2011.

Center for the Digital Future (2011). 2011 Digital future report. *http://www.digitalcenter.org./pdf/2011_digital_future_final_release.pdf*. Accessed 09/20/2011.

Chandra, A. and U. Kaiser (2011). Targeted advertising in magazine markets. *Mimeo*. University of British Columbia and University of Zurich.

Colombo, S. (2011). Spatial price discrimination in the unidirectional Hotelling model with elastic demand. *Journal of Economics 102*, 157–169.

Compaine, B. (1983). The new literacy. *Daedalus 112*, 129–142.

Crampes, C., C. Haritchabalet, and B. Jullien (2009). Advertising, competition and entry in media industries. *The Journal of Industrial Economics 57*, 7–31.

D'Aspremont, C., J. Gabszewicz, and J.-F. Thisse (1979). On Hotelling's "Stability in competition". *Econometrica 47*, 1145–1150.

Della Vigna, S. and E. Kaplan (2007). The Fox News effect: Media bias and voting. *Quarterly Journal of Economics 112*, 1187–1234.

Djankov, S., C. McLeish, T. Nenova, and A. Shleifer (2003). Who owns the media? *Journal of Law & Economics 46*, 341–381.

Dos Santos Ferreira, R. and J.-F. Thisse (1996). Horizontal and vertical differentiation: The Launhardt model. *International Journal of Industrial Organization 14*, 485–506.

Dukes, A. and E. Gal-Or (2003). Minimum differentiation in commercial media markets. *Journal of Economics and Management Strategy 12*, 291–325.

eco - Verband der deutschen Internetwirtschaft e.V. (2010). Die deutsche Internetwirtschaft 2009-2012. *http://public.eco-umfrage.de/Die_deutsche_Internetwirtschaft_2009-2012_eco_ADL.pdf*. Accessed 04/05/2011.

Economides, N. (1993). Hotelling's "main street" with more than two competitors. *Journal of Regional Science 33*, 303–319.

Esser, F. (1999). 'Tabloidization' of news : A comparative analysis of Anglo-American and German press journalism. *European Journal of Communication 14*, 291–324.

European Audiovisual Observatory (2011). MAVISE - database of TV companies and TV channels in the European Union and candidate countries. *http://mavise.obs.coe.int/*. Accessed 09/14/2011.

European Commission (2011). Audiovisual commercial communications. *http://ec.europa.eu/avpolicy/reg/tvwf/advertising/index_en.htm*. Accessed 09/14/2011.

European Interactive Advertising Association and Mediascope Europe (2010). EIAA European media landscape report. *http://www.dcm-eu.com/assets/1070/1075/EIAA_European_Media_Landscape_Report_SUMMARY.pdf*. Accessed 09/15/2011.

Europäische Audiovisuelle Informationsstelle (2004). Grenzüberschreitendes Fernsehen in der Europäischen Union - Marktanteile und ausgewählte juristische Aspekte. *http://www.obs.coe.int/online_publication/transfrontier_tv.pdf.de*. Accessed 09/14/2011.

Evans, D. and R. Schmalensee (2007). The industrial organization of markets with two-sided platforms. *Competition Policy International 3*, 151–179.

Evans, D. S. (2009). The online advertising industry: Economics, evolution, and privacy. *Journal of Economic Perspectives 23*, 37–60.

Ferrando, J., J. Gabszewicz, D. Laussel, and N. Sonnac (2008). Intermarket network externalities and competition: An application to the media industry. *International Journal of Economic Theory 4*, 357–379.

Filistrucci, L. (2005). The impact of the internet on the market for daily newspapers in Italy. *EUI Working Paper ECO 2005/12*.

France Télévisions (2010). Le rapport annuel du groupe. *http://www.francetelevisions.fr/groupe/rapport_annuel.php*. Accessed 08/10/2010.

Frank, M. (2008). Media substution in advertising: A spirited case study. *International Journal of Industrial Organization 26*, 308–326.

Gabszewicz, J., D. Laussel, and M. Le Breton (2008). The mixed strategy Nash equilibrium of the television news scheduling game. *Journal of Industrial Economics 56*, 418–425.

Gabszewicz, J., D. Laussel, and N. Sonnac (2001). Press advertising and the ascent of the "pensée unique". *European Economic Review 45*, 641–651.

Gabszewicz, J., D. Laussel, and N. Sonnac (2002). Press advertising and the political differentiation of newspapers. *Journal of Public Economic Theory 4*, 317–334.

Gabszewicz, J., D. Laussel, and N. Sonnac (2004). Programming and advertising competition in the broadcasting industry. *Journal of Economics & Management Strategy 13*, 657–669.

Gabszewicz, J., D. Laussel, and N. Sonnac (2006). Advertising and competitive access pricing to internet services or pay-tv. *CORE Discussion Paper 2006/86*. CORE, GREQAM, and CREST.

Gabszewicz, J., D. Laussel, and N. Sonnac (2010). The TV news scheduling game: When the face of the newscaster matters. *Journal of Media Economics 23*, 17–23.

Gabszewicz, J. and J. Resende (2008). Uncertainty, product variety and price competition. *Discussion Papers (ECON - Département des Sciences Economiques) No. 2008-27*. Université catholique de Louvain.

Gal-Or, E. (1985). First mover and second mover advantages. *International Economic Review 26*, 649–653.

Galtung, J. and M. Ruge (1965). The structure of foreign news: The presentation of the Congo, Cuba and Cyprus crises in four Norwegian newspapers. *Journal of International Peace Research 1*, 64–91.

Gentzkow, M. (2007). Valuing new goods in a model with complementarity: Online newspapers. *American Economic Review 97*, 713–744.

Gentzkow, M. and J. Shapiro (2006). Media bias and reputation. *Journal of Political Economy 114*, 280–316.

George, L. (2008). The internet and the market for daily newspapers. *The B.E. Journal of Economic Analysis & Policy 8*, 1–33.

George, L. and J. Waldfogel (2006). The New York Times and the market for local newspapers. *American Economic Review 96*, 435–447.

Glaser, M. (2007). 'Mr. Magazine' believes we'll always crave ink on paper. *http://www.pbs.org/mediashift/2007/05/mr-magazine-believes-well-always-crave-ink-on-paper122.html*. Accessed 09/14/2011.

Goldfarb, A. and C. Tucker (2011a). Advertising bans and the substitutability of online and offline advertising. *Journal of Marketing Research 48*, 207–227.

Goldfarb, A. and C. Tucker (2011b). Privacy regulation and online advertising. *Management Science 57*, 57–71.

Goldfarb, A. and C. Tucker (2011c). Substitution between offline and online advertising markets. *Journal of Competition Law and Economics 7*, 37–44.

Graber, D. (1988). *Processing the news: How people tame the information tide.* Longman Group United Kingdom.

Graber, D. (1990). Seeing is remembering: How visuals contribute to learning from television news. *Journal of Communication 40*, 134–155.

Greiner, T. (2010). The effect of entertainment in newspaper and television news coverage. *Munich Discussion Paper 28.*

Greiner, T. (2011). The role of online platforms for media markets - Multidimensional spatial competition in a two-sided market. *Mimeo*.

Greiner, T. and M. Sahm (2011). How effective are advertising bans? On the demand for quality in two-sided media markets. *CESifo Working Paper No. 3524*.

Hargreaves-Heap, S. (2005). Television in a digital age: What role for public service broadcasting? *Economic Policy*, 111–157.

Hickey, N. (1998). Money lust - how pressure for profit is perverting journalism. *Columbia Journalism Review 36*, 28–36.

Hotelling, H. (1929). Stability in competition. *The Economic Journal 39*, 41–57.

Internet Advertising Bureau (2010). Online adspend. *http://www.iabuk.net/en/1/iabknowledgebankadspend.html*. Accessed 09/14/2011.

Internet World Stats (2011). Internet usage statistics. *http://www.internetworldstats.com/stats.htm*. Accessed 09/15/2011.

Kaiser, U. and M. Song (2009). Do media consumers really dislike advertising? An empirical assessment of the role of advertising in print media markets. *International Journal of Industrial Organization 27*, 292–301.

Kalb, M. (1998). The rise of the "New News" - A case study of two roots causes of the modern scandal coverage. *Discussion Paper D-34*. Harvard University.

Kind, H., M. Köthenbürger, and G. Schjelderup (2011). Media firm strategy and advertising taxes. *NHH Dept. of Finance & Management Science Discussion Paper No. 2011/3*.

Kind, H., T. Nilssen, and L. Sorgard (2007). Competition for viewers and advertisers in a TV oligopoly. *Journal of Media Economics 20(3)*, 211–233.

Kind, H., T. Nilssen, and L. Sorgard (2010). Price coordination in two-sided markets: Competition in the TV industry. *CESifo Working Paper No. 3004*.

Kind, H. and F. Stähler (2010). Market shares in two-sided media industries. *Journal of Institutional and Theoretical Economics 166(2)*, 205–211.

Kirchhoff, S. (2010). The U.S. newspaper industry in transition. *Journal of Current Issues in Media and Telecommunications 2*, 27–51.

Kommission zur Ermittlung des Finanzbedarfs der Rundfunkanstalten (2009). 17. KEF-Bericht. *http://www.kef-online.de/inhalte/bericht17/kef_17bericht.pdf*. Accessed 09/15/2011.

Kotsogiannis, C. and K. Serfes (2010). Public goods and tax competition in a two-sided market. *Journal of Public Economic Theory 12(2)*, 281–321.

Krueger, U. and T. Zapf-Schramm (2001). Die Boulevardisierungskluft im Deutschen Fernsehen. *Media Perspektiven 7*, 326–344.

Laffont, J., P. Rey, and J. Tirole (1998a). Network competition: I. Overview and nondiscriminatory pricing. *RAND Journal of Economics 29*, 1–37.

Laffont, J., P. Rey, and J. Tirole (1998b). Network competition: II. Price discrimination. *RAND Journal of Economics 27*, 38–56.

Lai, F.-C. (2001). Sequential locations in directional markets. *Regional Science and Urban Economics 31*, 535–546.

Larralde, H., J. Stehlé, and P. Jensen (2009). Analytical solution of a multi-dimensional Hotelling model with quadratic transportation costs. *Regional Science and Urban Economics 39*, 343–349.

Launhardt, W. (1885). *Mathematische Begründung der Volkswirtschaftslehre*. B.G Teubner, Leipzig.

Lehman-Wilzig, S. and M. Seletzky (2010). Hard news, soft news, general news: The necessity and utility of an intermediate classification. *Journalism 11*, 37–56.

Manduchi, A. and R. Picard (2010). Circulation, revenues, and profits in a newspaper market with fixed advertising costs. *Journal of Media Economics 22*, 211–238.

Martin, S. (2002). *Advanced industrial economics*. Blackwell Publishers.

Matsumura, T. and N. Matsushima (2010). Spatial Cournot competition and transportation costs in a circular city. *Annals of Regional Science*. forthcoming.

MediaInfoCenter (2011). Media consumption based on hours per person. *http://www.mediainfocenter.org/film/competition/consumption.asp*. Accessed 09/15/2011.

Motta, M. and M. Polo (1997). Concentration and public policies in the broadcasting industry: The future of television. *Economic Policy*, 295–334.

Mullainathan, S. and A. Shleifer (2005). The market for news. *American Economic Review 95*, 1031–1053.

Mussa, M. and S. Rosen (1986). Monopoly and product quality. *Journal of Economic Theory 18*, 301–317.

Nelson, J. (1999). Broadcast advertising and U.S. demand for alcoholic beverages. *Southern Economic Journal 65(4)*, 774–790.

Neuman, W., M. Just, and A. Crigler (1992). *Common knowledge: News and the construction of political meaning*. University of Chicago Press.

Newspaper Association of America (2011). Advertising expenditures - annual (all categories). *http://www.naa.org/Trends-and-Numbers/Advertising-Expenditures/Annual-All-Categories.aspx*. Accessed 09/14/2011.

Nilssen, T. (1997). Sequential location when transportation costs are asymmetric. *Economic Letters 54*, 191–201.

Nilssen, T. and L. Sorgard (1998). Time schedule and program profile: TV news in Norway and Denmark. *Journal of Economics & Management Strategy 7(2)*, 209–235.

Oestgaard, E. (1965). Factors influencing the flow of news. *Journal of Peace Research 2*, 39–63.

Olmstead, K., A. Mitchell, and T. Rosenstiel (2011). The state of the news media 2011 - Online: Key questions facing digital news. *http://stateofthemedia.org/2011/online-essay/#subscription-model-and-user-fees*. Accessed 09/15/2011.

Oskam, J. and J. Hudson (1999). Media preference and believability among rural respondents for news and advertising information. *The Social Science Journal 36*, 285–298.

Peitz, M. and T. Valletti (2008). Content and advertising in the media: Pay-TV versus free-to-air. *International Journal of Industrial Organization 26*, 949–965.

Peters, J. (2010). Newspaper circulation falls broadly but at slower pace. *http://mediadecoder.blogs.nytimes.com/2010/10/25/newspaper-circulation-falls-broadly-but-at-slower-pace/*. Accessed 09/15/2011.

Pew Internet & American Life Project (2010). November 2010 - Paid content (Omnibus). *http://pewinternet.org/Shared-Content/Data-Sets/2010/November-2010–Paid-Content-%28Omnibus%29.aspx*. Accessed 09/14/2011.

Pew Project for Excellence in Journalism (2004). The state of the news media 2004 - Who's making a profit on local TV news web sites. *http://stateofthemedia.org/2004/onlline-intro/charts-tables/*. Accessed 09/14/2011.

Pew Project for Excellence in Journalism (2005). The state of the news media 2005 - Revenues and profits for select newspaper online divisions. *http://stateofthemedia.org/2005/online-intro/charts-tables/*. Accessed 09/14/2011.

Pew Project for Excellence in Journalism (2011a). The state of the news media 2011 - A year in the news interactive 2010. *http://stateofthemedia.org/2011/year-in-the-news/*. Accessed 09/14/2011.

Pew Project for Excellence in Journalism (2011b). The state of the news media 2011 - Audiences turn to web. *http://pewresearch.org/pubs/1924/state-of-the-news-media-2011*. Accessed 09/14/2011.

Pew Project for Excellence in Journalism (2011c). The state of the news media 2011 - Key findings. *http://stateofthemedia.org/2011/overview-2/key-findings/*. Accessed 09/15/2011.

Pew Research Center for the People & the Press (2008). December 2008 Political & economic survey. *http://people-press.org/files/legacy-questionnaires/479.pdf*. Accessed 09/14/2011.

Purcell, K. (2011). E-reader ownership doubles in six months. *http://pewresearch.org/pubs/2039/e-reader-ownership-doubles-tablet-adoption-grows-more-slowly*. Accessed 09/15/2011.

Radio Television Digital News Association (2009). About radio and TV news websites. *http://www.rtdna.org/pages/research/news-websites.php*. Accessed 09/14/2011.

Ratliff, J. and D. Rubinfeld (2010). Online advertising: Defining relevant markets. *Journal of Competition Law and Economics 6*, 653–686.

Reisinger, M. (2011). Platform competition for advertisers and users in media markets. *Mimeo*. WHU - Otto Beisheim School of Management.

Rochet, J.-C. and J. Tirole (2003). Platform competition in two-sided markets. *Journal of the European Economic Association 1(4)*, 990–1029.

Rochet, J.-C. and J. Tirole (2006). Two-sided markets: A progress report. *RAND Journal of Economics 37*, 645–667.

Rosenstiel, T. and A. Mitchell (2011). The state of the news media 2011 - Overview. *http://stateofthemedia.org/2011/overview-2/*. Accessed 09/20/2011.

Saffer, H. and F. Chaloupka (2000). The effect of tobacco advertising bans on tobacco consumption. *Journal of Health Economics 19(6)*, 1117–1137.

Santhanam, L. and T. Rosenstiel (2011). The state of the news media 2011 - Paid newspaper circulation. *http://stateofthemedia.org/2011/mobile-survey/international-newspaper-economics/*. Accessed 09/15/2011.

Schneller, J. (2008). Mediennutzung gestern - heute - morgen. *http://www.awa-online.de/praesentationen/awa08_Mediennutzung.pdf*. Accessed 09/15/2011.

Schoenbach, K. (2000). *Tabloid tales: Global debates over media standards*, Chapter Does tabloidization make German local newspapers successful?, pp. 63–74. Rowman & Littlefield.

Seamans, R. and F. Zhu (2011). Technology shocks in multi-sided markets: The impact of Craigslist on local newspapers. *Mimeo*. Stern School of Business and Marshall School of Business.

Seidenberg, J. (2009). Newspapers consider charging for online content. *http://john-seidenberg.suite101.com/newspapers-consider-charging-for-online-content-a165440*. Accessed 09/15/2011.

Seldon, B., R. Jewell, and D. O'Brien (2000). Media substution and economies of scale in advertising. *International Journal of Industrial Organization 18*, 1153–1180.

Simon, D. and V. Kadiyali (2007). The effect of a magazine's free digital content on its print circulation: Cannibalization or complementarity? *Information Economics and Policy 19*, 344–361.

Sonnac, N. (2000). Readers' attitudes towards press advertising: Are they ad-lovers or ad-averse? *Journal of Media Economics 13*, 249–259.

Stewart, M. (1993). The effect on tobacco consumption of advertising bans in OECD countries. *International Journal of Advertising 12*, 155–180.

Strömberg, D. (2001). Mass media and public policy. *European Economic Review 45*, 652–663.

Strömberg, D. (2004). Radio's impact on public spending. *The Quarterly Journal of Economics 119*, 189–221.

Sun, C.-H. (2010). Spatial Cournot competition in a circular city with directional delivery constraints. *Annals of Regional Science 45*, 273–289.

Sweney, M. (2010). Channel Five and ITV score 2009 audience share success. *http://www.guardian.co.uk/media/2010/jan/14/five-itv-tv-audience-share-2009*. Accessed 09/14/2011.

Tabuchi, T. (1994). Two-stage two-dimensional spatial competition between two firms. *Regional Science and Urban Economics 24*, 207–227.

Tabuchi, T. and J.-F. Thisse (1995). Asymmetric equilibria in spatial competition. *International Journal of Industrial Organization 13*, 213–227.

Tirole, J. (1988). *The theory of industrial organization.* The MIT Press.

Tulloch, J., C. Sparks, and B. Zelizer (2000). *Tabloid tales: Global debates over media standards (Critical media studies).* Rowman & Littlefield.

Uribe, R. and B. Gunter (2004). Research note: The tabloidization of British tabloids. *European Journal of Communication 19*, 387–402.

Vanacore, A. (2011). Is the end of free TV on the way? *http://www.heraldsun.com/view/full_story/5355736/article-IS-THE-END-OF-FREE-TV-ON-THE-WAY-*. Accessed 09/17/2011.

Werben & Verkaufen (2009). Halbjahres-Marktanteile: RTL setzt sich wieder klar an die Spitze. *http://www.wuv.de/nachrichten/medien/halbjahres_marktanteile_rtl_setzt_sich_wieder_klar_an_die_spitze*. Accessed 09/14/2011.

Wilbur, K. (2008). A two-sided, empirical model of television advertising and viewing markets. *Marketing Science 27*, 356–378.

Winston, B. (2002). Towards tabloidization? Glasgow revisited, 1975-2001. *Journalism Studies 3*, 5–20.

ZDF Werbefernsehen (2005). Die unterschätzte Werbezeit - Effiziente Werbewirkung zwischen 17 und 20 Uhr. *http://www.zdf-werbefernsehen.de/fileadmin/user_upload/zdfwerb/pdf/studien/werbewirkung_17bis20_Uhr.pdf*. Accessed 09/14/2011.

ZDF Werbefernsehen (2008). Werbung im öffentlich-rechtlichen Fernsehen ist unverzichtbar. *http://www.zdf-werbefernsehen.de/fileadmin/user_upload/zdfwerb/pdf/studien/werbungunverzichtbar.pdf*. Accessed 09/14/2011.

Zhou, W. (2004). The choice of commercial breaks in television programs: The number, length and timing. *The Journal of Industrial Economics 3*, 315–326.

Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebene Anregungen sind als solche kenntlich gemacht. Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

München, 21. September 2011

Tanja Greiner

Curriculum Vitae

Since August 2008	Research and Teaching Assistant Chair of Prof. Dr. Andreas Haufler Ph.D. Program in Economics Munich Graduate School of Economics Ludwig-Maximilians-Universität, Munich
October 2006 - April 2008	Studies in Economics (M.A.) Ludwig-Maximilians-Universität, Munich
October 2003 - June 2006	Studies in Communications (B.A.) Ludwig-Maximilians-Universität, Munich
June 2003	Abitur Mönchsee Gymnasium, Heilbronn
April 11, 1984	Born in Heilbronn, Germany