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Product Differentiation in Two-sided markets:

The case of online news portals

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Introduction

The topic of diversity of media has attracted the attention of economists for years. Most of these studies, however, concentrate on radio, television and press. In recent years another media sector has gained importance: the online media. The growth of the market is remarkable. In OECD countries already 25% of the population possessed fixed broadband internet in 2008.[1] The market's value increases also rapidly in terms of advertising revenues. Whereas in 1999 the total revenues from online advertising in the U.S. amounted to $4 621 Million, in 2008 they were almost 6 times higher and amounted to $23 448 Million. In the U.S. expenditures on online advertising reached 87% of the expenditure on the leading category - television advertising.[2] Also in Europe the market for advertising is growing. In the middle of the financial crisis – from 2008 to 2009 – online advertising revenues have increased by 4.5% and amount in 2009 to €14.7 Billion[3].

Whereas online advertising has gained significance in the advertising market, in economic literature it has attracted relatively little attention. Moreover, most of the existing literature on online advertising concentrates on advertising in search engines. This is certainly an interesting new field of research, especially given the complex pricing strategies of these platforms. Nevertheless, online display advertising i.e. advertising on various websites offering content to users still amounts to a high portion of online advertising spending. In the US it makes up 24% of total online advertising revenues.[4] In Europe this share is even higher and amounts to 30%.[5]

Note that on the Internet advertising is usually the sole source of revenue for the media platforms. Thus these firms will aim at maximizing advertising volume. At the same time, however, users dislike advertising and thus will not want to use websites full of advertising. This in turn makes these websites less attractive to advertising. In order to maximize profits an online media platform will thus have to balance the number of users and the number of advertisers.

Markets in which firms have to balance the number of two types of users have attracted much attention recently. A growing literature on two-sided markets analyses, how profit maximizing behaviour in this market differs from "one-sided" markets. Such analysis has also been recently applied to media. It concentrates, however, on television and press. In

[1] Source: World Bank, World Development Indicators
[2] Source: IAB Internet Advertising Revenue Report 2009, PwC 2010
[3] Source: AdEx Report 2009
[4] PwC, op. cit.
[5] IAB Europe, op.cit.

this paper I will contribute with a model designed for the analysis o online media. More specifically I will concentrate on the question, how advertising influences the diversity of content presented online. Previous analyses of media as two-sided markets have shown, that the principle of maximum differentiation (d'Aspremont et al, 1979) does not always hold in two-sided markets.

My model will be an extension of the Hotelling model with quadratic transportation costs (d'Aspremont et al, 1979) to describe two-sided markets. This has been also done before, but my model differs from the previous formulations in two ways. First none of the previous models incorporates at the same time users who dislike advertising, advertisers who have divergent valuations for users and platforms which can choose their location. The second novelty of my model is the assumption that each advertiser has his preferred user and that he is willing to pay a premium to contact him. With all these assumptions I can show that for different configurations of the model's parameters different levels of differentiation ranging from maximum to minimum differentiation. However, as long as users dislike advertising to some extend, platforms will not be completely homogenous. The degree of differentiation depends on the disutility of the users from advertising and the strength of advertisers preference for a distinct group of users.

I believe that my model is especially suited to online advertising for two reasons. First the online technology allows platforms to charge advertisers per user. Second online platforms have better technologies to indentify the characteristics of their users. Thus the fact that advertisers value different groups of users differently gains additional significance in this market.

This paper will be structured as follows. In Chapter I I will review the relevant literature. I will discuss traditional analyses of diversification in media markets then I will present the core models of two-sided markets and finally discuss how these have been applied to the analysis of media markets. I this chapter I will discuss also some empirical findings on media diversification and the two-sided nature of media. I will also discuss the specifics of online advertising. Chapter II will be devoted to my model of differentiation in online media markets. In Chapter III I will analyse the performance of my model on the example of the Polish online news portals' market. The last chapter will conclude.

CHAPTER I Literature Review

The literature dealing with diversification on media markets can be generally divided in the earlier "one-sided" literature and the more recent "two-sided". Whereas the first assumed that maximizing audiences is the sole goal of a media platform, the latter takes into account the fact that a media platform has to balance the number of advertisers and users in order to get maximal profits. In what follows I will first discuss the "one-sided" literature. Then I will discuss the general theoretical literature on two-sided markets. Afterwards I will discuss the application of the latter to media markets. The next section will be devoted to empirical verification of the one-sided and two-sided models. In this section I will also briefly discuss papers which confirm my hypothesis that advertisers value some users more than others. Finally I will discuss the specifics of the online advertising market

1.1. Diversification in media markets

An early analysis of the programme differentiation in media markets is due to Steiner (1952). He models the programming choice of radio stations. The model bears some resemblance to the Hotelling (1929) model but it is strongly simplified. Steiner (1952) assumes that there are several possible radio programmes and that each programme would be chosen by a given number of listeners. Further each listener has a "second choice" programme to which he would listen if his preferred programme type was not broadcasted. For some listeners not listening may be the second choice. Radio stations in Steiner's (1952) model enter the market sequentially. The first station chooses a programme which would have the highest number of listeners, the next will choose the same programme if half the number of listeners of this programme is higher than the number of listeners of the programme with the second largest audience and so on. Moreover not all listeners may be willing to switch to listening to the programme of the second station if it broadcasts the same programme as the first. In such a case the second stage would get less than half of the listeners and thus is more likely to broadcast a different programme. In optimum the number of broadcasted programme types depends thus on the distribution of listeners between various programme types and on the number of "captive" listeners who will stay with the first radio station even if other programmes of their preferred type are broadcasted.

In a multi-period model also analysed by Steiner (1952), the possible diversity of programmes broadcasted depends additionally on the willingness of listeners to listen to their favourite programme in a given period. Assuming that listeners of the most popular programmes are indifferent with respect to the broadcast time, whereas listeners of the less popular programmes have also different preferences about broadcast times, programme diversity is less likely than in the one-period case. If the opposite is true, programme diversity is more likely.

Note that in this model a station seeks to maximize the number of the listeners assuming that this will increase its attractiveness to advertisers. The nuisance from advertising for the listeners is not taken into account.

From Steiner's (1952) analysis it follows that only a monopoly can provide a maximum diversity of programming and thus media should be state-owned. This conclusion is challenged by Wiles (1963). He assumes that the most popular programme is a second choice for all listeners. In this case a profit maximizing monopoly would broadcast only this programme. However, according to Wiles (1963) also a monopoly that maximises listeners' satisfaction will produce a programming mix which is inferior to the programme variety which could by supplied when many firms operate in the media market. Wiles (1963) assumes that the most popular programme can be further differentiated, which yields an additional, small level of satisfaction to listeners. A monopoly which can broadcast only a limited number of programmes will produce this programme only once. However, if the broadcasting market is populated with sufficiently many firms, several types of the most popular programme will be produced along with other programmes and thus the audience is better off. Note that this result relies crucially on the assumption that a satisfaction-maximising monopoly has a limited number of channels available whereas there can be many private broadcasters. Nevertheless, even if this assumption is relaxed a broadcasting provided by private firms is equally good for the listeners as a listener-oriented monopoly.

The results of Steiner (1952) and Wiles (1963) are formalised and recapitulated by Beebe (1977). He shows that the number of programmes in the monopoly and competition case depends on two factors: second choice structure of the users (viewers or listeners) and distribution of the preferences. In cases where users prefer only one programme the monopoly produces superior results. It will broadcast all programmes at the lowest cost. Whereas competing firms could also broadcast al programmes if they are sufficiently many, duplication of programmes is inevitable unless users' preferences are distributed evenly and thus competition lead to duplication of costs. The situation changes when users have also a second choice and for none of the users the second choice is not to watch. Assume e.g. that the users second choice is closely related to their preferred programme. In this case a monopoly will provide only some of the programmes and some users will have to choose their second choice. Under competition, on the contrary, firms will provide the entire range of programming. The programme offer under monopoly is even worse when all users have also a third choice which is the same for all of them. In this case a monopoly will choose to broadcast only this third choice called by Beebe (1977) "the lowest common denominator". Competition in this case produces mixed results. It is even possible that no pure strategy Nash equilibrium will occur. This will be the case when the number of firms in competition is lower than the number of programme types.

A related result where no pure strategy Nash equilibrium may occur is described by Cancian et al. (1995). Assume that there are two stations and both would like to broadcast the same programme type, say news, but they have to choose the broadcasting time. There is a time interval $[0,T]$ in which users come back from work and want to watch the news. In this case if both stations broadcast at time $t<T$, each of them has an incentive to broadcast a little earlier to capture all the viewers who are at home by this time. But this will eventually lead both firms to land at time 0, when there is no audience.

As shown in the model of Steiner (1952) and Beebe (1977) the programmes that are least likely to be aired under competition are those with small audiences. This idea is further developed by Spence and Owen (1977). These authors consider several market structures for television broadcasting i.a. a competitive and monopolised market where viewers pay for television. They build a model of monopolistic competition where each viewer has a preferred programme, but gets also some benefit from watching other programmes and thus the demand for a given programme depends on the prices of other programmes. Firms in this model incur only fixed costs. Typically to models of monopolistic competition the number of firms (in this case television programmes) is such that prices can be above marginal costs. This means that some programmes will not be aired although the benefits that could be extracted from the users are positive. Spence and Owen (1977) characterise also the programmes that are least likely to be broadcasted. These include programmes with high fixed production costs, but also programmes for which the inverse demand function is steep i.e. programmes which have a few viewers with high valuation for the programme and a large group of viewers with low valuations. This is a more precise characterisation than the one given by Steiner (1952) and Beebe (1977).

At the same time similarly to Beebe (1977) and Wiles (1963) Spence and Owen (1977) argue that a monopolist broadcaster will air less programmes than there would be aired in competition. This is obvious, since in a monopolistic competition new broadcasters will enter with new programmes as long as their overall profits are positive, whereas a monopolist seeks to maximize his profits. Moreover the authors show that if television is financed only from advertising revenues less programmes are aired. The authors assume that advertisers pay a fixed price per user. Thus if broadcasters cannot levy charges from viewers, programmes with small audiences will not be broadcasted although they could be profitable if these small group of viewers is willing to pay a high price for watching the programme. The most important conclusion from this paper is thus that competition and the possibility to charge viewers increases the diversity of programmes.

Note that the model of Spence and Owen (1977) does not allow for programme duplication because it cannot be profitable to air the same programme as some broadcaster already in the market. The diversity of programmes is thus guaranteed by a larger number of broadcasters in the market.

All the models described so far assume that the price of advertising does not depend on the number and characteristics of the users and that users are indifferent to advertising. In reality though both of these assumptions are not necessarily true. Users tend to be annoyed by advertising. The assumption that advertisers do not care about the number of the users is true only if advertisers pay per user and that they are all willing to pay the same fixed amount per user irrespective of his characteristics. The first condition is certainly violated in the case of television and newspapers, where advertisers pay a fixed fee no matter how many persons watch a given commercial or buy a given newspaper. The fact that media platforms collect detailed information about the characteristics of the users suggests that also the second condition is violated. This means that in fact media platforms are faced with users who dislike advertisers and advertisers who prefer media with more users.

The problem of firms which compete on two interrelated markets is discussed in a relatively recent strand in economic literature on two-sided markets started with Rochet and Tirole in 2003. In what follows I will first discuss the general models for two-sided markets and then their application to various media.

1.2. Two-sided markets

The literature on two-sided markets deals with cases where firms have two types of clients and the number of consumers they attract on one side of the market determines the attractiveness of their services to consumers on the other side. Such firms include credit card issuers whose services become more attractive the more buyers have a card and the more sellers accept them or producers of computer operating systems who sell the operating system to users and developers' kits to programme developers.

The theory of two-sided markets combines the theory of multiproduct firms with network externalities. Indeed a two-sided platform offers two services (to the two sides o the market), which are complements. Its users also profit from network externalities although indirectly. An agent on one side does not profit directly from the large number of users on his side. More agents on his side, however, attract more agents on the other side and in this indirect way they benefit the agent.

Most papers in this literature define two-sided platforms loosely as aiming to "bring the two sides on board", but as argued by Rochet and Tirole (2006) this definition is too broad. If firms are able to bargain after the transaction they may pay to the platform prices which exceed their benefit from the transaction. They will compensate for this loss in the bargaining stage. If this is the case a platform can influence the number of users and the total surplus only through the total price i.e. the sum of prices paid by the two sides. In such a case the platform behaves as in a one-sided market. The authors show that this follows from the Coase theorem. They argue, however, that markets may be one-sided even in the presence of information asymmetries. Relaxing one more assumption of the Coase theorem is necessary for a market to be two-sided.

From this discussion the defining feature of to-sided markets becomes evident. For a market to be two-sided not only the total price has to influence the number of transactions on the platform, but also the division of this price between the two sides. In other words a platform must be able to change the volume of transactions by reducing the price for one side and increasing the price for the other side by the same amount. To cite Rochet and Tirole (2006) "the price structure matters".

In the theory of two-sided markets there are two seminal papers: Rochet and Tirole (2003) and Armstrong (2006). Whereas both aim at modelling the same phenomenon they get results which differ in many respects.

This may be due to the different assumptions these papers make about pricing strategies and the way in which users attach utility to the platform. Rochet and Tirole (2003) assume that platforms charge users on per-transaction basis and incur only per transaction costs and that users derive benefits only interaction with other users. This model was designed primarily to explain the functioning of credit cards and thus the assumptions are fitted mainly to this market. Users would be customers and merchants. The payment in this market occurs on a per-transaction basis. Consumers derive no utility from the sole fact of having a card, but only if they are able to pay with it in many places. Similarly merchants do not derive any utility just from having a terminal in their shops.

Armstrong (2006) on the other hand assumes that users derive utility from the sole fact of being on a platform and additionally they have per-transaction benefits. Firms in this model set fixed prices and incur costs per user. This model is better suited to explaining e.g. the functioning of markets for newspapers. In these markets a newspaper serves as a connection between readers and advertisers. Transactions between users in these markets are unobservable and therefore a platform cannot set prices per transaction. Moreover firms incur costs per user and not per transaction. Finally users do get a benefit from the sole fact of using a platform. A reader increases his utility be reading the newspaper.

In both models users are differentiated, but this differentiation is also modelled in different ways. Whereas in Rochet's and Tirole's (2003) paper users have different per-transaction benefits from using a given platform in Armstrong's model they differ in their valuation of the platform as such.

In the monopoly case in general the results for a two-sided platform are very similar to a standard monopoly solution. The price of a monopolist depends on the opportunity costs of serving a user and the price elasticity of that user. The crucial difference lies in the opportunity costs. In a one-sided setup the opportunity cost of providing a service to a customer is just the cost the firm has to incur to provide the service. In the two-sided case this cost is much lower, in extreme cases even negative. In Armstrong's (2006) model if a platform serves one customer less it economises on the cost of service, but at the same time it decreases the benefit from this one customer to all customers on the other side and therefore it has to decrease the price on that side. This leads to an interesting conclusion. Under some circumstances the price on one side may be negative. This may happen for instance if *j*- users value interaction with *i*-users very much or if the price elasticity of demand of *i*-users is very high.

In Rochet's and Tirole's (2003) model a platform which offers one transaction less looses the revenue on both sides i.e. the opportunity cost of serving one consumer less is decreased by the price the platform sets on the other side.

An interesting feature of the model by Rochet and Tirole (2003) is that the platform in this set-up does not act to maximise the utility of the users but rather the number of transactions. Whether a user will join the platform does not depend on the number of users on the other side but on the difference between his per transaction benefit and the per-transaction price.

The simplest case of competition in a two-sided market is where both sides use the services of only one platform. This case is modelled with the use of an adapted Hotelling (1929) model by Armstrong (2006). Again the price is set in a manner similar to a standard Hotelling (1929) model but again opportunity costs consist not only of the cost of serving a consumer but also of the lost benefits on the other side.

The difference is that the opportunity cost due to two-sidedness is now twice as important as in the monopoly case. A lost *j*-user does not disappear from the market as in the monopoly case. Instead he switches to the competing platform making it more attractive to *i*-users. As a consequence some *i*-users will switch.

A more interesting case is one in which consumers use the services of more than one platform i.e. engage in multi-homing. For example advertisers usually place their ads in more than one newspaper and most merchants accept more than one credit card. This also has an influence on the price structure. Generally if we assume that only one side multi-homes the platform has quasi monopoly power over the single-homing users and thus the multi-homing side is worse off.

The case of multi-homing on only one side is discussed by Armstrong (2006). In the case where one group, say *i*-users, single-homes the platform posses quasi monopoly power over this group. If *j*-users want to transact with them they must use one specific platform. Therefore, as shown in by Armstrong (2006), the platform can ignore the interests of the *j*-users. Its profit maximising behaviour involves attracting *i*-users in the first place. A platform chooses the number of *j*-users so as to maximise the number *i*-users (because with many *i*-users it can set a higher price for *j*-users) and its own profit. This set-up, Armstrong (2006) argues, leads to a suboptimal number of *j*-users on the platform. Social surplus could be increased by taking the interest of *j*-users into account.

Contrary to Armstrong (2006) , Rochet and Tirole (2003) allow for multi-homing on both sides of the market. The per-transaction benefit of users of one group, say *i*-users, depends on the platform on which they are trading. In this case for a given set on the platform with the lower price some *i*-users may be willing to transact on both platforms, some only on one and some are not willing to transact at all. *j*-users, whose benefit is independent from the platform, always transact on the platform that is cheaper for them. However, due to the fact that some *i*-users are willing to trade only on one platform they will also multi-home.

Again each platform acts to maximise the number of transactions and the total price is equal to costs plus some mark-up. But this time the price structure is determined by different factors. If the cheaper platform decreases its prices some, *i*-users may resign from multi-homing and decide to single-home. The reason for this is that the users who now single-home enter fewer transactions, but will have a higher per transaction net benefit. It is important to notice that the switching *i*-user is still able to transact with some of the *j*-users with whom he was previously trading on the more expensive platform. Therefore the price set to the *i*-user does not depend only on the *i*-user's price elasticity of demand but also on the proportion of *j*-users who will still trade with him if he ceases multi-homing. On the side of the *j*-user the price depends on the "own-brand" elasticity of demand i.e. the number of *j*-users who are willing to transact on a given platforms when both platforms are available.

The models of two-sided markets, especially in the on laid out by Armstrong (2006), can be applied to the analysis of media, although with some modifications. First note that in the case of television, radio and the online media the price for the users is usually zero. Thus the problem of optimal price choice disappears. Second advertisers usually do not gain any benefit from the sole fact that their advertisement is placed in a given medium, but only from the interaction with its users. The assumption of the Armstrong (2006) model that both sides gain utility from being on a platform does not apply to advertisers. Note, however, that e.g. press publishers face an optimization problem very similar to the one presented by Armstrong (2006).

In the next section I will discuss, how the theory of two-sided markets has enriched the models of media differentiation discussed above.

1.3. Differentiation of two-sided media markets

The model of Armstrong (2006) has been used with some modifications by Gabszewicz et al. (2001) to analyse newspapers' choice of content. Each newspaper chooses its political option which can range from the extreme right to extreme left. In this model there are two newspapers, which engage in a three-stage game. In the first stage they choose a political option, in the second stage a price of the newspaper and in the third stage prices of advertisement. Advertisers pay a price per advertisement and they may multi-home. They do care about the number of the readers who read a given newspaper and thus they will buy an advertisement if the price does not exceed their valuation of a reader times the number of readers. This valuation is assumed to differ from advertiser to advertiser and its distribution in the population is uniform. Readers pay per newspaper and, what is crucial, they do not care about advertising. They have varying political opinions and these are uniformly distributed on a unit interval, 0 denoting extreme left and 1 the extreme right. Their utility from reading a given newspaper decreases quadratically with the distance of the newspaper's political option from their own.

Where it not for the dependence of publishers' profits on the advertising revenues, newspapers would choose their content exactly in the same way as in the Hotelling model with quadratic transportation costs (d'Aspremont et al., 1979) and thus maximal political differentiation would prevail. The addition of advertisers, however, may have a significant impact on the differentiation of newspapers. The authors show that for a given range of parameters the location ½, ½ is a unique Nash equilibrium in pure strategies. This happens if the political preferences of readers are rather weak whereas the unit receipts from advertising are high. In this case readers will get their newspapers for free and advertising will be the sole source of income for the publishers. Note that this finding applies very well to free newspapers handed out in some cities. Indeed the content of these newspapers is what Beebe (1977) calls the lowest common denominator.

Gabszewicz et al. (2006) incorporate also readers who are non-neutral to advertising into the model discussed above. They argue that it is not clear whether readers like or dislike advertising and therefore they assume that a fraction of readers are ad-lovers and the rest ad-avoiders. Assuming additionally that advertisers do not multi-home they can show that under certain circumstances a dominating publisher is able to drive its competition out of the market. This happens due to the following mechanism. Assuming that the majority of readers are ad users and that they value advertising very high a newspaper with many advertisements will attract more users. Advertisers take the high number of readers as a proxy for future readership and thus place even more ads in this newspaper. At the same time the competing publisher looses advertisers and readers. Through this circular causality the leading firm can evict its competitor from the market. Under weaker ad attraction the leader will not be able to drive his competitor out of the market, but he will still enjoy higher readership, higher number of advertisers, higher prices and thus higher profit. If readers are ad-lovers a higher market concentration in the press industry takes place.

In the context of television concentration is discussed by Anderson and Coate (2005). These authors introduce a model which in many respects resembles set-up of Gabszewicz et al. (2001). Advertisers and viewers behave the same way, with the difference is that viewers may choose not to watch television at all. A distinctive feature of the model is, however, that viewers are averse to advertisers. Moreover users watch television for free. Note that in the model of Gabszewicz et al. (2001) zero prices appear only when advertisers are located at the same place in the political spectrum. In the Anderson and Coate (2005) model, however, advertisement which is a nuisance serves as the “price”. If two channels broadcast the same programme, viewers will watch the one with less ads which will lead to Bertrand competition with no advertising and zero profits and thus this can never be optimal for the channels.

This important conclusion shows that duplication present in the Steiner (1952), Wiles (1963) and Beebe (1977) models cannot occur if users dislike advertising. Programme variety can thus happen only if a channel leaves the market and this case is analysed by Anderson and Coate (2005). The authors do not analyse the optimal placement on the viewers’ preference line, but only the number of channels in equilibrium. There can be either one channel located at 0 or two channels located at 0 and 1. A second broadcaster will enter the market only if his profit will exceed the fixed costs.

One interesting finding of the paper is that although viewers dislike commercials, the level of advertising may be below the socially optimal one in equilibrium. This happens when the viewers’ nuisance cost from advertising is low and the advertisers’ valuation of the users high. Indeed in order to increase audience channels have to set lower advertising levels. If, however, advertising does not strongly decrease the utility of viewers, but is very valuable to advertisers a social planner may balance the number of advertisers so that there are fewer viewers than in the competition case.

Contrary to what has been argued by Steiner (1952) competition in the Anderson and Coate (2005) model may also lead to over-provision of programmes. This happens although competing channels cannot appropriate viewers’ benefits and thus are, in most cases, likely to provide less programmes than would be socially optimal. At the same time, however, they are concerned only with their own profit and thus they do not take into account the fact that their programme may be a close substitute to the programme of the other channel. Part of their audience comes from business stealing and due to additional fixed cost incurred by the second firm the overall social benefit may decrease.

As mentioned earlier Spence and Owen (1977) argued that charging prices on viewers increases the programme variety. Anderson and Coate (2005) show again that this result holds only for a range of parameter values. Moreover if in equilibrium broadcasters charge positive prices on viewers, both viewers and advertisers have to pay more. The channel can decrease advertising without changing the audience and thus charge higher prices on advertisers. This result, however, does not necessarily mean that the introduction of prices decreases social surplus. For instance when users strongly dislike advertising and production costs are low, a social planners solution would involve two programmes and no advertising. Since without viewers’ charges this also means zero profits, this outcome cannot be achieved if advertising is the sole source of income. It can, however, be achieved if viewers pay for watching the second programme.

In a later paper Gabszewicz et al. (2004) also develop a model of TV advertising in which viewers consider advertising a nuisance. They assume that viewers can watch more than one channel to obtain a programme mix which is as close as possible to their preferred. However, in this model advertisers are homogenous i.e. all obtain the same benefit from contacting one viewer. In this setup the authors are able to show that also intermediate differentiation may be an equilibrium. This is due to the fact that if a TV station chooses a programme mix different from the one of its competitor its profit will be affected in two ways. It will loose audience for which the current programming mix of the station is too remote from their preferences. At the same time its programme mix becomes more attractive to the users who stay with the station. These viewers are now willing to accept higher levels of advertising. This will increase its profit. Whereas in the model of d'Aspremont et al. (1979) this mechanism leads to maximum differentiation, this is not necessarily the case in the present model. The disutility of buyers from price in the d'Aspremont et al. (1979) paper is just the price, whereas in the model of Gabszewicz et al. (2004) it is a possibly nonlinear function of the advertising rate and it decreases at an increasing rate with the broadcast time devoted to advertising. It is thus possible that the platforms profits increase when it moves away from its competitor but only to some point. Afterwards the level of advertising necessary to increase profit would be to annoying for viewers and thus unprofitable.

Note that the literature discussed so far did not consider the competition of advertisers in the product market. It simply assumed that advertisers have a monopoly over their product and thus their level of advertising does not depend on the strategy of its competitor. The fact that advertisers compete in the product markets is taken explicitly into account by Gal-Or and Dukes (2003). In this model there are two firms who compete for buyers in a Hotelling (1929) fashion and two broadcasters who compete simultaneously for viewers and advertisers. Advertising is informative i.e. viewers will consider buying a product if they view an ad and not otherwise. However, contrary to the previously discussed models, the probability that a given viewer buys the product is not given, but determined by the price of the product, viewer's preference for the other product and the probability that the viewer will watch also the advertisement of the competing producer. Also in contrast to other models, Gal-Or and Dukes (2003) do not assume that the stations are able to extract some fixed part of or even the entire advertiser's surplus. In this model advertisers and broadcasters bargain over the net surplus accruing to advertisers and to the platform. This sophisticated setup has several consequences. Higher advertising levels intensify the price competition of the advertisers on the product markets and thus decrease the advertisers' surplus to be bargained over. At the same time they strengthen the bargaining position of the broadcasters. The authors show, that under certain conditions higher numbers of advertising decrease the platforms profits. The authors argue also that higher advertising levels are optimal the more differentiated the programming mix of the stations. From this the authors conclude that if both broadcasters are located in the middle of the programming mix line, none of them has an incentive to move away from this point. Minimum differentiation prevails. A drawback of the model is that the authors are unable to derive the profit of a broadcaster as a function of the station's location. This means that indeed none of the stations has an incentive to move slightly from the middle of the programming mix interval, but nothing can be said about large deviations from this point. This is due to the fact that many variables considered exogenous in previous literature are endogenous in this model.

This brief review of the literature which analyses differentiation of media in the context of two-sided markets has shown that recognising the two-sidedness of media may yield results which differ significantly from those discussed at the beginning. In other words the fact that viewers dislike advertising and advertisers are willing to pay more for more audience or readership can significantly alter the predictions of the models. First, in most of the models minimum differentiation, i.e. Steiner's duplication principle does not necessarily hold. Second, it may be profitable for media platforms to broadcast programmes different from the ones offered by their competitors. In fact, as shown by Anderson and Coate (2005) in some circumstances a competing media platforms may even produce more programme variety than would be socially optimal.

On the other hand the literature proves also that even with quadratic transportation costs the Hotelling (1929) setup does not have to result in maximum differentiation of firms. If firms compete in two-sided markets minimum differentiation may be an equilibrium.

1.4. Empirical findings

In the following section I will discuss some empirical findings which deal with the theoretical hypotheses outlined above. Unfortunately whereas the one-sided literature has received relatively good confirmation, to my knowledge there do not exists full-fledged empirical analyses of media differentiation in the two-sided case. There are, however papers which explore the two-sided nature of media markets.

1.4.1. Empirics of media diversification

Empirical literature in general seems to confirm the hypotheses formulated in earlier one-sided literature. This has predicted[6] that programme diversity will increase with the number of stations and that minority tastes will in general be not satisfied.

Levin (1977) estimates the impact of the number of stations on the available programme choices in American television. He shows that indeed the number of available choices increases with the number of stations. Moreover he shows that public TV stations contribute to diversity more than commercial stations. This confirms Steiner's (1952) hypothesis that a state-owned monopolist will broadcast more diverse programmes and contradicts the predictions of Beebe (1977), who argued that a monopolized market will lead to broadcasting only the lowest common denominator. The author shows also that more diversity is likely to prevail in markets with more viewers. This is consistent with the fact that broadcasting involves a fixed cost and thus in smaller markets the revenues from producing niche programmes may not cover the costs.

Rogers and Woodbury (1996) provide an even stronger confirmation of Steiner's (1952) hypotheses. Their empirical analysis shows on real data, what Steiner (1952) has argued on a hypothetical dataset. In a regression they show that the number of formats increases with the number of stations. This suggests that in more competitive markets it may be indeed more profitable to air a programme which caters minority tastes instead of duplicating one of the existing programmes. Moreover they show that high variety of offered programmes increases also total audiences. This in turn suggests that, as predicted by Steiner (1952), there are listeners whose second choice is not to listen to the radio at all. Additionally Rogers and Woodbury (1996) show that the audience of a given programme does not increase if more stations air this programme. Recall that Wiles (1963) suggested that programmes of one type may slightly differ and thus the more programmes of this type are aired the higher the overall welfare. This hypothesis is rejected by Rogers and Woodbury's (1996) findings and thus Steiner's (1952) claim that programme duplication is entirely wasteful is confirmed. Finally Rogers and Woodbury (1996) show also that within one programme type listeners are not uniformly distributed. This was also predicted by Steiner (1952), who suggested that there may be "captive" listeners who will not change the station if additional stations offering the same programme occur on the market.

[6] Especially Steiner (1952)

The papers discussed so far measured diversity in media simply by assuming that there is an arbitrarily defined set of programme types. In this set-up all news programmes would be the same. This is, however, not necessarily true. Alexander and Cunningham (2004) follow a different approach. They analyse the diversity of news programmes of the American local stations. From a database which includes all news stories in some regions of the U.S., they calculate which part of the entire news content appeared only in one station.

The results of this paper also confirm the hypotheses of Steiner (1952). The more stations there are in the market the more diversified the news. Also the structure of the market matters. Concentration, as measured by the Herfindahl–Hirschman Index, decreased diversity.

1.4.2. Media as two-sided markets

The empirical literature which analyses media in the two-sided framework is rather scarce. It, however, confirms the theoretical predictions, especially that platforms subsidise the users (readers and viewers) and finance this subsidy with revenues from advertisers. Indeed the price of the users’ side is below cost.

Kaiser and Wright (2006) test the predictions of two-sided market models by estimating the price mark-ups in the German press industry. They develop a model which is very similar to Armstrong's set-up. Users care about advertising as well as about the content of the newspaper. Advertisers care about the number of users and additionally about some characteristics of the newspapers. These, as Kaiser and Wright (2006) explain, contain the quality of the paper, advertising possibilities and possibly also the characteristics of the users, but the last factor does not enter the utility function directly. From this set-up the authors obtain formulas for the price mark-ups on the users' and advertisers' sides which depend only on the parameters of the demand function and thus by estimating demand functions the authors are able to obtain estimations of the mark-ups.

In their estimation Kaiser and Wright (2006) take the theoretical model very seriously. Since it analyses competition between only two platforms they also divide the press market into subcategories and analyse only those subcategories where two newspapers were present.

As is usual in demand regressions, one can expect that the left-hand-side variables in the regression are endogenous. Therefore to estimate the demands of readers and advertisers the authors use an instrumental variables estimation and a seemingly unrelated regression. The results of these regressions indicate that indeed the newspapers’ profits come from advertising revenue. Prices of magazines are not even able to cover the costs of providing content to readers. This is due to the fact that advertisers value readers more than reader value advertisers. Interestingly, however, Kaiser and Wright (2006) show that readers do not dislike advertisers. Their results indicate in fact that readers value advertising more than the content.

The analysis suffers, however, from a very small sample. Due to the strict adherence to the theoretical model, the authors analyse less than 5% of the entire newspaper market and obtain 91 observations. Moreover, they do not have broad interest newspapers such as daily newspapers in their sample, which may strongly change the predictions. The surprising finding that users value advertising more than content is probably also due to sample selection. The analysed magazines were rather for specialized audiences and in this case readers may consider advertising as a useful source of information.

A much more detailed empirical study of two-sided markets was conducted by Wilbur (2007). He analyses the broadcasting market in the U.S. The model, he builds his estimations on, is analogous to the set-up of Anderson and Coate (2006). Viewers dislike advertising and have heterogeneous preferences for programme content. Advertisers have a preference for viewers. Additionally advertisers care about the characteristics of the viewers. This has not been done yet in theoretical models. The broadcaster decides also about the time he devotes to advertising his own programmes.

This model is very complex, but since the aim of the paper empirical, the author does not solve the model. Instead he estimates viewers demand, advertisers demand and the broadcasters “demand” for own advertising. He shows that viewers are adverse to advertising. Advertisers care about the audience. Additionally advertisers have their preferred programmes. The authors show that the programming preferences of the advertisers are respected more than the preferences of the viewers. This is due to the fact that the demand of viewers is less elastic. This result is similar to the one obtained by Kaiser and Wright (2006). A result which is particularly relevant for my analysis of the online news portals markets is that ad avoidance technology increases equilibrium advertising quantities and decreases the broadcasters' revenues. The popularity of ad block programmes indicates that this result may also hold in the online market.

1.4.3. Determinants of advertisement prices

Empirical literature shows also that advertisers have their favourite target users and that they are willing to pay higher prices to reach these users. This fact has not been taken into account in the theoretical literature so far although is it fairly well established empirically.

Brown and Cavazos (2003) show that contrary to what is assumed in the theoretical models discussed above, advertisers do not value all users the same. They show that the price of TV advertising depends on several factors. One of them is indeed the broadcasters share in audience, but several others also play a role. Advertisers are willing to pay more for programmes viewed by persons with above average income. Additionally advertisers are willing to pay more for advertising broadcasted with certain programmes. The price increases most for sitcoms. On the contrary, advertisements broadcasted with news and police series are on the average cheaper. Also advertisements broadcasted with programmes for children and adolescents are cheaper.

Also Brown and Alexander (2005) show that advertisers value different viewers differently. The factors which increase advertising prices are according to them: income of the viewers, their ethnic origin (in programmes targeted at Hispanics advertising is more expensive) and age. Interestingly the advertising prices decrease with the number of viewers. This may mean that the higher the audience the lower the probability that a given ad will reach the desired target. Brown and Alexander (2005) also show that market concentration increases advertising prices, This finding is, as they point out, consistent with the predictions of Anderson and Coate (2005). Increased competition forces broadcasters to decrease advertising in order to attract viewers. In a way thus Brown and Alexander (2005) explore the two-sided structure of media, but their analysis is rather fragmentary.

1.5. Advertising on the internet

In this section I will discuss the specifics of online advertising. At first glance online advertising shares many features with advertising in other media. However, as noted by Evans (2008) there are 3 features which make online advertising unique and may have an important impact on advertising strategies in near future. First, the technology allows for a better targeting of advertisements. Online platforms have the possibility to identify their users (e.g. through their IP address or cookies) and thus to fit advertisements to all users individually. Second, they can set up more sophisticated pricing schemes, e.g. letting advertisers pay only if a user clicks on their ad. Third, advertising slots in online media tend to be sold more and more often through intermediaries such as Google AdSense rather than through the platforms themselves.

In general there are two main types of advertising on the internet: search-based advertising i.e. ads displayed in search engines such as Google next to search results and display advertising which includes advertising placed next to online content. Search based-advertising relies especially heavily on first two innovations discussed earlier. Search engines use a keyword bidding system, where the ads of the advertisers with the highest bids will be placed next to the search results if a user enters a given keyword. Moreover these platforms use a cost per click system in which advertisers pay for the ad display only if the user visits their web-side.

Display advertising resembles traditional advertising more closely. As noted by Evans (2008) in this sector platforms tend to charge the advertiser per thousand views (CPM), which is also the typical method e.g. for television advertising. Moreover most platforms only roughly fit the advertising to the type of content without using keyword matching or information about the users. However, also in this type of advertising there are developments which are unique to the online advertising business. Online publishers may sell their advertising space to intermediaries who then sell this space to advertisers. Intermediaries can pool advertising space of some type from different publishers and sell such targeted packages to different advertisers. For instance, intermediaries may buy advertising on different women magazines' websites, divide the content of all of these websites into types (e.g. fashion, beauty, cooking etc.) and then sell ads for a given type on all of the websites. This solution is particularly advantageous for advertisers because they have to fit their ads only to the technology of the intermediary and not to the technologies used by each online platform.

The most important conclusion from this brief overview is that fitting advertisement to users is an important task of the online platforms. This suggests that advertisers have not only preference for high audiences of their ads but that they also care about the characteristics of the audience. In the case of online advertising information about these characteristics is particularly easy to get. Through the IP address it is possible to locate where a particular user lives, cookies installed on a computer allow a website to track how a particular user uses the site. Whereas, as noted by Evans (2008), currently this information is used mainly by search engines, in near future it should be also excessively used by other online media platforms. This means that these platforms will not only seek to attract many users, but also users with the characteristics most desired by advertisers.

A feature which online advertising certainly shares with television advertising is that users are averse to advertising. Advertising distracts them from the actual content they would like to see and may significantly reduce the readability of a website e.g. through the fact it they takes time to load. As argued by Cho and Cheon (2004) this fact significantly reduces the effectiveness of online advertising. Users used to high levels of advertising are able to scan the website unconsciously and filter out everything which looks as a banner. This prevents them from reading even those ads which they could find interesting. Thus to high levels of advertising do not only induce users to switch to a different portal, but also to ignore advertising thereby reducing its effectiveness.

The two core features of online advertising i.e. possibility of ads targeting and advertising avoidance are not jointly analysed in the models I discussed in the previous section. Whereas the fact that users dislike advertising is discussed to some extend, the fact that advertisers may have a preference for users with some given characteristics is not taken into account. In the next chapter I will develop a model which will incorporate both o the features of online advertising.

CHAPTER II A theoretical model of advertising and content diversity in online media

In this chapter I will develop a model which is suited to the analysis of the behaviour of online news portals. It thus discusses the display type of online advertising. In my model I will incorporate the fact that advertisers care about the characteristics of the users and that users dislike advertising. Moreover in accordance with the pricing strategies for display advertising discussed in the previous chapter, I will assume that advertisers pay a price per ad display. A short glance at the price tables of online portals justifies this assumption. In my model I will also make several simplifications. First I will assume away the possibility of ad targeting. As noted by Evans at the current stage of development of online media this is a realistic assumption. Moreover in line with most of the previous literature I will assume that advertisers posses monopoly over their product and thus advertisers do not compete in the product markets.

The model I will develop in this chapter extends the existing literature in two ways. First I will combine the model of Gabszewicz et al. (2004) who assume that platforms can choose any location on the Hotelling (1929) line, but advertisers have all the same valuation of users with the model of Anderson and Coate (2005), who assume that each advertiser has a different valuation of the users, but that the number of possible platforms' locations is restricted to 0 and 1. Second I will assume that advertisers prefer a certain kind of user. In the previous literature it was assumed that a given advertiser values all potential receivers of their ads the same, but this assumption is an oversimplification in my opinion.

The model I develop is a version of the Hotelling model with quadratic transportation costs for a two-sided market. As proven by d'Aspremont et al. (1979), in a Hotelling (1929) model were firms choose prices and location a Nash equilibrium exists if transportation costs are quadratic and at this equilibrium firms choose maximum differentiation. If transportation costs are linear, a game in which firms first choose location and then price has no pure strategy Nash equilibrium.

As discussed in the literature review, the principle of maximum differentiation does not necessarily apply in two-sided markets. The aim of my model is to check when it applies if advertisers have a preference for a given user.

In what follows I will first describe the users' side of the market, then the advertisers' side and finally I will show how the platform strategically chooses the optimal location and number of advertising in a two-stage game. I will also discuss the properties of the equilibrium and provide intuition for my findings.

3.1. Users' side

There exists a unit mass of users. The platform provides content to the users for free, but they dislike advertisements. The cost they have to pay is thus the disutility from advertising. Users differ also in their preferences for content. Assume that these preferences are uniformly distributed on a unit interval. If platforms A and B are located on A and B respectively on this interval, a user x has a utility of $u_A = \beta - t(x-A)^2 - ca_A$ when using platform A and $u_B = \beta - t(x-B)^2 - ca_B$ when using platform B, where a_A and a_B are the advertising levels of platforms A and B, β is the benefit a user gets when he uses his preferred platform, t is a parameter which measures the disutility from the fact, that the platforms provide content different to the one preferred by users and c is the disutility from advertising. Assuming that all users have to use exactly one platform, this setup yields the following users' demand:

$$x_A = \frac{A+B}{2} + \frac{c(a_B - a_A)}{2t(B-A)} \qquad \text{for platform A}$$

and (1)

$$x_B = 1 - x_A \qquad \text{for platform B.}$$

In what follows I will assume that t is equal to 1 and thus c measures the degree of users' aversion towards advertising relative to their preference for differentiation.

3.2. Advertisers' side

In my characterisation of the advertisers' side I will modify the model of Anderson and Coate (2005). To do this I have to make three simplifying assumptions. First, advertisers do not have a budget constraint. Second, all advertisers have a monopoly over their product. Finally, users value all products at w, which is for simplicity assumed to be one. This guarantees that the demand for the advertised product is perfectly elastic. These assumptions will be necessary for the derivation of the advertisers' demand.

The purpose of advertising is to inform users about the existence of a product which they will then buy with some probability. Assume that each informed user will buy the product with a probability of γ. Further let me assume that each advertiser has preferred user for whom the probability that he will buy is $\gamma+\rho$. These preferences are again uniformly distributed on a unit interval and the correlation between the location of the users in respect to their content preferences and with respect to the advertisers' preferences is one. A user preferred by an advertiser located at *z* will thus also prefer a platform located at *z*.

Advertisers pay a price p_i ($i=\{A,B\}$) per advertisement broadcast.

All these assumptions yield the following advertiser's utility:

$u_i = \rho + \gamma x_i - p_i x_i$, i=1,2, if the advertiser's preferred user uses platform i

and

$u_i = \gamma x_i - p_i x_i$, if the advertiser's preferred user is on the other platform.

Note that with this utility formulation the advertiser's utility per user is non-increasing in the number of users. Since advertisers pay per user, they will have to spend more to reach their preferred user when the number of users on a given platform is large.

Assume that advertisers differ in their valuation of any given user- γ is distributed uniformly on an interval $[0,r]$ ($r+\rho<1$ so that the probability of selling a product to the preferred consumer never exceeds 1) and this distribution is independent from the distribution of the preferred users. This assumption means that the product of some advertisers is suitable for the broad public, whereas some advertisers sell products which are suitable only for a very distinct group.

The demand for advertising on platform *i* is thus given by

$$a_i = \overbrace{x_i(r - p_i + \rho / x_i)}^{1} + \overbrace{(1 - x_i)(r - p_i)}^{2} = r - p_i + \rho \; .$$

The first part of this equation gives the demand from advertisers, whose preferred user uses platform *i*. The second part is the demand from all other advertisers.

This set-up is very similar to that proposed by Anderson and Coate (2005) except for the additional ρ and the fact that advertisers pay per user. It is, however, not a two-sided market in the spirit of Rochet's and Tirole's (2006) definition. The price on the users' side is suppressed to zero and thus the price structure does not influence the profits of the platforms. It is true, however, that a price increase for the advertisers cannot be passed on to the users, because there is no direct interaction between the two sides of the market. Moreover the demand for the advertised products is perfectly elastic and thus a firm cannot increase the price of the product as it pays more for advertising.

3.3. Equilibrium

Platforms engage in the following two-stage game. In the first stage they choose the characteristics of their product. In terms of the Hotelling (1929) model this means that they choose their location on the unit interval. In the second stage they choose the optimal advertising level and price.

Since advertisers may multihome, platforms have a monopoly over their users. A platform's advertisement price depends in this case only on it's own advertising level. As argued by Anderson and Coate (2005) this means that whether platforms choose prices or advertising levels does not influence the results. For simplicity of calculations I will assume that platforms maximise their profits with respect to their advertising levels. I will also assume that the platform does not incur any marginal costs, but only a fixed cost. This can be set to zero without loss of generality

The inverse advertisers demand functions are:

$$p_i = r - a_i + \rho \qquad \text{for } i\text{=A,B} \qquad (2)$$

Each platform sets an advertising level to maximize its profit $\Pi = p_i\, a_i\, x_i$. Substituting (1) and (2) this yields:

$$\Pi_A = (r - a_A + \rho)a_A\left(\frac{A+B}{2} + \frac{c(a_B - a_A)}{2(B-A)}\right) \qquad \text{for platform A}$$

and (3)

$$\Pi_B = (r - a_B + \rho)a_B\left(\frac{2-A-B}{2} + \frac{c(a_A - a_B)}{2(B-A)}\right) \qquad \text{for platform B.}$$

Note that the profit function can be decomposed into revenue per user $(r - a_i + \rho)a_i$ times the number of users: $\left(\frac{A+B}{2} + \frac{c(a_B - a_A)}{2(B-A)}\right)$ for platform A and $\left(\frac{2-A-B}{2} + \frac{c(a_A - a_B)}{2(B-A)}\right)$ for platform B. The platform has to choose a_i such that the elasticity of revenue per user equals minus the elasticity of the number of users. The elasticity of the number of users is always negative. The elasticity of revenue is positive for $p_i \geq 0$. This implies that the level of advertising is lower than it would be if users did not care about it, which is intuitive.

Let me now start with an analysis of a special case. Assume that users do not care about advertising, i.e. c=0. This case is similar to the one analysed by Gabszewicz et al. (2001) except for the fact that users in my model do not pay for using the internet portals.

If users do not care about advertising, they will simply choose the platform which is closest to them which yields users' demands:

$x_A = \frac{A+B}{2}$ for platform A

and

$x_B = 1 - \frac{A+B}{2}$ for platform B.

In this simplified version of the model for any given location of platform *j*, platform *i* will always have an incentive to move closer to their competitor in order to increase its number of users. Once, however, both platforms are located at the same point users choose some platform at random which yields users' demands equal to 0.5 for both platforms. Platforms are also homogenous for advertisers. This means that a given advertiser's utility from using platform *i* is $u_i = \rho/2 + \gamma/2_i - p_i/2$. But this does not change the demand function which remains $a_i = r - p_i + \rho$ and thus the maximization problem of a platform with given locations does not change when firms are located at the same point. If firms are able to choose location this choice influences only the number of the users and thus by the median voter theorem (Black, 1948) applies. They will choose to locate in the middle of the [0,1] interval.

In reality, however, users of on-line portals may be annoyed by advertising which distracts them from the actual content they would like to see. Due to high order non-linearities already in the reaction functions[7] of the platforms' reaction functions, the general case cannot be solved analytically. Therefore I will follow a different strategy. The reasoning I will present here was used also by Gal-Or and Dukes (2003). First I will assume that users are located symmetrically. In this case the advertising levels of both platforms are equal and it is possible to calculate the equilibrium advertising level for A and B depending on the distance between them. The equilibrium levels of advertising are given in the appendix.

With this equilibrium levels it is then possible to calculate profits. Also these will depend on the distance between A and B. Finally I can calculate the derivative of the profits with respect to the location of both platforms and find such locations at which none of the

[7] See Appendix

platforms will have an incentive to marginally change its location. These locations are given by the following condition:

$$\left(\frac{c(\rho + r)}{2}\right)^2 = 16B^4 - 16B^3 + 4B - 1 \text{ and } A\text{=1-}B \qquad (4)$$

Note that in a symmetric equilibrium B must be larger or equal to ½. At the same time B must be equal or less than 1. In the interval (1/2,1] the right-hand side of the first condition is decreasing and will range from 0 to 3. This has two implications. First for any positive values of *c*, *ρ* and *r*, there must be some symmetric location *A* and *B*, such that none of the platforms will have an incentive to marginally change its position. Second for high values of *c* the left-hand side of the condition will always be larger than the right hand side for all possible values of *B*. It can be shown that in this case a platform will have an incentive to marginally move from its competitor in each symmetric location. Symmetric locations in which none of the platforms has an incentive to marginally change its position will thus exist if $c \leq \frac{2\sqrt{3}}{\rho + r}$. In other words if users strongly dislike advertising and advertisers have a strong preference for a their favourite user, maximal differentiation of platforms' content is likely to occur.

Note that I have not claimed so far that any of the symmetric locations described by the conditions in (4) are a Nash equilibrium. Indeed the above analysis proves only that marginal movements from the symmetric equilibrium are unprofitable. For a location to be a Nash equilibrium it is, however, necessary that no location, also none of the locations remote from the symmetric one, cannot yield higher profit given the location of the competitor. Unfortunately I was unable to calculate the profit functions for asymmetric locations and thus I cannot claim that the symmetric location is a Nash equilibrium. The same problem appeared in Gal-Or and Dukes (2003). These authors deal with this problem by assuming some numerical values for the parameters calculating the potential symmetric equlibria and analysing the profit function of one platform given a fixed location of the other.

In my case, however, the calculation of equilibrium advertising levels for given numerical values of parameters *c* and *ρ* still yields very complex formulas. Therefore I will follow a different strategy.

I will assume some numerical values for the coefficients *c* and *ρ*. Further I will restrict the possible locations of platform A and B to a finite, small number. Finally I will assume that *r*=0.1. This covers a wide range of possible differentiation of the platform content.

Let me first assume that c=100 i.e. users strongly dislike advertising. The optimal levels of advertising for any given pair of locations can be easily calculated from the reaction functions given in the appendix. The normal form of the location game in the first stage for $e \in \{0.1\ ,\ 0.9\}$ is presented in Table 1. In this case platforms will always prefer maximum differentiation. Indeed this is also predicted by conditions (4).

To see, why this is the case note that the profit function of the platform is very similar to one-sided maximization problem in a Hotelling model with quadratic transportation costs (d'Aspremont et al., 1979). The profit function can be rewritten as follows:

$$\Pi_A = \overbrace{\frac{(r - a_A + \rho)}{c}}^{1} \quad \overbrace{ca_A\left(\frac{A+B}{2} + \frac{c(a_B - a_A)}{2(B-A)}\right)}^{2} \qquad (5)$$

, where part 2 is analogous to the profit function in the Hotelling model with quadratic transportation (d'Aspremont et al., 1979) costs and part 1 one is equal to p_A/c.

In a Hotelling model with quadratic transportation costs d'Aspremont et al., 1979), the principle of maximum differentiation arises because by moving away from its competitor a platform looses users, but at the same time it is able to increase prices. Since users utility decreases quadratically in distance, this price increase can be sufficiently high to increase profits even with a lower number of users. In my model this effect is contained in part 2 of the profit function (4) with the difference that ca_A stands now for prices, i.e. maximum differentiation would maximize the platforms' total volume of advertising. However, to obtain this high volumes of advertising the platform has to decrease the price and thus high volumes of advertising are not necessarily profit maximizing.

If *c* is high the variation of the price charged on advertisers at different levels of advertising (part 1 in (5)) does not strongly influence profits and thus the firm behaves as if its sole objective was to maximise the total volume of advertising. In this case maximum differentiation is optimal.

However, if *c* is low a completely different picture emerges. This is illustrated in Table 3., where c is assumed to be 0.l. For this case condition (4) predicts that A≈0.48, B≈0.52 for ρ=0.1 and A≈0.45, B≈0.55 for ρ=0.9. The differentiation should be very low. In this case the variation of the price at different advertising levels becomes crucial in the determination of maximal profit. If platforms are located far from each other, each platform will want to move closer to its competitor in order to decrease the volume of advertising and increase profits.

Table 1. Location game with c=100

ρ=0.1

		B											
		1		0.9		0.8		0.7		0.6		0.5	
A	0	0.000905	0.000905	0.000768	0.000879	0.000642	0.000841	0.000527	0.000791	0.000423	0.000727	0.000329	0.000648
	0.1	0.000879	0.000768	0.000739	0.000739	0.000609	0.000697	0.000491	0.000644	0.000384	0.000576	0.000288	0.000494
	0.2	0.000841	0.000642	0.000697	0.000609	0.000565	0.000565	0.000444	0.000508	0.000334	0.000438	0.000235	0.000353
	0.3	0.000791	0.000527	0.000644	0.000491	0.000508	0.000444	0.000384	0.000384	0.000272	0.000311	0.000171	0.000223
	0.4	0.000727	0.000423	0.000576	0.000384	0.000438	0.000334	0.000311	0.000272	0.000196	0.000196	0.000093	0.000106
	0.5	0.000648	0.000329	0.000494	0.000288	0.000353	0.000235	0.000223	0.000171	0.000106	0.000093	0	0

ρ=0.9

		B											
		1		0.9		0.8		0.7		0.6		0.5	
A	0	0.0049	0.0049	0.00413	0.00472	0.00343	0.00448	0.00279	0.00418	0.00222	0.00381	0.00172	0.00337
	0.1	0.00472	0.00413	0.00394	0.00394	0.00322	0.00369	0.00258	0.00337	0.002	0.003	0.00149	0.00255
	0.2	0.00448	0.00343	0.00369	0.00322	0.00296	0.00296	0.00231	0.00264	0.00173	0.00226	0.00121	0.0018
	0.3	0.00418	0.00279	0.00337	0.00258	0.00264	0.00231	0.00159	0.00198	0.00139	0.00159	0.00087	0.00113
	0.4	0.00381	0.00222	0.003	0.002	0.00226	0.00173	0.00159	0.00139	0.001	0.001	0.00047	0.00053
	0.5	0.00337	0.00172	0.00255	0.00149	0.0018	0.00121	0.00113	0.00087	0.00053	0.00047	0	0

Table 2. Location game with c=1

ρ=0.1

		B													
		1		0.9		0.8		0.7		0.6		0.58		0.5	
A	0	0.00499	0.00499	0.00449	0.00548	0.00399	0.00597	0.0035	0.00645	0.00301	0.00691	0.00291	0.007	0.00253	0.00735
	0.1	0.00548	0.00449	0.00498	0.00498	0.00448	0.00547	0.00399	0.00594	0.00349	0.0064	0.0034	0.00649	0.00301	0.00682
	0.2	0.00597	0.00399	0.00547	0.00448	0.00497	0.00497	0.00446	0.00544	0.00397	0.00588	0.00387	0.00596	0.00347	0.00625
	0.3	0.00645	0.0035	0.00594	0.00399	0.00544	0.00446	0.00492	0.00492	0.0044	0.00533	0.0043	0.0054	0.00386	0.00558
	0.4	0.00691	0.00301	0.0064	0.00349	0.00588	0.00397	0.00533	0.0044	0.00472	0.00472	0.00458	0.00475	0.0038	0.00448
	0.42	0.007	0.00291	0.00649	0.0034	0.00596	0.00387	0.0054	0.0043	0.00475	0.00458	0.00459	0.00459	0.0036	0.00409
	0.5	0.00735	0.00253	0.00682	0.00301	0.00625	0.00347	0.00558	0.00386	0.00448	0.0038	0.00409	0.0036	0	0

ρ=0.9

		B													
		1		0.9		0.8		0.72		0.7		0.6		0.5	
A	0	0.1180	0.1180	0.1061	0.1271	0.0944	0.1348	0.0854	0.1399	0.0831	0.1409	0.0724	0.1447	0.0622	0.1453
	0.1	0.1271	0.1061	0.1147	0.1147	0.1025	0.1218	0.0928	0.1260	0.0904	0.1268	0.0784	0.1288	0.0666	0.1264
	0.2	0.1348	0.0944	0.1218	0.1025	0.1086	0.1086	0.0978	0.1116	0.0951	0.1120	0.0811	0.1113	0.0661	0.1044
	0.28	0.1399	0.0854	0.1260	0.0928	0.1116	0.0978	0.0995	0.0995	0.0963	0.0994	0.0796	0.0956	0.0605	0.0835
	0.3	0.1409	0.0831	0.1268	0.0904	0.1120	0.0951	0.0994	0.0963	0.0961	0.0961	0.0786	0.0914	0.0581	0.0777
	0.4	0.1447	0.0724	0.1288	0.0784	0.1113	0.0811	0.0956	0.0796	0.0914	0.0786	0.0677	0.0677	0.0382	0.0439
	0.5	0.1453	0.0622	0.1264	0.0666	0.1044	0.0661	0.0835	0.0605	0.0777	0.0581	0.0439	0.0382	0.0000	0.0000

Table 3. Location game with c=0.1

ρ=0.1

		B							
		1	0.9	0.8	0.7	0.6	0.52	0.501	0.5
A	0	0.0050 0.0050	0.0045 0.0055	0.0040 0.0060	0.0035 0.0065	0.0030 0.0070	0.0026 0.0074	0.0025 0.0075	0.0025 0.0075
	0.1	0.0055 0.0045	0.0050 0.0050	0.0045 0.0055	0.0040 0.0060	0.0035 0.0065	0.0031 0.0069	0.0030 0.0070	0.0030 0.0070
	0.2	0.0060 0.0040	0.0055 0.0045	0.0050 0.0050	0.0045 0.0055	0.0040 0.0060	0.0036 0.0064	0.0035 0.0065	0.0035 0.0065
	0.3	0.0065 0.0035	0.0060 0.0040	0.0055 0.0045	0.0050 0.0050	0.0045 0.0055	0.0041 0.0059	0.0040 0.0060	0.0040 0.0060
	0.4	0.0070 0.0030	0.0065 0.0035	0.0060 0.0040	0.0055 0.0045	0.0050 0.0050	0.0046 0.0054	0.0045 0.0055	0.0045 0.0055
	0.48	0.0074 0.0026	0.0069 0.0031	0.0064 0.0036	0.0059 0.0041	0.0054 0.0046	0.0049 0.0049	0.0047 0.0048	0.0046 0.0048
	0.499	0.0075 0.0025	0.0070 0.0030	0.0065 0.0035	0.0060 0.0040	0.0055 0.0045	0.0048 0.0047	0.0016 0.0016	0.0009 0.0009
	0.5	0.0075 0.0025	0.0070 0.0030	0.0065 0.0035	0.0060 0.0040	0.0055 0.0045	0.0048 0.0046	0.0009 0.0009	0 0

ρ=0.9

		B							
		1	0.9	0.8	0.7	0.6	0.55	0.53	0.5
A	0	0.1250 0.1250	0.1120 0.1370	0.1000 0.1500	0.0870 0.1620	0.0750 0.1740	0.0689 0.1805	0.0664 0.1829	0.0630 0.1860
	0.1	0.1370 0.1120	0.1250 0.1250	0.1120 0.1370	0.1000 0.1500	0.0870 0.1620	0.0813 0.1679	0.0788 0.1702	0.0750 0.1740
	0.2	0.1500 0.1000	0.1370 0.1120	0.1250 0.1250	0.1120 0.1370	0.1000 0.1490	0.0936 0.1551	0.0911 0.1574	0.0870 0.1610
	0.3	0.1620 0.0870	0.1500 0.1000	0.1370 0.1120	0.1250 0.1250	0.1120 0.1360	0.1055 0.1420	0.1030 0.1441	0.0990 0.1470
	0.4	0.1740 0.0750	0.1620 0.0870	0.1490 0.1000	0.1360 0.1120	0.1230 0.1230	0.1159 0.1275	0.1127 0.1286	0.1070 0.1290
	0.45	0.1805 0.0689	0.1679 0.0813	0.1551 0.0936	0.1420 0.1055	0.1275 0.1159	0.1180 0.1180	0.1127 0.1167	0.0993 0.1078
	0.47	0.1829 0.0664	0.1702 0.0788	0.1574 0.0911	0.1441 0.1030	0.1286 0.1127	0.1167 0.1127	0.1086 0.1086	0.0830 0.0869
	0.5	0.1860 0.0630	0.1740 0.0750	0.1610 0.0870	0.1470 0.0990	0.1290 0.1070	0.1078 0.0993	0.0869 0.0830	0.0000 0.0000

In the intermediate case the optimal level of differentiation may be somewhere between minimum and maximum differentiation. This is illustrated in Table 2 for c=1. In this case condition (4) predicts that $A \approx 0.42$, $B \approx 0.58$ for $\rho=0.1$ and $A \approx 0.28$, $B \approx 0.72$ for $\rho=0.9$. A platform will choose locations which, given the location of the other platform will yield an optimal volume of advertising. Note also that in the intermediate case the optimal differentiation depends on the probability that a preferred user will buy. The higher this probability the higher will be the optimal differentiation. This follows directly from the advertisers' demand function. The higher the ρ, the higher the price the platform is able to obtain with a given level of advertising and thus the platform can obtain maximum profit with lower advertising volumes.

Since only symmetric equilibria are possible the number of users on each platform will always be 0.5. What differs, however, is the level of advertising. First obviously levels of advertising are much lower, when users strongly dislike advertising. The level of advertising depends, however, also on the probability that the advertiser's preferred user will buy the product. In the intermediate case, the level of advertising is higher for lower values of ρ (0.71 for $\rho=0.1$ and 0.27 for $\rho=0.9$). This means that the higher the price, a platform can set to obtain a given advertising volume, the lower the number of advertisements per user. The opposite is true for the case where users strongly dislike advertising. In this case the higher the price, a platform can set to obtain a given volume of advertising, the higher the number of advertisements per user (0.0095 for $\rho=0.1$ and 0.0099 for $\rho=0.9$). This difference follows from different profit maximizing behaviours of the firms in the two cases. In the intermediate case platforms have a given volume of advertising for which they attain maximum profit, whereas in the other case they will always want to increase the volume of advertising.

3.4. Discussion

In Hotelling model with quadratic transportation costs (d'Aspremont et al., 1979) platforms will always have an incentive to differentiate themselves more from its competition in order to increase profits. They will attract less demand, but will be able to set higher prices. In my model this reasoning cannot be applied. It is true that by moving away from its competitor it increases the volume of advertising it can sell. But the sole fact that users are now willing to accept more ads does not increase the profit of the firm. In order to sell the volume of advertising users are now willing to accept the platform has to decrease prices and thus increasing the volume of advertising must not be profitable. A firm has thus to choose a location in which the increase in advertising volume exactly offsets the decrease in price. This may lead to equilibria where both firms choose some location between maximal and minimal differentiation.

In this respect my model resembles the one developed by Gabszewicz et al. (2004). These author also obtain intermediate differentiation as equilibrium locations for some value parameters. In their paper, however, this result is a consequence of the fact that the utility of users decreases at an increasing rate with advertising, i.e. the more advertising users already have to bear with the more annoyed will they be about additional ads. Without this assumption maximum differentiation is the only equilibrium as in the d'Aspremont (1979) model.

My model allows for intermediate differentiation even if users' dissatisfaction increases at a constant rate with the increase of advertising. This is due to the fact that advertisers are not homogenous with respect to the general utility they can obtain from contacting a user. Additionally in model advertisers have a preferred user for whom they are willing to pay more. Thus by increasing differentiation and thereby decreasing the number of users a platform increases the utility of advertisers whose favourite user is on the platform. It can then charge a higher price on these users.

In the model of Gabszewicz et al. (2004) optimal location depends solely on the speed at which users disutility of advertising grows, in my model on the contrary it depends on how strong users dislike advertising and on the strength of the advertisers preference for their favourite user. My model concentrates thus more on the advertisers' side. In my opinion it is also more general since its results do not depend on a particular form of the utility function but rather on the fact that different advertisers are willing to pay different prices for users and that each advertiser prefers some users more than others. The analysis of the online advertising market, I have presented before suggests that these assumptions are realistic.

My model shows also that the assumption in Anderson and Coate (2005) that a potential second platform in the market will always choose to maximally differentiate from the first is not valid. This fact may influence the predictions of Anderson's and Coate's (2005) model. They argue e.g. that if advertising is not a significant nuisance for users, under some circumstances the market will provide more programme varieties than would be socially optimal and attribute this to business stealing. My model predicts that if users are not strongly annoyed by advertising platforms will choose to locate very close to each other. This fact may even aggravate the problem of overprovision. If firms locate close to each other the social benefit from a second platform is lower than I they locate more distant from each other. Users get a programme which is not significantly better than the one they were watching already.

All the papers I discussed in the literature review as well as my model assume that platforms choose location simultaneously. At the same time an important question in the literature is whether new entrants to the media industry will provide content similar or different to the one already broadcasted. This raises also the question, how many platforms will operate in equilibrium. Both of these questions were analysed in the "one-sided" literature, but in more recent papers they get less attention. The problem of the number of platforms is to some extend addressed in the paper by Anderson and Coate (2005) but only in a very limited way. Sequential entry is in this literature absent altogether. I believe that my model could be extended to incorporate both of these questions.

CHAPTER III. How strongly are online media differentiated in reality? Case study

In this chapter I will analyse the real extend of differentiation of online news portals on the example of polish news portals and show that the findings from this market provide confirmation for the results of my model.

The Polish online community is still smaller than in other EU countries. The latest report of IAB Poland (IAB Poland, 2010) shows that whereas in countries with the highest internet penetration (Iceland and Norway) over 90% of citizens have used internet in 2009, in Poland it is only 59%. This is also less than the EU-27 average which amounts to 67%. Also in the category of New Member States Poland is lagging behind. At the same time the number of internet users in Poland is growing faster in Poland than in the EU. Whereas the number of persons who used internet in the last year has increased by 20 percentage points in the entire EU-27 in Poland this was 26 percentage points.

As compared to the entire population Polish internet users are better educated and younger. Whereas persons with at least secondary education account for 51% of the total education in the group of internet users this share is 70%. As for age, age groups 15-24 and 25-34 are strongly overrepresented. They account for respectively 27% and 24% of the total number of internet users, whereas in the entire population these shares are 15% and 16% respectively[8]. Due to this young age internet users, however earn less. Whereas a median Pole earned 2 639 PLN in 2008 the median internet user earned between 1000 and 2000 PLN. Is a group with such demographic characteristics attractive to advertisers? It seems so. In 2009 the online advertising market in Poland has grown by 13%, which is strongly above the European average[9], although spending on online advertising lies still below 20% of total advertising spending.

Polish internet users remain loyal to local websites (Pelc et al., 2009). Whereas Google is the market leader, other international websites (e.g. youTube or Wikipedia) have numbers of users far below the ones of local websites. Among local websites, online portals are the most important ones. In the top 10 websites with highest reach online portals occupy half of the ranks.

In the sector of news portals there are 4 major players in Poland: onet.pl, wp.pl, gazeta.pl and interia.pl. Initially the portals offered different products. Wp.pl was established in 1995 as a search engine. The same service was offered by onet.pl at the beginning in 1996.

[8] Data on education and age of the entire population are taken from the Polish Central Statistical Office (GUS)

[9] Source: AdEx Report 2009

Gazeta.pl entered the market already in 1993 and initially it was an on-line service of a major polish newspaper “Gazeta Wyborcza”. Interia.pl was registered in 1999 and started its operations as a provider of mailboxes.

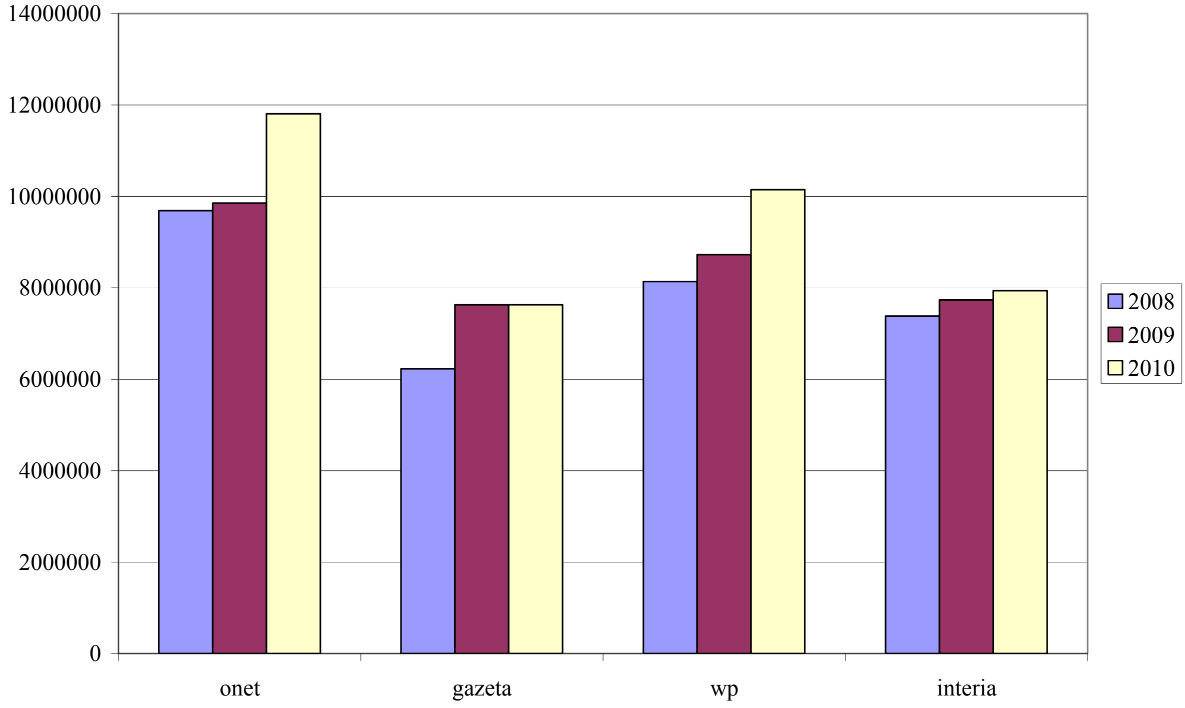
Meanwhile all portals have evolved to news portals. All of them display mostly articles (more recently also video) for a broad public. The content is usually bought from other suppliers, but partly it is also produced by the portals themselves. Next to news usually taken from press agencies, users may also read articles from various sources. All content on sites of the portals is available to the users for free. Additionally portals offer email services, blogging platform, chat and others.

Currently onet.pl is the main player in the market, closely followed by wp.pl. The number of users (real users) for the last 3 years is presented in Figure 4. Note that in the last three years onet.pl has gained the most users. This may be an indicator of a “winner takes it all” competition as predicted for online platforms by Evans (2008). The polish market is, however, not extremely concentrated and also the competitors of onet have gained new users.

As noted by Pelc et al. (2009) the most important feature regarding Polish horizontal portals is the fact that the market leaders do not differ significantly from each other. The content of the four news portals may seem very similar at first glance. All of them provide mostly news, usually coming direct from the same news agencies. According to Pelc et al. (2009), any interesting and meaningful disparities can be observed only on two levels of analysis: the most broad (referring to the portals’ general image and marketing strategy) and the most detailed one (referring to the particular products, solutions, services or sub brands). What may distinguish portals between each other could be the way in which they display content and the choice of articles to be especially exposed and of the way in which they are exposed. Most traffic on a portal comes through the homepage. The space there is limited and thus the choice of articles exposed on this page is crucial. A second important choice an online editor has to make is the title of the article linked on the home page. Users online decide whether to read an article basing only on this title. With these two tools online portals are able to attract users with specific demographics. E.g. by giving tabloid-like titles to information on the homepage a portal is likely to attract less educated persons. On the contrary by exposing information about investment funds a portal is likely to attract users with higher income.

The fact that differences in the content are so subtle makes an assessment of content differentiation online difficult. However, since different types of content are likely to attract different users, it is possible to compare the characteristics of the users.

Figure 1. The number of real users in February

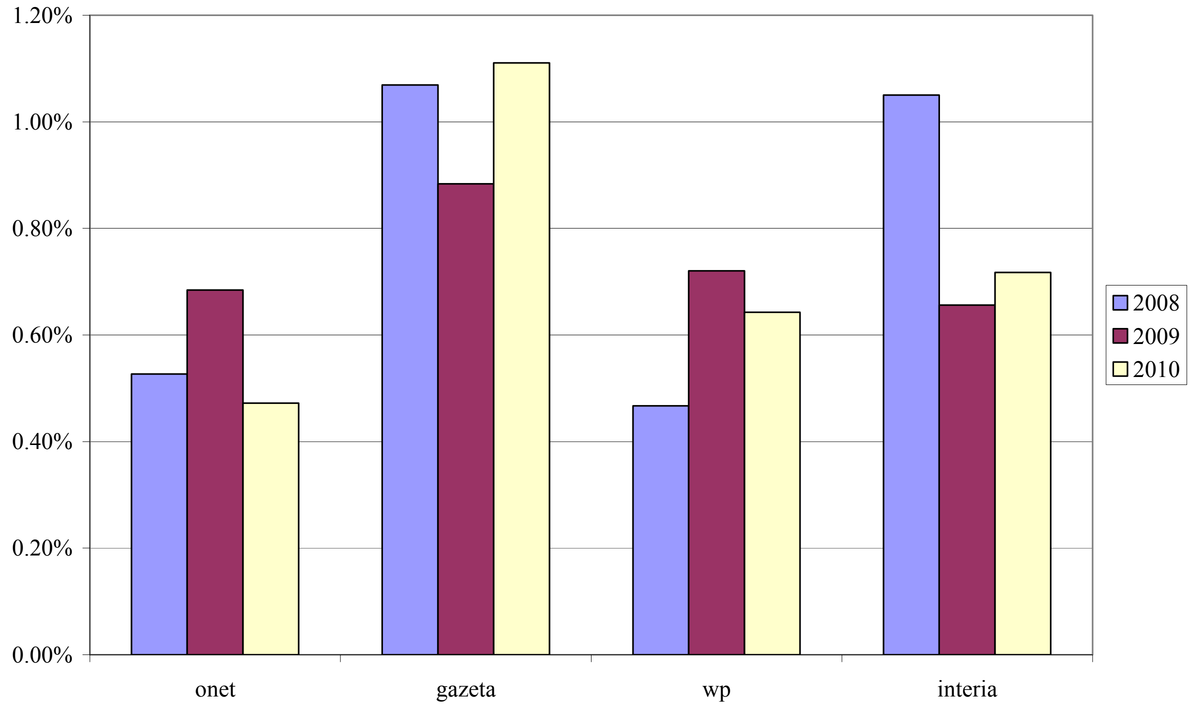


Source: Megapanel PBI/Gemius

To do this I have constructed an index of differentiation. The index was calculated as follows. From the polish internet survey Megapanel PBI/Gemius I have obtained data on the demographic profiles of users the four portals for the month of February in years 2008-2010. This profiles contain data about the number of users by sex, age, education, place of living, income and several other characteristics I did not use. I have converted these number into shares. Then I have compared the shares for each portals with the average. E.g. the average share of persons with higher education in the audience of internet portals in 2008 was 28.9%, for gazeta.pl this share was 30.6% and thus this share was 1.7% higher in this portal than in other portals. By calculating the average of the absolute values of these differences I obtain an index which measures how strongly the users of a given portal differ from those of other portals.

The indices are presented in Figure 5. The results suggest that differentiation is not very high in the polish news portals. Gazeta.pl, the portal with the highest values of the index reached a maximum differentiation of 1.11% at its peak. It is interesting to see that portals which increased their differentiation also had lower growth rates of the number of users. This is in line with the predictions from my model which shows that higher differentiation leads to lower users' demand. Note also that the overall values of the differentiation indices are higher for the two portals with less users. At the same time little can be said about the development of differentiation over time. The values of the index do change over time, but with no clear pattern. Moreover the average value of the index stays roughly the same reaching 0.78% in 2008 and 0.74% in 2009 and 2010. This suggests that portals have reached their optimal (low) level of differentiation and are not willing to change their relative location.

Figure 3. Differentiation index



Source: Own calculations based on data from Megapanel PBI/Gemius

A comparison of the values of the differentiation index with the prices charged by platforms on advertisers does not provide much insight. This partly due to the fact that portals change their price schedules infrequently. For the comparison I have chosen the CPM (cost per mille) price of a standard product called billboard in premium services including news, finance etc. A billboard is a 100x750 pixel large box which appears on the top of a website and is displayed on almost every page. In the price schedule of wp.pl published in April 2008 costed 100 PLN. The same price was demanded since September 2009 by interia.pl. These portals are very different. Whereas wp attracts more users, interia has a higher differentiation index. Also the price of a billboard in gazeta.pl was the similar and amounted since

September 2009 to 95 PLN. Only onet demanded a much lower price. Since August 2009 the price was 60 PLN. In the first half of 2010 all portals have introduced new price lists. Surprisingly all have chosen the same price for a billboard (40 PLN), only gazeta has set a price twice as high. This could be an indication of the fact that gazeta is charging advertisers more for better fitted users, but since no such tendency was visible in previous price lists this conclusion should be treated with caution.

In the context of my model the low differentiation means that users are not strongly averse to advertising. Moreover as predicted by my model platforms whose content differs from the others have fewer users and higher advertising prices. This would suggest that advertisers in the Polish online advertising market are willing to pay a premium for the higher probability to reach their preferred consumers. Unfortunately I could not obtain data on the number of advertisers per user and thus a complete analysis was not possible. The short insight I have presented here suggests, however, that at least the functioning of the polish market of internet news portals can fairly well described by my model.

Conclusion

Diversification in media is a much debated topic. It is a common belief that private firms will tend to provide the all the same content although the economic intuition behind this belief is not clear. Whereas in traditional, one-sided markets firms can increase their profit by differentiating their products from those offered by the competition, in media it seems not to be the case.

The belief that profit maximizing media are homogenous is justified if one takes into account the two-sided nature of this market. Media do not compete for users (viewers, readers, listeners) by setting prices and choosing optimal content. They rather have to attract users in order to attract advertisers, who will then pay for advertising. This significantly alters the situation. Users dislike advertising and thus a platform with may ads will have fewer users. At the same time advertisers value users and will be willing to place ads on platforms with many users. Moreover, what has been shown in empirical studies, but incorporated into theory, advertisers value different users differently. This means that the media platform does not only have to optimize the number of users and advertisers but also characteristics of the former.

The internet has awaken new hopes for more diversity in online media. Whereas these expectations may be fulfilled in the case of social online media, so called web 2.0, this is not the case in the case of commercial portals. These function very similarly to traditional media. The difference is that they have means to better fit advertising to the customers and thus the divergent tastes of advertisers play a more important role here.

All these considerations were incorporated in my model. Whereas this is not the first attempt to model diversification in two-sided media, I believe that it is more complete than previous studies. My model shows that the optimal diversification depends crucially on how strongly users dislike advertising. If their nuisance is very high, platforms will prefer maximum differentiation. This is due to the fact that in this case the effect of differentiation on advertising volume outweights the effect on per-user price. For lower values this outweighting effect may work only to some degree of differentiation. Afterwards platforms would have to set to low prices to achieve the optimal number of advertisers. For lower values of the users nuisance intermediate differentiation may thus be an equilibrium. However, according to my model homogeneity of media will never be the case as long as users are not indifferent to advertising.

My model has thus shown that one cannot state unanimous predictions about divergence in media. The degree of this divergence depends on how strongly users dislike advertising and how much advertisers value a given group of consumers relative to all others. Note that for some combinations of value parameters optimal divergence of media may be achieved, but at the expense of advertising which is a nuisance for users.

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Appendix

The reaction functions of the platforms in the advertising level game.

$$r_A\text{: } a_A = \frac{B^2 - A^2 + c(a_B + e + r) - \sqrt{\left(B^2 - A^2 + c(a_B + e + r)\right)^2 - 3c(e + r)(B^2 - A^2 + a_B c)}}{3c}$$

$$r_B\text{: } a_B = \frac{(B - A)(2 - (B + A)) + c(a_A + e + r) - \sqrt{\left((B - A)(2 - (B + A)) + c(a_A + e + r)\right)^2 - 3c(e + r)((B - A)(2 - (B + A)) + a_A c)}}{3c}$$

Equilibrium levels of advertising in the symmetric case

$$a_A{}^* = \frac{1}{2}\left(\frac{2(B^2 - A^2)}{c} + \rho + \gamma - \frac{\sqrt{(2(B^2 - A^2))^2 + (c(\rho + \gamma))^2}}{c}\right)$$

$$a_B{}^* = \frac{1}{2}\left(\frac{2(2(B - A) - (B^2 - A^2))}{c} + \rho + \gamma - \frac{\sqrt{2(2(B - A) - (B^2 - A^2))^2 + (c(\rho + \gamma))^2}}{c}\right)$$

Abstract

The subject of this thesis is diversity in media markets, especially in the market of online news portals. In the thesis I develop a model which is an extension of the Hotelling model to two-sided markets. From this model it follows that the content of media platforms will be maximally differentiated if users strongly dislike advertising and if advertisers have a high valuation for users with given characteristics. An analysis o data from the polish online news portals market provides some confirmation of the models findings

Zusammenfassung

Gegenstand dieser Arbeit ist die Differenzierung der Medien, insbesondere von online Medien. In der Arbeit wird ein Model entwickelt, welches das Hotelling Model auf zweiseitige Märkte erweitert. Aus diesem Model folgt, dass Mediendifferenzierung dann maximal ist, wenn Nutzer Werbung als sehr störend empfinden und Werbeauftraggeber eine bestimmte Gruppe von Nutzern besonders schätzen. Eine Analyse des polnischen Medienmarktes liefert eine vorläufige Bestätigung dieser Ergebnisse.

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Education	
October 2008 – June 2010	Double Degree Central European Programme in International and Institutional Economics, Department of Economics, Vienna University / Faculty of Economic Sciences, Warsaw University Master thesis topic: Product Differentiation in Two-sided Markets: The Case of Online News Portals
October 2005 – June 2008	Undergraduate Programme in Economics, Specialisation: Economics of the European Integration, Faculty of Economic Sciences, Warsaw University Bachelor thesis topic: Determinants of the Location of Foreign Funded Enterprises in China
October 2003 - June 2006	Master's Degree Program in Applied Lingustics, Institute of Applied Linguistics, Warsaw University Languages: German, English
Professional experience	
Since January 2010	Research Assistant in the Project "Temporary Migration, Integration and the Role of Policies" (TEMPO) at the Economics Faculty of the University of Vienna Employer: University of Vienna, Dr.-Karl-Lueger Ring 1, 1010 Vienna, Austria Literature reviews and preparation of data

July 2009	Internship at the Vienna Institute for International Economic Studies (WIIW) Employer: Vienna Institute for International Economic Studies, Rahlgasse 3, 1060 Vienna, Austria Documentation of the scientific output of the WIIW staff
December 2006 - September 2008	On-line editor at the Internet portal gazeta.pl, economy section Employer: Agora SA, Czerska 8/10 00-732 Warsaw , Poland Writing articles on economic topics, editing news from news agencies
Since 2003	Freelance translator German – Polish Translation of medical texts including official documents, guidebooks etc.
Research grants	
October 2008 to June 2009	Central European Exchange Program for University Studies awarded by the Austrian Federal Ministry of Science and Research held at the University of Vienna
Membership in Organisations	
April 2007 to October 2008	Member of the Board and Treasurer of the Polish Young Journalists Association "Polis" Ordinary Member since October 2005
Languages	
Polish	Mother tongue
English	Excellent
German	Excellent
French	Basic