The Virtual Location of E-Tailers
Evidence from a B2C E-Commerce Market

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Abstract

The virtual location of e-tailers is explained by strategic and profit maximising behaviour of firms in an empirical analysis. A unique set of primary data from the online market for contact lenses is used comprising detailed information on online retailer services, the product range and relative price level offered, as well as information on their virtual location. The results suggest that for e-tailers optimising their virtual location, better service can be substituted by investments in online advertising. Moreover, banner ads seem to serve as price advertising mechanism, whereas sponsored links rather seem to be used by e-tailers in order to signal outstanding customer service. The search engine rank appears to remain relatively stable over time suggesting that the virtual locations for the whole market are in an equilibrium during the period under observation.

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1 Introduction

Today, it is widely accepted that the Internet is not the "great equalizer" it was expected to be for competition and retailer prices (see for example Smith and Brynjolfsson, 2001; Clay, Krishnan, Wolff and Fernandes, 2002). Empirical analyses have mainly focused on differentiation in retailer service as a reason for price premiums which induce price dispersion and impede the observation of the law of one price. Smith, Bailey and Brynjolfsson (2000, p. 110) argue that there are certain websites which make some retailers easier to be found than their competitors and refer to the huge amounts of money invested in portals and "content sites". This phenomenon is interpreted by the authors as "neural real estate" (see Smith et al., 2000, p. 110).

It should be obvious from everyday observation that not all online retailers can be found by uninformed consumers in an equally easy way. Instead, some online shops are easier to be found than others. There seems to be an analogy to the location in the physical world where shop owners invest considerable amounts of money in superior locations, for example in highly frequented shopping malls or pedestrian areas. On the Internet, search engines or news portals are the highly frequented locations where hyperlinks leading to other sites on the Web are noticed by Internet surfers with a larger probability. That an Internet analogy to the concept of location in the physical world should be considered is argued in Häring (2003), where the phenomenon is termed *virtual location*.

This paper focuses on an empirical analysis of the determinants of the virtual location of e-tailers[1]. As most consumers seem to spend relatively little effort on searching the Web, an outstanding virtual location is a crucial factor for the attraction of potential customers to e-commerce sites. Thus, optimising their virtual location becomes an inescapable part of e-tailers' overall strategy. To the best of my knowledge, this is the first attempt to relate the strategic choice of retailers with their virtual location. In the empirical analysis, the virtual location will be proxied by an online retailer's position in the Google search results list and by online advertising activities, since these may be the most important factors making it more probable for consumers to get to know about a specific online shop.[2] The observed activities of online advertising are context dependent banner ads and sponsored links in the 10 most-widely used Internet search engines.[3]

The importance of a prominent location on the Internet can be read off a recent study investigating the market for Internet search engines in German language (Machill, Neuberger, Schweiger and Wirth (2003)).[4] The study consists of two parts: a survey among search engines in German language and an experiment, in which the steps of Internet users when solving specified search tasks are observed and analysed. Machill et al. (2003, p. 92) report extensive linkages between different search engines,

[1] Throughout the paper, the terms 'e-tailer' and 'online retailer' are used interchangeably and refer to firms selling products online via e-commerce Web sites.

[2] After market entry there will of course be repeat purchasers or customers who directly access a specific e-tailer which they are aware of due to retailer branding or word of mouth. Hanece, similarly to the physical location, the virtual location is crucial for the attraction of new customers.

[3] Examples for Banner Ads and Sponsored Links are depicted in Figures 2 and 3 in the Appendix.

[4] The author of this paper is not aware of any comparable study for a further language area.

as many of them share the same search technology. Furthermore, it is well-known that several highly-frequented search engines rely on the Google technology, and that the Google Web site itself has a dominant market share. Both factors combined lead to consumers being highly dependent on the information provided by just a few search sites on the Web.

Most consumers are neither aware of the economic dominance of the Google technology, nor aware of the possibility of sponsored links on results pages (see Machill et al., 2003, p. 94).[5] Furthermore, search engine providers state in the survey, that users click-through to just a few links of the results pages and that nearly 70% of the users do not examine more than the first two pages of results, corresponding to the first 20 hits. This is confirmed by the experimental results of the study (see Machill et al., 2003, p. 255): 81% of the users evaluated only the first page of results, further 13% the first and second pages, implying that only 6% considered more than the first 20 entries. These observations suggest that many consumers are even not able to distinguish location from promotion on the Internet. This is in line with the virtual location being proxied by both the rank in the Google list of results and contextual advertising in different Internet search engines.

The contribution of this paper is twofold: This is – to the best of my knowledge – the first attempt to relate the virtual location to e-tailer strategy. Second, the analysis is based on a unique set of primary data from the online market for contact lenses relevant for consumers living in Germany, which was collected in 2002.

The primary data set contains the prices and range of products offered by retailers in approximately the whole market for contact lenses. The data are merged with retailer characteristics as well as information on the virtual location of online retailers. Neither is the observed product range restricted to a predetermined subset of products, nor are the retailers selected. The observations are collected directly at the retailers' web sites instead of using shopbot data or data from price comparison web sites. Thus the data set is not a selected sample but it represents the whole population of online shops, which are relevant for consumers living in Germany. The data set contains 929 observations for 146 different online retailers collected between March and September 2002 on a monthly basis.

The results presented in this paper suggest that for e-tailers optimising their virtual location, investment in online advertising is regarded as a substitute for better service. Moreover, banner ads seem to serve as price advertising mechanism, whereas sponsored links rather seem to be used by e-tailers in order to signal outstanding customer service. The search engine rank appears to remain relatively stable over time suggesting that the virtual locations for the whole market are in an equilibrium during the period under observation.

The paper is organised as follows: Section 2 describes the related literature, and Section 3 provides useful background information on the market for online advertising. Section 4 describes the data set, which is analysed in Section 5. Section 6 concludes.

[5]This is supported by the fact that in contrast to journalism, where advertising and editorial contents are usually clearly separated according to a code of conduct, this is not common in the field of Internet search engines (see Machill et al., 2003, p. 92).

2 Related Literature

So far, the existing literature on aspects of the virtual location has been sparse. The growing importance for online retailers to be prominently placed on the Internet has been brought to the discussion by Smith et al. (2000),as described in the Introduction.

Smith (2002) distinguishes in a theoretical model between online retailers with a high awareness on the consumer side and those with a low awareness and focuses on implications on the pricing strategies of the two groups. That location merges in the virtual space with brand, is an observation by Tang and Lu (2001) who analyse price dispersion among online retailers.

There is a growing strand of literature dealing with advertising on the Internet, most of which tackles the effect of price advertising on competition (see for example Stahl (2000) or Baye and Morgan (2001)). Stahl (2000) focuses on the relation between online price advertising and pricing in e-commerce and the welfare implications of his model. Baye and Morgan (2001) analyse e-tailers' incentives to advertise prices on a gatekeeper's site (such as a price comparison site where firms pay in order to have their prices listed) and the competitive effects of such price advertising. Morgan, Orzen and Sefton (2003) investigate the predictions of the Baye and Morgan (2001) model in an experimental setting. They find pricing and advertising strategies being more aggressive than in the theoretical model resulting in non-increasing firm profits. Further results of the experimental setting are in line with the model predictions of higher advertising costs inducing less advertising and higher advertised prices.

Empirical papers – in contrast to this paper – mostly use data from a specific gatekeeper's Web site (for example Baye, Morgan and Scholten (2004)). An important difference of such approaches to the work presented in this paper is the neglect of retailers never listing on the specific price comparison site considered which may imply a highly selective sample. In contrast to this, also retailers never advertising are observed in empirical analysis presented in Section 5 in this paper.

A further difference of the papers cited above and this paper is the focus on price advertising. Baye and Morgan (2003) consider the effects of informational and promotional advertising in a common theoretical framework. Informational advertising means the listing of prices on a price comparison site attracting price sensitive consumers, whereas promotional advertising is understood as creating loyal customers and thus enticing web site traffic away from price comparison sites. The authors concentrate on the effects of both types of advertising on price competition.

The role of location on the Internet has received attention in a recent paper from Chirmiciu, Gatti and Kattuman (2004), where a different aspect of virtual location is investigated: effects of the position of retailers in the price quotation list of an Internet price comparison site on the decision to click-through to a specific retailer are analysed. The estimates suggest that customers favour products that are listed higher on the screen. It is important to note that this effect is modelled and estimated independently of the relative price compared to the other firms in the

list.[6] Also Ellison and Fisher Ellison (2001) include the rank of the retailer in their estimation explaining the demand for computer memory modules, but retailers are automatically sorted according to price on the shopbot site underlying their sample. Therefore, the effect of the order cannot be distinguished from the price effect. Smith and Brynjolfsson (2001) find in an empirical analysis of the click-through behaviour at an Internet shopbot for books that a considerable fraction of consumers does not decide in favour of the cheapest retailer. Considered are however only retailer brand effects, and the position is neglected, as retailers are automatically sorted according to price.

The question of how to identify the ideal location for paid online advertising is addressed by Bhatnagar and Papatla (2001). They directly address the issue of narrowly targeting potential customers on the Internet. Their discussion starts from the consideration that a firm's customer segment would be best found on the websites of its competitors which however would deny to sell advertising space. The discussion focuses on ways to identify adequate websites to advertise at and considers consumer search behaviour in the analysis. Consumer response to banner ads is discussed and empirically analysed using clickstream data in Chatterjee, Hoffman and Novak (2003).

The virtual location is tied to e-tailers' rankings and context dependent advertising efforts in Internet search engines. This view is supported by Machill et al. (2003) where a first systematic evaluation of the role and power of Internet search engines can be found. The study discusses the role and market power of search engines in the German language area of the Internet but the results should be transferable to the English part of the Internet without major obstacles. The authors focus on the market structure in the search engine market and additionally present an extensive experimental study of user behaviour when using Internet search engines (selected results of this study have already been reported in the Introduction).

3 The Market for Online Advertising

Online advertising faces increasing problems of lacking acceptance by Internet users. A recent study for Germany revealed that the proportion of Internet users tolerating advertising on websites as a necessary instrument for financing websites has shrunk to 41 percent from 53 percent at the beginning of 2001 (see Fittkau & Maaß (2003), cited in ECIN (2003a)). Simultaneously, the proportion of Internet users claiming to ignore online advertising has risen from 34 to 41 percent. In this context, the optimal placement of online advertising activities seems to be even more important.

One way of exactly targeting the preferred consumer group is context dependent advertising which can be realised as keyword advertising in search engines via banner ads or sponsored links. According to Jupiter Media Metrix (as cited in ECIN (2003b)), 42 percent of online purchases are initiated via a preceding search which makes context dependent advertising in Internet search engines an ideal advertising

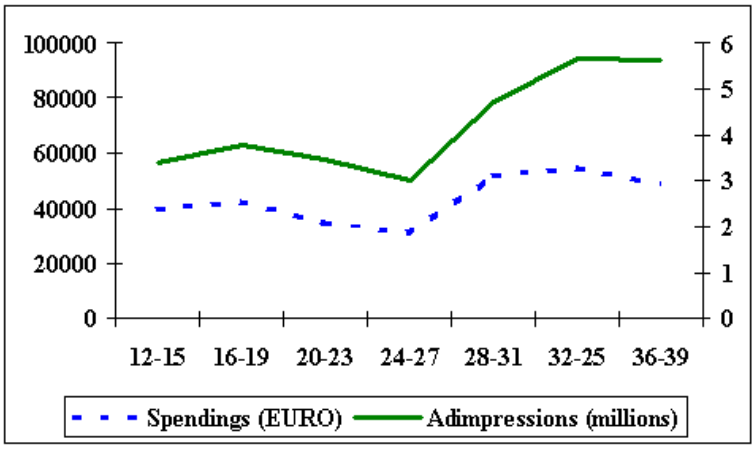
[6] Chirmiciu et al. (2004) are able to assess the roles of the price and the position on the screen separately, as firms are not listed according to price on the price comparison site they observe.

channel for online retailers. If advertising is linked to specified search terms, people interested in the product qualify as possible customers by the word(s) they actively search for. In addition to the better targeting of the audience, the advertiser incurs costs only if the user actually clicks on the banner ad or sponsored link.

Both banner ads and sponsored links appear together with the results list after search engine queries for specific keywords, which have been chosen by the advertiser. *Banner ads* refer to ads which are graphically emphasised, for example by using coloured boxed, graphics or pictures to draw attention on them. In contrast, *sponsored links* have an impact by their unconspicious placement on top of the results list. The optical appearance of these prominently placed links is meant to differ as least as possible from the ordinary list of results. Examples for banner ads and sponsored links are depicted in Figures 2 and 3 in the Appendix.

The evolution of online advertising in the market for glasses and contact lenses during the period covered by the data set underlying this paper is depicted in Figure 1.[7] According to W3SCAN.COM, the spending rose from 29,879 Euro during the first wave of data collection in March 2002 to 48,855 Euro during the weeks following the last collection of data in September 2002. In total, 614,063 Euro were spent for online advertising for optics in 2002. These figures are published online by the company W3SCAN.COM on their website (www.w3scan.com).

Figure 1: Market for online advertising in the weeks of data collection



Source: www.w3scan.com

4 Data

The analysis of markets for optometric devices has a long tradition in economics (see for example Benham, 1972; Kwoka, 1984). The online market for contact lenses was chosen due to several criteria which make the products suitable for both being sold

[7] Unfortunately, there is no separate information on contactlenses excluding glasses available.

via e-commerce and being analysed empirically.[8] The data set used for the analysis is condensed from a data set with monthly observations of online shops for contact lenses which were observed between March and September 2002.

Before collecting the primary data set, the online shops for contact lenses had to be identified. This was done by searching for the German word for contact lenses in its two possible spellings (*Kontaktlinsen* and *Contactlinsen*) in the ten most-widely used Internet search engines at the beginning of March 2002. The list of search engines can be found in Table 4 in the Appendix. From each of these search queries, the first 250 results were evaluated in order to identify sellers of contact lenses.

The primary data set contains monthly information on both the range of products and the prices offered by the retailers which results in more than 20,000 price observations. Relevant product attributes of the contact lenses and the service characteristics of the online shops were evaluated once during the period of data collection and then merged with the price data. This was appropriate since none of the online shops underwent major changes, and also no product was relaunched with retention of its original brand name.

Furthermore, information on the online shops' virtual locations is included. The virtual location is proxied by context dependent banner ads and sponsored links in the ten most-widely used search engines[9] and by the rank in the Google search engine at each time of data collection when a search for the German word for contact lenses in its two possible spellings was conducted. The ranks in the Google list of results were only considered for the first 10 pages of results (i.e. ranks 1 to 100). Price comparison sites played no role in the market for contact lenses at the time of data collection.

For the analysis of the link between e-tailer strategies and their virtual location, the original data set was condensed. The characteristics of the online shops underwent a factor analysis in order to obtain factors describing the service of the online retailers. Names were assigned to the factors according to the underlying variables they represent. The result are five factors indicating: Convenient navigation, superior customer service, a favourable return policy & supply of lens care products, security and trustworthiness features of the Web sites, and special services for customers using contact lenses for the first time.[10] The width of the product range offered by the e-tailers is measured by the number of different products offered. If this number increases, also the probability of the online shop covering different product segments of the contact lense market increases. Each e-tailer's overall price level in comparison to its competitors is proxied by the average of its standardised prices. For this standardisation, each product price has been divided by the average price over all e-tailers for this product.

The virtual location is proxied by various dummy variables indicating two different categories of online advertising: banner ads and sponsored links, respectively. Both forms of online advertising are linked to the searches for contact lenses in the

[8] These criteria are discussed in Häring (2003) where also a more detailed description of the data set can be found.

[9] A list of these can be found in Table 4 in the Appendix.

[10] The construction of these factors is explained in Häring (2003).

search engines as described above. Examples for both forms of online advertising linked to the German word *Kontaktlinsen* (contact lenses) can be found in Figures 2 and 3. The linkage of the appearance of context-sensitive ads to pre-specified search terms allows the advertising to be very targeted: The ads appear only on the screen if a search for the German word for "contact lenses" is conducted and not if the query is for other words excluding this notion.

The results is an unbalanced panel data set with 934 observations on a monthly basis for 146 different e-tailers. On average, the e-tailers are observed in 6.4 of the seven months of data collection. Descriptive statistics of the variables used in the empirical analysis can be found in the Appendix.

5 Empirical Analysis

5.1 Framework

As has been described in the Introduction, the virtual location of e-tailers is proxied by advertising in search engines and the rank in the Google list of results. The determinants of virtual location are analysed using data from the online market for contact lenses. In the case of online advertising, it is obvious that firms deliberately choose if they advertise at all and which kind(s) of advertising to invest in. But also the rank in the Google results list can be interpreted as an outcome of the profit maximising behaviour of e-tailers. Thus, both dimensions reflect the underlying latent profit maximisation of the e-tailers, and both dimensions of the virtual location can be investigated using the latent profit index framework which will briefly be described in the following.

The latent profit is an analogue to the latent utility in the consumer choice literature (see McFadden, 1974). The latent profit index of an e-tailer when choosing alternative j out of J possible choices is not observable and assumed to consist of a systematic and a stochastic component:

$$y^* = x\beta + \epsilon \tag{1}$$

where the latent profit y^* is not observable, x is a vector of observable characteristics, β is a parameter vector, and ϵ is a stochastic error term. The observed outcome y takes on one of the values 1, ..., J indicating the chosen alternative. Thereby, some information about the latent index is revealed but the underlying profit level cannot be fully recovered. In order to use the observed information on the virtual location of e-tailers, assumptions about the decision process are made in order to estimate the relationship between various e-tailer attributes and their virtual location. These are explained in the context of the estimation problem in the following two subsections.

5.2 Explaining the Virtual Location

5.2.1 Determinants of the Search Engine Rank

It has been argued in the previous sections that a superior position in the results list of search engines is of considerable importance. Since most of the popular search engines nowadays rely on the Google technology, the achieved position in the Google list of results is a valid proxy for the virtual location of online retailers. On the Google web site itself, it is stated that the Google ranking is determined by the contents of a web site and by the amount of links referring to it. But of course, the exact "formula" for the ranking of search results is not provided. Therefore, the determinants of the search engine rank can not be evaluated directly. Nevertheless, the observed search engine rank is a result of the profit maximising behaviour of the e-tailers. Precisely because firms do not know exactly what to do in order to achieve a high rank, they should be interested in strategies leading to a superior position in the list of results.

According to the previous result of Machill et al. (2003) according to which most consumers evaluate only the first or the first two pages of results when using Internet search engines, the observed Google ranks were grouped into categories for the first (position 1-10) and the second (position 11-20) page of results in the list. The rest of the e-tailers was sorted into the third category (position 21 and above). The frequency distribution over these ordered categories is depicted in Table 5 in the Appendix.

In order to identify the strategies pursued by e-tailers which are rewarded by a high Google rank, the rank is explained by the width of the product range the e-tailer offers, its relative price level, the amount of online advertising and the five factors describing retailer services.

Since the rank categories are ordered (a higher rank is better), an ordered discrete choice model is the appropriate tool for analysis. The latent index y^* in Equation 1 can be used together with further assumptions to estimate the influence of the e-tailers' strategies on their Google rank using an ordered probit model[11]. In the case of three categories it is assumed that we observe:

$$\begin{aligned} y &= 0 \qquad \text{if } y^* \leq \mu_1 \\ y &= 1 \qquad \text{if } \mu_1 < y^* \leq \mu_2 \\ y &= 2 \qquad \text{if } \mu_2 < y^* \end{aligned}$$

where $\mu_1 < \mu_2$ are unknown threshold parameters. By using the ordered probit model, one has to assume a standard normal distribution for the error term $\epsilon \mid x$. Then the unknown parameters β, μ_1 and μ_2 can be estimated by maximum likelihood. The estimated parameter value $\hat{\beta}_k$ for regressor x_k does not correspond to the marginal effect of a change in x_k on the conditional probability to observe outcome j, denoted as $Pr(y = j \mid x)$. These marginal effects $\partial p_j(x)/\partial x_k$ have to be computed separately for each outcome category. This has been done in Table 1 where the estimation results are depicted. The estimated standard errors are robust to heteroskedasticity.

[11] For a textbook treatment of the ordered probit model, see Wooldridge (2002, ch. 15.10).

Table 1: Analysis of rank in Google list of results

	Dependent categorical variable: rank in Google list of results					
	Rank 1-10		Rank 11-20		Rank $\geq$ 21	
	m.eff.	s.e.	m.eff.	s.e.	m.eff.	s.e.
Width of product range $*10^{-2}$	0.079***	0.017	0.124***	0.026	-0.203***	0.036
Relative price level	0.058**	0.023	0.091***	0.028	-0.149***	0.049
Online advertising:						
Number of banner ads	0.010***	0.003	0.015***	0.005	-0.025***	0.007
Number of sponsored links	0.003**	0.001	0.004**	0.002	-0.007**	0.003
Retailer service:						
Convenient navigation	-0.010***	0.003	-0.015***	0.005	0.025***	0.008
Superior customer service	-0.012***	0.004	-0.019***	0.007	0.032***	0.011
Return policy + lens care	-0.010***	0.003	-0.016***	0.006	0.025***	0.009
Security + trustworthiness	-0.019***	0.004	-0.030***	0.005	0.049***	0.007
New CL user service	-0.002	0.002	-0.004	0.004	0.006	0.006
Thresholds:						
μ_1 (s.e.)			3.767 (0.586)			
μ_2 (s.e.)			4.260 (0.568)			
Number of observations			929			
Log likelihood			-257.4			
Wald test (χ^2_9)			143.2			
Pseudo R^2			0.230			

Notes: Marginal effects of ordered probit estimation. The marginal effects are calculated at the mean values of continuous variables. ***, **, * denotes significance at the 1%, 5% and 10% level. Standard errors are robust to heteroskedasticity.

Almost all estimated effects (with exception of the factor representing special services for consumers who are new to using contact lenses) are statistically significant at a high level. The estimated marginal effects reveal that a wider product range and a higher price level are associated to a higher probability of being ranked on the first two pages of results in the Google search engine. Moreover, the probability of ranks between one and 20 decreases with the service level offered by the e-tailers. But poor service can be offset by investments in online advertising. Both the amount of banner ads and the amount of sponsored links increase the probabilities of being ranked on the first two pages of results. The opposite is true for the probability of being ranked lower than the first 20 entries: Offering more favourable service raises the probability of being ranked there. Also cheaper and more specialised e-tailers (offering a narrower product range) are more often found below the first 20 entries in the list of results. Investing in online advertising, however, lowers the probability of an adverse rank significantly.

That a higher rank is associated with a higher price level compared to the

competitors could stem from a reverse causality in the sense that online retailers with a superior search engine rank are possibly able to exploit this prominent position through price mark-ups. This possibility is suggested by Smith et al. (2000).

5.2.2 Determinants of the Advertising Decision

In order to capture an additional dimension of the concept of virtual location, different types of online advertising are explained by e-tailer strategies. The dependent variable distinguishes between online retailers investing only in banner ads, those investing only in sponsored links, online retailers investing in both forms of online advertising, and those without any online advertising.[12] In this subsection the fundamental decision with respect to online advertising is analysed, implying that the observed outcome is a categorical variable, indicating the type of online advertising strategy.[13]

The advertising decision is explained by the width of the product range, the relative price level, the Google rank and the factors describing the e-tailer services. To avoid endogeneity, the one-month lag of the Google rank is used. Although this leads to a loss of 16% of the observations, the estimated results do not change substantially.

The frequency distribution of the online advertising categories is depicted in Table 6 in the Appendix. The categories reflect profit maximising behaviour of the e-tailers. In contrary to the search engine ranks, the categories describing the online advertising decision are not ordered but only mutually exclusive. Again, the latent profit index idea of Equation 1 can be specified leading to the multinomial logit model (see for example Wooldridge, 2002, ch. 15.9). The multinomial logit model is based on the assumption that the observed outcome y is the one which the individual (or firm) attaches the largest latent utility (or here: profit) to. Since the alternatives are mututally exclusive, the probabilities must sum to unity, and the probability of observing alternative j can in our case with three possible forms of advertising be described as:

$$Pr(y = j \mid x) = \frac{exp(x\beta_j)}{1 + \sum_{h=1}^{3} exp(x\beta_h)}$$

where $j = 1, 2, 3$. Once the probabilities for $j = 1, 2, 3$ are specified, the probability for no online advertising $Pr(y = 0 \mid x)$ is known, because the probabilities must sum to unity. Now the parameter vector β can be estimated by maximum likelihood. Again, the estimated parameter value $\hat{\beta}_k$ for regressor x_k does not correspond to the marginal effect of a change in x_k on the conditional probability to observe outcome j, denoted as $Pr(y = j \mid x)$. The marginal effects $\partial p_j(x)/\partial x_k$ are computed separately for each outcome category and are depicted together with their estimated standard errors in Table 2.

[12] Note that online advertising is measured only in terms of search-term related advertising in search engines. Possible activities like banner ads on portals or general interest websites, for example, are not observed.

[13] The actual numbers of banner ads or sponsored links are thus neglected.

Table 2: Analysis of online advertising activities

	Dependent categorical variable: type of online advertising activities							
	None		Banner ads		Sponsored links		Both	
	m.eff.	s.e.	m.eff.	s.e.	m.eff.	s.e.	m.eff.	s.e.
Width of product range $*10^{-2}$	-0.022	0.021	0.001	0.008	0.020	0.018	0.001	0.003
Relative price level	0.235***	0.085	-0.156**	0.079	-0.033	0.028	-0.046**	0.022
Google rank$_{t-1}$ (ref.: $\geq$ 21):								
Google rank$_{t-1}$ 1-10	-0.196**	0.086	0.075	0.048	0.038	0.041	0.083*	0.047
Google rank$_{t-1}$ 11-20	-0.349***	0.103	0.039	0.031	0.127	0.086	0.183**	0.088
Retailer service:								
Convenient navigation	-0.030***	0.007	0.003	0.003	0.023***	0.006	0.004**	0.002
Superior customer service	0.009	0.008	-0.013*	0.008	0.004**	0.002	0.000	0.000
Return policy + lens care	-0.034***	0.010	0.014*	0.008	0.011**	0.005	0.008***	0.003
Security + trustworthiness	-0.010**	0.004	0.003	0.002	0.004	0.003	0.003***	0.001
New CL user service	0.011***	0.004	-0.003	0.002	-0.007***	0.003	-0.001	0.001
Number of observations	779							
Log likelihood	-306.13							
Wald test (χ^2_{27})	261.94							
Pseudo R^2	0.339							

Notes: Marginal effects of multinomial logit estimation. The marginal effects are calculated at the mean values of continuous variables and the base categories of dummies. The marginal effects of dummy variables are calculated as discrete changes in the expected value of the dependent variable. ***, **, * denotes significance at the 1%, 5% and 10% level. Standard errors are robust to heteroskedasticity.

The width of the product range offered by online retailers has no significant influence on their decision to promote their web shop online. The more expensive an e-tailer, the more probably it does not invest in online advertising. Being relatively cheaper in comparison to the competitors significantly increases the probability of investing at least in banner ads. This implies that banner ads seem to be used as a means of signalling low prices.[14] On the contrary, the positive marginal effects estimated for the probability of using sponsored links indicate that sponsored links seem to serve as a vehicle for signalling superior customer service. Both explanations appear plausible, since banner ads are a more aggressive type of advertising, probably targeting a more price-sensitive customer group than the more reliable seeming sponsored links. Moreover, e-tailers having been ranked higher in the past, invest more probably in both types of online advertising, whereas e-tailers with previously less favourable ranks do not invest in online advertising with a larger probability.

5.3 Changes in the Virtual Location

In the next step it would be interesting to investigate the determinants of changes in the virtual location, particularly in the search engine rank. The frequency distribution of changes in the Google rank is depicted in Table 3. It can be seen that substantial changes in the rank do not occur very often. Most retailers stay in the same rank category in which they were ranked in the previous month. Of course, changes occur in in the exact list of results, but who would notice if a seller with position 56 in May would climb to position 53 in June? Unfortunately, the number of substantial changes in the Google results is too small to be analysed econometrically. For the moment, it can only be concluded that search engine ranks appear to remain relatively stable over time.

Table 3: Changes in the search engine rank

rank in month t	rank in month $t+1$		
	1-10	11-20	≥ 21
1-10	27	5	2
11-20	7	16	12
≥ 21	1	14	697

6 Conclusions

In this paper, a first empirical analysis of the profit maximising strategies of e-tailers with respect to their virtual location has been provided. The important role of an outstanding virtual location in the attraction of new customers has been discussed. The results suggest that for e-tailers optimising their virtual location,

[14] Banners were only sporadically used for price advertising during the period of data collection.

better service seems to be substitutable by investments in online advertising. A high Google rank and online advertising are appear to be complements, as e-tailers using banner ads and sponsored links are ranked among the first 20 results with a higher probability than e-tailers which do not invest in context dependent online advertising, and vice versa. Moreover, banner ads seem to serve as price advertising mechanism, whereas sponsored links rather seem to be used by e-tailers in order to signal outstanding customer service. These two means of online advertising may target different consumer groups. When the dynamics of the search engine rank are considered, it appears to remain relatively stable over time. It must however be kept in mind that the estimated coefficients should not be interpreted as causal effects but rather as multivariate correlations. It can be supposed that the decisions with respect to online advertising, price setting and the service offered by the e-tailers are part of the overall strategy and are thus the result of a simultaneous decision.

The literature on the virtual location of firms has been sparse, and it would be useful to compare the results of this study to other empirical approaches. The role of promotional (or brand) advertising online has only been illustrated in a theoretical setting so far. Furthermore the competing roles of promotional and informational (or price) advertising deserve an empirical investigation: What exactly is the trade-off for e-tailers when allocation their budget for online advertising? In this context but also for the isolated analysis of virtual location, information on consumer response to online advertising would be quite useful. This lack of information could be alleviated using clickstream data (like for example in Chirmiciu et al. (2004), Smith and Brynjolfsson (2001) or Goldfarb (2002)) – which unfortunately only allow the observation of clicks but not of actual purchasing decisions – or clickstream data being merged to information of quantities sold by e-tailers.

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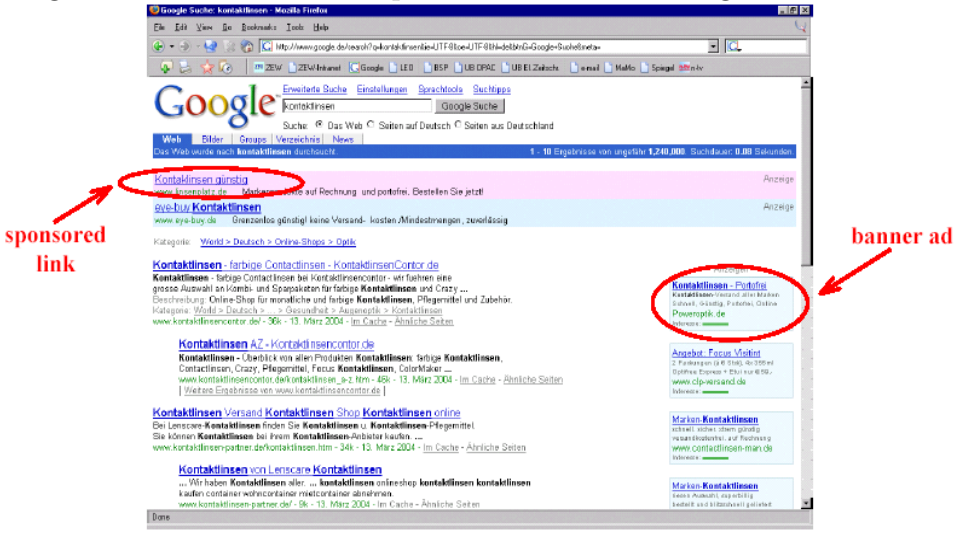
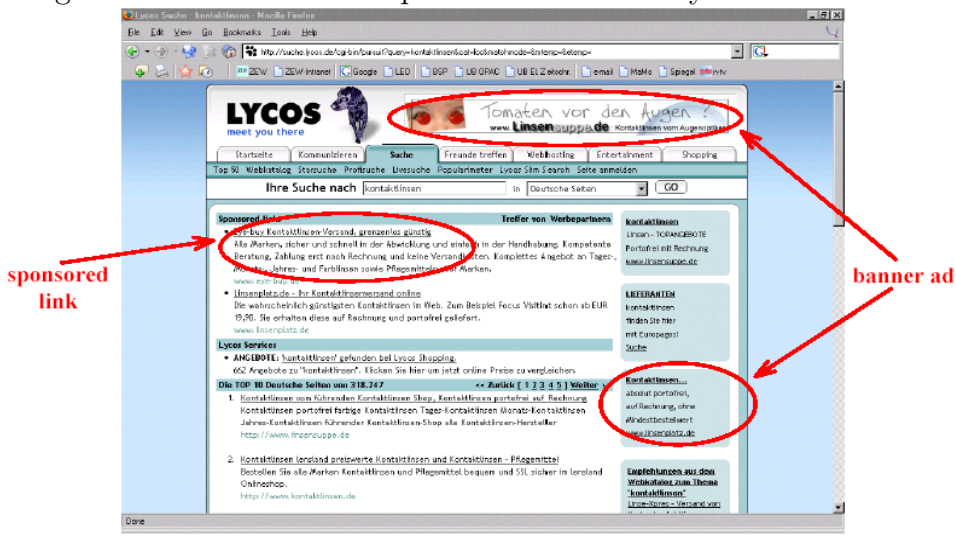
Appendix

Figure 2: Banner ads and sponsored links in a Google list of results



Note: Screenshot from 14.03.2004

Figure 3: Banner ads and sponsored links in a Lycos list of results



Note: Screenshot from 14.03.2004

Table 4: 10 most-widely used search engines

www.google.de
www.yahoo.de
search.msn.de
www.lycos.de
www.t-online.de
www.altavista.de
www.web.de
www.metager.de (meta search engine)
www.fireball.de
suche.aol.com

Source: www.webhits.de, 04.03.2002.

Table 5: Frequency distribution of Google rank categories

Google rank	Frequency
Google rank 1-10	41
Google rank 11-20	41
Google rank $\geq$ 21	847
Number of observations	929

Table 6: Frequency distribution of online advertising categories

Online advertising activities	Frequency
Banner ad	66
Sponsored link	34
Both	43
None	786
Number of observations	929

Table 7: Descriptive Statistics of explanatory variables

	Mean	Std. Dev.
Width of product range	21.743	17.661
Relative price level	1.024	0.135
Number of banner ads	0.300	1.062
Number of sponsored links	0.670	2.917
Google rank (ref.: not ranked 1-100):		
Google rank 1-10	0.044	
Google rank 11-20	0.044	
Google rank $\geq$ 21	0.912	
Retailer service:		
Convenient navigation	0.015	0.844
Superior customer service	0.002	0.813
Return policy + lens care	0.018	0.810
Security + trustworthiness	0.008	0.813
New CL user service	0.011	0.794
Number of observations	929	