The effects of website provision on the demand magazines

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Abstract: What happens to the demand of the print version if a magazine launches a website? This question is empirically analyzed for the German women's magazine market, a particularly relevant segment of the German magazine market. Static and dynamic nested logit–type demand models are estimated on quarterly panel data covering the period 1996 to 2001. Main findings are that website provision does not have a significant effect on magazine demand — a conclusion that is robust to alternative specification of the potential website effect (including 'passive' learning and 'active learning') — and there are significantly positive 'awareness' spillovers from website presence of competitors.

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JEL classification: C3, L1

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1 Introduction

A website launch by a magazine or a newspaper is a costly venture. Apart from the outlays associated with setting up and maintaining the website, there is the danger that consumers might substitute away from the print medium towards the online version. There is some circumstantial evidence, for example for Italy, where the three leading daily newspapers experienced a substantial decline in circulation after they had launched websites that contain all articles that are published in the print version — a clear indication of a substitution relationship between the online version and the print medium.[1] At the same time, industry representatives that I have talked to report that they regard magazine websites as an additional service to the readers — for example the provision of a daily updated horoscope, thus pointing at complementarities between the print versions and the associated websites.

Structural econometric evidence on the effects of website provision is missing, however, and in this paper I quantify the short–run and long–run effects of website launches on magazine demand as an exercise in the analysis of the relationship between virtual markets and real markets.

The attention of this paper is restricted to German women's magazines not only

[1]This piece of circumstantial evidence was communicated to me by Elena Argentesi and Lapo Filistrucchi.

because it is the hardest fought segment of the German magazine market[2] but also because it has been a front–runner in establishing magazine websites. The first German women's magazine went online in spring 1996. Two directly competing magazines followed the same year. By the end of 2001, 15 women's magazines out of a total of 41 magazines active in the market provide an own website.

The effects of website provision on magazine demand are studied empirically using a differentiated product demand framework and detailed quarterly data on both magazine characteristics and consumer characteristics that spans the period 1996 to 2001.

I estimate static and, following the suggestion of a referee, dynamic models of magazine demand using instruments of potentially endogenous variables. In both models I allow for 'passive' and 'active' consumer learning about a magazine's website.

The main results of my paper are that (i) there is no significant effect of website launching on magazine circulation, (ii) there is no significant learning about the existence of a website, (iii) there are significantly positive 'awareness' spillover effects on circulation from other magazines in the same group (direct competitors)

[2]In 2001, 36 women's magazines titles were published, more than twice as many as in the second most densely populated segment, TV magazines. Market concentration, as measured by the Hirshman–Herfindahl index, is much lower in women's magazines than in any other segment, and this is true both in the magazine demand dimension and in the advertising demand dimension. These figures are based on data contained in Gruner + Jahr (2002).

that are online and (iv) there are significantly positive effects of past magazine market shares on current market shares

2 Background information

2.1 Website launching

Visits between July 2001 and November 2003 to the websites of the magazine I study, along with an inspection of the printed magazines, showed that there is at least superficially a large overlap between the magazine contents and the main website contents. Contents related to 'Beauty and fashion', 'Love and partnership', 'Diets and nutrition', 'Recipes' etc. play an equally important role in both the print versions and the online editions. It turns out, however, that articles appearing in the most recent print version are not accessible on the internet, which considerably limits the degree of substitution between online version and the print edition. There also is the general question whether the experience of reading a magazine on the sofa is the same as the experience from reading the online version sitting in front of a computer. Instead of placing full–text articles online, the magazine websites contain information that might be termed 'time–free', meaning that they allow to gather information that is not subject to very recent developments, for examples articles that appeared in earlier print versions that are now moved to the magazine's website archive.

Although there is indication given that magazine websites and magazine print versions could be complementary, it is an empirical question to what extent this potential complementary might be balanced out by substitution effects.

Whatever their motives are to launch a website, and in Kaiser (2003) I discuss the motives in further detail, many women's magazines are online today. Table 1 displays what magazines from what groups went online at what point in time. The grouping of the magazines follows industry convention, for example Jahreszeitenverlag (1996–2002).[3]

Insert Table 1 about here!

Table 1 indicates that there are two distinct entry cohorts: the first entry wave was around 1996/1997, the second one more recently around 2000/2001. There are three women's magazines websites that I miss in this study since they were launched after the end of my observation period: 'Marie Claire' (monthly medium priced magazines), 'Mädchen' (girl's magazines) and 'Madame' (monthly high priced magazines).

2.2 Other features of the German magazine market

Apart from the purely website–related issues, there are two more facts about the German magazine market in general and about women's magazines in particular

[3]The magazine grouping is not important at this stage of the study but it is relevant for the econometric analysis that follows.

that are important and that distinguish the German magazine market from the U.S. magazine market. The first is that subscription rates and cover prices are almost identical. Comparisons of cover and subscription prices in early October 2001 and in early November 2003, which included all magazines considered in this study, shows that for 26 magazines subscription and cover prices are exactly the same. For 13 magazines the subscription price is *higher* than the cover price, with a mean price difference of 17.9 per cent. This is the case for the low–priced magazines. They do not directly offer subscriptions. Instead, consumers turn to retailers who charge fees for their services to have the magazines delivered. For twelve magazines consumers save when they subscribe (with the mean saving being -10.5 per cent). I therefore consider the differences between cover and subscription prices as sufficiently small to be neglected. This might of course introduce measurement error, so that there is the danger of obtaining biased coefficients on cover prices in the econometric analysis, but the instrumentation of prices I apply will take care of this.

A second issue is that access to the websites of women's magazines is free of charge. Nor are website visitors required to reveal any information about themselves.

3 Empirical specification

Discrete–choice models of product differentiation (Anderson et al. 1990; Berry 1994) provide a somewhat natural framework for studying the determinants of demand for women's magazines. Internet provision is considered as a quality characteristic in a 'Nested Logit' model of product differentiation.

Due to the fact that there might be some inherent dynamics in magazine demand, for example due to the existence of subscriptions, I estimate both a static and a dynamic model for magazine demand. The next subsection describes the static demand model, the following subsection discusses the dynamic specification.

3.1 Static model

The nested logit model is a popular choice among empirical researchers since it is computational simple. Its simplicity comes at a cost, however: it places restrictive assumptions on own and cross–price elasticities, so that recent research uses the more flexible random coefficient model to estimate models for differentiated product demand (Berry et al. 1995; Davis 2000; Nevo 2001; Petrin, 1998).

Apart from the fact that own and cross–price elasticities are not of interest here, the nested logit model may be appropriate for the market studied here. The magazines that I study are very much alike *within groups* if one compares, for example, content pages, advertising pages and magazine content shares (the share of e.g. beauty, fashion, wellness etc. pages). By contrast, for example a fashion

page of a magazine from the 'monthly high priced' magazine category looks very different from a fashion page of a magazine from the 'monthly medium priced' magazine category. This suggests that being a member of one of the six magazine groups is an important quality characteristic of a magazine. It hence seems worthwhile to use the nested logit model based on this grouping in the econometric analysis since the nested logit model places random coefficients on dummy variables for the six magazines.

In order to introduce some additional flexibility in the own–price and cross–price elasticities without giving up the simplicity of the nested logit specification I make the elasticities dependent on magazine purchaser's income.

The nested logit model for differentiated product demand is well described in the existing literature so that there is no need to go into great detail here.[4]

The nested logit demand equation I estimate is

$$ln(s_{jt}/s_{0t}) = \boldsymbol{x_{jt}}\boldsymbol{\beta} + \alpha_{jt}p_{jt} + \sigma ln(\bar{s}_{j|gt}) + \boldsymbol{\kappa w_{jt}} + \boldsymbol{\delta a_{\neq jt}} + \tau_t + \xi_{jt}, \qquad (1)$$

where the subscript jt corresponds to the jth magazine observed at time t. τ_t denotes demand shocks that are the same for all magazines (I use quarter and year dummy variables to take them into account) and ξ_{jt} is a time–specific quality characteristic of magazine j that is unobserved to the econometrician. Magazine j's market share at time t is denoted by s_{jt}. The market share of the 'outside

[4]Note that the logit demand type framework allows consumers to purchase more than one magazine as long as the magazine purchase decision is uncorrelated with the number of magazines bought (Rysman 2002).

good', which is needed in order to identify the model, is defined as total market size at time t, M_t, minus the circulation sum of of the N 'inside goods', q_{jt}, relative to total market size: $s_{0t} = (M_t - \sum_{j=1}^{N} q_{jt})/M_t$ (likewise $s_{jt} = q_{jt}/M_t$). In accordance to industry practice (AG.MA 2001), I define total market size as the the number of women aged 14 years and above that live in Germany. $\boldsymbol{x_{jt}}$ is a vector of magazine characteristics that is linked to relative market shares; $\boldsymbol{\beta}$is a parameter vector. Elements of $\boldsymbol{x_{jt}}$ are the natural logarithm of the number of content pages, the ratio of advertising pages to the total number of pages and 21 "content shares", i.e. the share for example of fashion pages in the total number of pages,[5] and the Hirschman–Herfindahl index of content concentration (the sum of the squared 21 content shares). These three variables are included in linear and quadratic form to allow for nonlinearities, in particular for an optimal number of editorial pages, an optimal advertising share and an optimal content concentration.

Own–price and cross–price elasticities are made dependent on the income of its readers by interacting the cover price of magazine j with the share of readers without personal income. The parameter α_{jt} is thus a function of the per-

[5]These 21 content shares are fashion for purchase, self–crafted fashion, cosmetics, cooking, interior design, handicraft, children, partnership, society, vacation, counselling, hobby, cars, politics, science, the arts, sensational journalism, TV, fiction, sexuality, VIPs and service pages of the editors (Table of Contents etc.) with health being the comparison content share that is dropped to avoid perfect collinearity with the constant term.

sonal income of magazine j's readers at time t. Specifically, I assume that $\alpha_{jt} = \alpha_0 + \alpha_{no\ own\ income} \cdot \text{Share of consumers without own income}_{jt}$.[6]

The parameter σ measures the degree of product substitution within product groups. If $\sigma = 1$, products within product groups are perfect substitutes and if $\sigma = 0$, products are symmetric and the 'simple logit' model without random coefficients is obtained. The substitution parameter maps the market share of magazine j in group g (i.e. in one of the six magazine groups) at time t, $\bar{s}_{j|gt}$, to total relative market shares.

The two terms $\boldsymbol{\kappa w_{jt}}$ and $\boldsymbol{\delta a_{\neq jt}}$ are my measures for website effects on magazine demand and for 'awareness' spillovers from other magazine's (other than magazine j) website presence to magazine j's relative market shares respectively.

I estimate three different specifications that are supposed to capture the effect of having a website. In the first and most simple specification, the website effect is represented by a dummy variable, denoted by $website_{jt}$. It is coded one

[6]Earlier specifications included four additional income group shares, namely the share of consumers enjoying an own income lower than 1,500 DM, between 1,500 DM and 2000 DM, between 2,000 DM and 2,500 DM, between 2,500 DM and 3,000 DM and higher than 3,000 DM. The coefficients related to these income shares did not prove to be statistically significantly different from α so that I left them out. I also experimented with household income instead of magazine reader income but obtained implausible results, for example upward sloping demand curves. My explanation for these implausible results is that according to Deutscher Hausfrauen Bund (2003) many housewifes — the likely consumer of women's magazines — are unaware of their partner's income so that they give wrong assessments of their household income.

for each period in time magazine j runs a website (and zero otherwise). This simple specification does not allow for the possibility that there might be significant learning effects that could be at work in this market although magazines advertise their websites at prominent places in the print version. It may take time until consumers notice that there is a website and until consumers have learned about website quality so that the effect of websites on demand might vary over time. Such 'learning' effects are incorporated in my empirical model by a dummy variable for having a website and lagged website dummies. I arbitrarily set the maximum lag length at two years (or eight time periods). Changing the lag length did not lead to quantitatively different results. It is important to note that I do not lose observations due to the inclusion of lagged website dummy variables since the first website that was ever launched in the women's magazine market was released when my data start (so that the value of all lagged dummy variable corresponding to time periods prior to I/1996 are coded zero).

If none of a magazine's consumers uses the internet at all, then it is unlikely that they learn about the magazine's website quality and contents. It is my third specification, which I term 'active learning' (as opposed to the 'passive learning' in my second specification), I therefore additionally include interactions of the contemporary and lagged website dummies with the share of magazine j's readers that regularly use the internet at time t, $onlineshare_{jt}$.

My specifications of the website effect on magazine demand are hence the follow-

ing:

$$\boldsymbol{\kappa w_{jt}} = \kappa_0 \text{ website}_{jt}$$

$$\boldsymbol{\kappa w_{jt}} = \kappa_0 \text{ website}_{jt} + \sum_{k=1}^{7} \kappa_k \text{ website}_{jt-k}$$

$$\boldsymbol{\kappa w_{jt}} = \kappa_0 \text{ website}_{jt} + \sum_{k=1}^{7} \kappa_k \text{ website}_{jt-k} + \sum_{k=0}^{7} \omega_k \text{ website}_{jt-k} \text{ onlineshare}_{jt-k}.$$

Apart from those 'direct' effects of website presence there might also be indirect effects coming from the website presence of other magazines. These effects are called 'awareness' spillovers in the marketing literature. The idea behind 'awareness' spillovers in my setting, which are picked up by the term $\boldsymbol{\delta a_{\neq jt}}$ in my empirical model, is that a consumer who surfs on the internet calls up the website of women's magazine l (and possibly also the website of women's magazine m etc.). Her interest in women's magazines is caught so that she buys a women's magazine the next time she stops at a kiosk. The important thing to note here is that she might buy some magazine other that l or m since women's magazines in general caught her attention. Confronted with the choice of magazines at the kiosk she might decide to buy magazine j instead of magazine m or l since it better fits her needs. Magazine j does not need to run an own website to free ride on the awareness spillovers from other magazines.

My magazine demand specification considers two types of awareness spillovers: those coming from (i) the own magazine group — i.e. from direct competitors — and (ii) those coming from other women's magazines. The empirical proxy variables I use are (i) the number of magazines that have a website in a maga-

zine's own group (I term this variable 'Group–awareness') and (ii) the number of magazines that maintain a website in the entire women's magazines market ('Total awareness').[7] Both variables exclude a website presence of magazine j.

3.2 Dynamic model

In addition to the standard static model I also estimate a dynamic model of magazine demand since an important magazine characteristic might be how many others (friend, family, colleagues) purchase the magazine as well. I assume that a potential consumer's best guess for magazine j's market share at time t is its market share at $t-1$.[8] Network effects in magazine consumption are hence considered by an autoregressive model that contains the lagged endogenous variable as an additional magazine quality characteristic:[9]

$$ln(s_{jt}/s_{0t}) = \rho\, ln(s_{jt-1}/s_{0t-1}) + \boldsymbol{x_{jt}\beta} + \alpha_{jt}p_{jt} + \sigma ln(\bar{s}_{j|g}) + \boldsymbol{\kappa w_{jt}} + \boldsymbol{\delta a_{\neq jt}} + \tau_t + \xi_{jt}, \quad (2)$$

[7] I have also run specifications with interaction of the awareness variables and the dummy variable for website presence. The coeffients related to this interaction were insignificantly different from zero so that I left them out.

[8] This is consistent with adaptive expectations where only the most recent period matters.

[9] There are two other reasons that motivate the use of a dynamic model. First, there might be learning effects: consumers do not instantaneously become aware of a magazine's quality but rather need to repeatedly purchase it. Second, changes in magazine quality does not instantaneously lead to changes in demand (as assumed by the static model). This is a particularly relevant issue for women's magazines where the share of readers that subscribe to a particular magazine is 14.3 per cent (median 10.3 per cent) so that instantaneous adjustment is very unlikely to take place.

where the parameter ρ measures the effect of past relative market shares on current relative market shares.

From an econometric perspective, adding a lagged endogenous variable just changes the interpretation of the coefficients. The coefficients obtained from an estimation of the dynamic model imply two sets of results: a short–run and a long–run one. The parameter estimates obtained for the magazine quality characteristics, cover price, within group market share, the website effects and the awareness spillovers — i.e. the parameter vector $\boldsymbol{\theta}$=($\boldsymbol{\beta}$,α_{jt}, σ,$\boldsymbol{\kappa}$,$\boldsymbol{\delta}$) — represent the short–run effects on relative magazine demand. The long–run effect is given by $\boldsymbol{\theta}/(1-\rho)$.

A final econometric justification for introducing dynamics to the demand equation is that the residuals obtained from the static model exhibit highly significant positive serial correlation, with values of the Durbin–Watson statistic around 0.2. This is not a cause for major concern as such, since the parameter estimates are consistent in any case, and my estimates for the variance–covariance matrices are all robust to first–order serial correlation (and also to heteroscedasticity). Serial correlation in the error terms is, however, an indicator of omitted dynamics in the empirical model, so the introduction of a lagged endogenous variable is justified from an econometric point of view.

3.3 Identification

Equation (1) and Equation (2) could in principle be estimated by OLS. Since both consumers and producers know the unobserved (to the econometrician) magazine quality component ξ_{jt}, producers take its value into account in its pricing decision which in turn induced a positively correlation between ξ_{jt} and magazine cover price p_{jt}. This leads to a downward bias in the parameter estimates that correspond to the price coefficients α_{jt}, calling for an instrumentation of cover prices. By the same token, within group market shares need to be instrumented as well. In the dynamic model, the lagged endogenous variable $ln(s_{jt-1}/s_{0t-1})$ needs to be instrumented since there is suspicion of serial correlation in the residuals. In fact, the existence of positive serial correlation cannot be rejected for the dynamic models as well, although the Durbin–Watson statistics increase from values around 0.2 in the static model to values of around 1.7 in the dynamic model (it is 2.0 for serial–correlation free error terms). Natural instruments for lagged relative market shares are lags of the exogenous variables and lags of the instruments and I use them to identify the model.

My construction of the cover price instruments is based on the idea is that cost shocks occurring to magazines other than magazine j will be correlated with cost shocks occurring to magazine j, and hence — to the extent that cost shocks are carried over to cover prices —, prices of magazines other than magazine j will

be correlated with magazine j.[10] They will, however, be uncorrelated with unobserved quality characteristics ξ_{jt}. I construct three different instrument sets based on this idea: (1) the average cover price across all magazines published in Germany, (2) the average cover price across all women magazines and (3) the average cover price across magazines in the own magazine group. Instruments (2) and (3) were rejected by tests for overidentifying restrictions in almost all specifications so that only instrument set (1) is used in the empirical analysis only. I will henceforth call it the 'main cover price instrument' although I use additional variables as instruments for price.

It is well documented that (functions of) other products' (other magazines) characteristics are valid instruments for prices and within group market shares since the pricing equation associated with differentiated product demand models depend on the characteristics of the other products. Existing studies have used the means of the characteristics of other products as instrument for product prices and the means of the characteristics of products from the own product group as instruments for within group market shares (e.g. Verboven, 1996). I follow this approach and use the following variables as instruments for cover prices and within group market shares ('overall' means the entire German magazine market): (i) the share of own information pages relative to the mean share of information pages in the own product group, (ii) the own advertising pages share relative

[10] This assumption is related to Hausman (1996) and Nevo (2001), although our setups differ substantially.

to mean overall advertising share, (iii) the own advertising pages share relative to mean overall advertising share within the own product group, (iv) the own content concentration index relative to the mean overall content concentration index, (v) the own number of pages relative to the mean overall number of pages, (vi) the main cover price instrument, (vii) the main own price instrument relative to mean overall main own price instruments and (viii) the ratio of the main own price instrument relative to the main own price instrument from the own product group. Note that the instruments that are defined on the group–level basis are thought of as instruments for within group market share while the instruments defined for the entire German magazine market are thought as instruments for cover prices. The distinction does not really matter, however, since in practice instruments for cover prices are also used as instruments for with group market share and vice versa.

For an instrument to be valid it has to have two properties: (i) there must be a high correlation between the instruments and the variable to be instrumented and (ii) the instruments and the residual of the estimation equation of interest must be uncorrelated. In order to check the first property I have run auxiliary OLS regressions of the instruments and the exogenous variables on cover prices and within group market shares (a so–called 'first stage reduced form estimation'). The instruments were jointly highly significant in these auxiliary regression, indicating a high correlation between the instruments and the variables to be instrumented. Estimation results for the auxiliary regressions are presented in Appendix A on

the internet.[11] The second property, the non–correlation between the residuals and the instruments, is tested by J–tests. Non–orthogonality of the instruments is easily rejected in all specifications. In addition, I run OLS regressions of instruments on the residuals and do not find evidence for correlation of even one of the instruments with the residuals.

The potential endogeneity of website provision also is an issue that is at stake here. As one of the referees pointed out, it might be the case that having a website affects the quality of a magazine compared to a magazine which has not yet launched an internet site which makes website provision is an endogenous variable.

I test for endogeneity of website provision within a framework I develop in Kaiser (2002) and cannot reject non–exogeneity of website provision (of course given my assumptions regarding the exclusion restrictions). Appendix B on the internet provides details on my test for endogeneity.

The magazine demand models are estimated using a GMM routine that is programmed in the software package TSP (Hall and Cummings 1998 and http://www.tspintl.com).

[11] All Appendices appear at URL www.ulrichkaiser.com/papers/magdem_web.html.

4 Data

My data set consists of quarterly information on all German women's magazines that existed between the first quarter of 1996 and the fourth quarter of 2001. The minimum number of magazines per period is 38, the maximum is 41. A total of 860 observations is used in the estimation. Data on circulation, cover prices, editorial pages and advertising pages were downloaded from the internet at http://medialine.focus.de. This data has been updated quarterly since 1972 and is continuously recorded. The original source of this information is 'Information Association for the Determination of the Spread of Advertising Media' ('Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V', IVW). IVW ascertains, monitors and publishes circulation and magazine dissemination information.

This data is supplemented by annual information on magazine contents that I received from the publishing house 'Jahreszeitenverlag' (Jahreszeitenverlag 1996–2002). Jahreszeitenverlag distinguishes 22 different content categories and I use the shares of the content pages in the total number of pages as explanatory variables.

This information on magazine characteristics is supplemented by data on magazine reader characteristics that was provided to me by the 'Arbeitsgemeinschaft Media–Analyse' (AG.MA), an association of the German advertising industry for research on mass communication. The purpose of the AG.MA is to gather

and supply data for media audience measurement. The original source of the AG.MA data is a consumer survey that is annually collected by the 'Institut für Demoskopie, Allensbach', Germany. Around 20,000 interviews are realized annually.[12]

Information on magazine readers' internet use was supplied to me by 'Burda Advertising Center', a subsidiary of the publisher 'Burda Verlag'. This data is also based on the 'Institut für Demoskopie, Allensbach' survey data. The data does not contain very precise information on internet usage by magazine readers so that the only piece of information I have is if the readers 'regularly' use the internet.

A final piece of information the data contains is website presence. The date a magazine launched a website was assembled by my own by email and telephone inquiries at the editorial staff of the magazines.

Descriptive statistics of the variables involved in the estimations are shown in Appendix C on the internet.

5 Estimation results

Since I estimate two different econometric models with three different specifications of the effects of website provision on magazine demand, I produce six different sets of parameter estimates. In my presentation of the estimation re-

[12]For more information on this data, see http://www.awa-online.de/.

sults I distinguish between the parameters of 'secondary interest' — these include all parameters that are unrelated to the website effects and unrelated to the website awareness spillover effect — and those of 'primary interest' — the coefficients corresponding to my website effect specifications and the website awareness spillovers. I start by presenting the parameters of core interest since if they do not make sense economically it is unlikely that my demand equations are well specified. The parameters of secondary interest stemming from the static model are displayed in Table 2, those generated by the dynamic model are shown in Table 3.

Insert Table 2 about here!

Insert Table 3 about here!

The parameters of primary interest produced by the static model are displayed in Table 4, those estimated by the dynamic model are shown in Table 5. The estimates for both dynamic models in Table 3 and Table 5 are the long–run coefficients, i.e. the transformed parameter values of $\boldsymbol{\theta}/(1-\rho)$. The variance–covariance matrix corresponding to the transformed parameters is calculated using the 'Delta' method (Greene 1997, Section 6.7.5) The original parameter estimates for the dynamic models are moved to Appendix D on the internet.

Insert Table 4 about here!

Insert Table 5 about here!

5.1 Secondary interest parameters

The parameters related to cover prices, α and $\alpha_{no\ own\ income}$, are very precisely estimated and carry the correct negative signs indicating that magazine demand decreases in prices. The high significance of $\alpha_{no\ own\ income}$ shows that consumers that do not have an own income have a significantly higher price–elasticity of demand than those who do have an own income. The coefficient related to within group market shares is around 0.58 in the static model and 0.72 in the dynamic models meaning that products within the six product groups are highly substitutable.

There seems to be a concave relationship between the number of editorial pages per quarter and magazine demand, suggesting that readers like magazines with either few or with many editorial pages. Minimum demand is, however, reached at number of editorial pages around 130 (per magazine and quarter) in the static model and of around 230 in the dynamic model. The average number of editorial pages is 625 with a median of 710 pages, so the minima are outside the relevant range for most magazines. This implies that consumers in fact prefer magazines with many editorial pages over magazines with few such pages.

The demand–maximizing share of advertising pages is also outside the relevant range. The coefficient estimates related to advertising share and its square indicate a concave relationship between advertising share and magazine demand. In the static model, maximum demand is reached at an advertising share of around

three per cent and in the dynamic model it is even negative. These findings show that consumers have a distaste for advertising.

The parameters on the content concentration index indicate an optimal degree of concentration that is reached at a concentration index of around 0.14 in all specifications.

Results for each of the parameters associated with the 21 content shares variables that are included in each of the specifications are not displayed to conserve space. Instead, the tables contain Wald test for joint significance. Content shares have a highly significant joint effect on magazine demand only in the static model. They are jointly insignificant in the dynamic model. Some of the individual coefficients are, however, significant at the usual significance level in the dynamic model.

In all specifications I find highly significant effects of the three quarter dummies variables and the five dummies for the years 1997–2001.

The parameter ρ, which links past relative market shares to current relative market shares, is highly significantly different from zero and large in magnitude. This may indicate significant learning effects but could also simply be due to relatively high subscription rates.

5.2 Primary interest parameters

The most striking and most important finding related to the estimates of the coefficients of primary interest is that there are no significant effects of website

provision on magazine demand. There are two possible explanations for this result: the first one is that the substitution effect and the complementarity effect just balance out one another. The second is that a magazine's online version and the print edition are independent goods but I cannot distinguish between these two explanations.

The estimation results also show neither significant 'active learning' nor significant 'passive learning' effects. None of the lagged website dummies is significantly different from zero and they are also jointly insignificantly different from zero. Likewise for the interactions with magazine's readership share that regularly uses the internet.

By contrast, I do find highly significant and positive awareness spillover effects coming from other magazines in the own magazine group in all specifications: competing magazines' website presence leads to positive demand spillovers. There are no significant general awareness effects from other women's magazines.

5.3 Comparison to other studies

There are two papers that I am aware of that also analyze the effects of website provision on print media, Argentesi (2003) and Gentzkow (2003). My finding of insignificant effects of website provision on magazine demand is consistent with Gentzkow (2003). Gentzkow uses data on the print and online newspaper readership of consumers in Washington DC and finds that crowding out of print

demand by the online paper is minimal. By contrast, Argentesi (2003) finds a very large decrease in the circulation of Italian daily newspapers of 5.6 per cent. In her paper (which focuses on the effects of supplements on demand), website effects are captured by a simple dummy variable.

5.4 Caveats

There are (at least) six potential caveats about the results presented in this paper. The first is that I do not have information on website traffic. If a magazine's website is of poor quality potential, magazine readers do not visit it and hence there is no relationship between the online version and the print version. One would, however, term the websites I study 'high quality' websites since they are for example very well designed and daily updated, which is not surprising since the websites' technical maintenance is outsourced to professional website design firms.

The second potential caveat is that I also do not have information on what fraction of magazine consumers also visit the corresponding magazine website. The only evidence I have is for the biweekly classical magazine 'Brigitte', for which the publisher claims that 95 per cent of the website visitors also purchase the print copy.[13]

[13]This statement is made on the publisher's website at http://www.ems.guj.de/portfolio/index_fremd.html?http://www.ems.guj.de/portfolio/port.php?id=2&header=brigitte.

The third potential caveat is that there might be significant effects of website provision on some aspects of magazine demand but not on others. For example Bernd Ziesemer, editor–in–chief of the daily 'Handelsblatt', the 'German Financial Times', mentioned in a round table discussion hosted by the German Federal Ministry of Education and Research in Berlin on November 9, 2001: "Most websites are run at a loss. In certain areas, for example in online subscription, website provision actually pays off." This implies that there might be significant effects of website provision on magazine subscription. To test for website effects on subscriptions I have estimated dynamic econometric models with a lagged dependent variable and in first differences using the same sets of instruments as described in Subsection 3.3 and did not find significant effects.

The fourth potential caveat is that the results I find in this paper might not be generalizable for three reasons: (i) website access is free of charge in the market I consider, (ii) internet penetration is lower in Germany than it is in the U.S. (but internet penetration rates are similar across most EU countries) and (iii) articles in the current print edition are not moved to the internet. Inversely, I do believe that my results are generalizable to other magazine markets that also offer free website access, do not make the articles of the current print version available online and for countries that have similar internet penetration rates. That is to say I believe that they are applicable to most other European magazine markets. I also do not think that focussing attention to women's magazines is a severe restriction. As mentioned earlier, women's magazines were the front–runners in

launching websites so that *the* market to look if one ones to study website effects and website learning effects.

The fifth potential caveat is that I might not have included all relevant magazines in my analysis. I.e. there might be other magazines in the German magazine market that could be substitutes to the magazines I consider in this paper. My first line of defense is that my market definition is borrowed from industry professionals who I believe to know their market well. My second line of defense builds on the very definition of women's magazines: it is primarily read by women. I use the 'Arbeitsgemeinschaft Media–Analyse' data I introduced in Section 4 to check if there are magazines around that have a primarily female readership and that I did not include in my analysis. The first descriptive finding is that the mean (median) share of females readers is 86.7 (88.5) per cent for women's magazines and 48.8 (50) per cent for non–women's magazine. The second descriptive finding is that there are eleven non–women's magazines that have a female readership share of more than 80 per cent — these eleven magazines could indeed by substitutes to the magazines I consider in this paper. All eleven magazines, however, very narrowly focus on a single issue such as handicraft, cooking, children and fiction, with one of these content shares making more than 80 per cent of the magazine. This is in sharp contrast to the magazines I consider, where none of the magazines ever had a single content share of more than 20 per cent, suggesting that magazines with a narrow focus are not good substitutes for the magazines I include in my analysis.

The sixth potential caveat might lie in the fact that none of the magazines inside the 'yellow' magazine group maintains a website, which could influence the estimation results. Leaving the magazines from this magazine group out in the estimation did not qualitatively change the estimation results at all.

6 Summary and conclusions

There are two answers to the main question this paper asks: "What happens to demand if magazines go online?". The first is that there is no significant effect of own website provision on own magazine demand. There are two candidate causes for this finding that I cannot, however, separately identify: (i) the substitution effect between the online version and the print version on the one hand and the demand–inducing quality–improvement effect from maintaining a website on the other hand just balance out and (ii) a magazine's online version and its print edition are independent goods.

The second answer is that there are significant effects from *other* competitors' website presence on own magazine demand indicating significant awareness spillovers.

The approach of the paper is empirical. I estimate two different econometric variants of the 'nested logit' model for differentiated product demand, a standard static model and a dynamic model that allows for delayed adjustment of magazine demand due to changes in magazine characteristics. In my most basic specification of the effects of website provision on magazine demand the website

effect is implemented by a simple dummy variable that indicates website presence. In more flexible specifications I also allow for 'passive' consumer learning by including also lagged website dummies and 'active learning' where I interact the lagged website dummies with the share of a magazine's readers that regularly use the internet. My econometric models do not find significant evidence for either effect.

The econometric models also consider two different types of 'awareness spillovers'. The first one measures how many womens' magazines (other than the magazine in question) are online at a given point in time. The second one measures how many women's magazines in the own magazine group (again other than the magazine in question) — i.e. direct competitors — are online. I do not find significant effects of the general awareness variable but I do find significant effects of awareness spillovers coming from direct competitors.

Further research will primarily focus on evaluating effects of website provision on magazine profitability. Even though there are only small and insignificant effects of website provision on magazine demand it might well be that there are indirect effects on magazine profitability through the circulation–advertising spiral: a small change in circulation might lead to significant changes in advertising revenue and hence on magazine profits. At the same time advertisers might view a magazine's website presence as a magazine quality signal.

Table 1: Women's magazine online history

Group 1: monthly high priced magazines	
Elle	I/1996
Vogue	III/2000
Group 2: monthly medium priced magazines	
Allegra	I/1996
Amica	I/1997
Cosmopolitan	I/1998
Petra	III/2000
Group 3: biweekly classical magazines	
Brigitte	IV/1997
Freundin	I/1996
Für Sie	I/2001
Journal für die Frau	I/2001
Group 4: weekly advice–giving magazines	
Bild der Frau	II/2001
Group 5: 'yellow' magazines	
no magazine online	
Group 6: girl's magazines	
Bravo Girl	II/2001
Brigitte Young Miss	II/1999
Joy	IV/2000

Table 2: GMM estimation results for the static model (i): secondary interest parameters

	Simple dummy		Simple dummy & lagged dummies		Simple dummy & lags & interaction	
	Coeff.	***p*–value**	**Coeff.**	***p*–value**	**Coeff.**	***p*–value**
'Key' demand parameters						
α	-0.4789	0.000	-0.4792	0.000	-0.4847	0.000
$\alpha_{\text{no own income}}$	-0.9971	0.000	-0.9915	0.000	-1.0001	0.000
σ	0.6220	0.000	0.5920	0.000	0.5794	0.000
Other utility components						
ln(ed. pages)	-1.1327	0.236	-1.2712	0.186	-1.2813	0.178
ln(ed. pages)^2	0.1174	0.132	0.1286	0.102	0.1296	0.097
Share ad. pages	1.2768	0.035	1.4215	0.023	1.3734	0.036
Share ad. pages^2	-0.1394	0.850	-0.3949	0.601	-0.2439	0.758
Content conc.	0.0542	0.172	0.0661	0.118	0.0688	0.108
Content conc.^{2}	-0.1852	0.047	-0.2138	0.031	-0.2189	0.030
Wald–tests for joint significance						
	Test-stat.	***p*–value**	**Test-stat.**	***p*–value**	**Test-stat.**	***p*–value**
α's	65.0564	0.000	64.1564	0.000	65.4116	0.000
Ed. pages	55.0587	0.000	51.6179	0.000	52.9876	0.000
Ad. shares	11.6225	0.003	10.7285	0.005	10.8577	0.004
Quarter–dummies	77.9340	0.000	75.6047	0.000	67.3828	0.000
Year–dummies	19.5083	0.002	17.9779	0.003	16.0273	0.007
Content conc.	9.1002	0.011	9.8641	0.007	9.4493	0.009
Content shares	197.5583	0.000	191.9395	0.000	166.0073	0.000
Miscellaneous						
J–test	3.9425	0.684	4.9855	0.546	4.6405	0.591
# of obs.	860		860		860	

Table 2 presents GMM estimates for the static model as in Equation 1. The instruments used in this estimation are described in Subsection 3.3. Parameter α relates to cover prices, $\alpha_{\text{no own income}}$ is associated with the interaction between cover price and the share readers that regularly uses the internet. This variable varies both over time and across magazines. The abbreviations I use in the table are the following: 'ed. pages' – number of editorial pages, 'Share ad. pages' – relation of advertising pages to total number of pages, 'Content conc.' – Hirshman–Herfindahl index of magazine content concentration.

Table 3: GMM estimation results for the dynamic model (i): secondary interest parameters

	Simple dummy		**Simple dummy & lagged dummies**		**Simple dummy & lags & interaction**	
'Key' demand parameters						
α	-0.3962	0.000	-0.4035	0.000	-0.3990	0.000
$\alpha_{\text{no own income}}$	-1.0750	0.000	-1.0909	0.000	-1.0529	0.000
σ	0.7282	0.000	0.6987	0.000	0.6867	0.000
Other utility components						
ln(ed. pages)	-1.9553	0.061	-2.1489	0.050	-2.2928	0.037
ln(ed. pages)^2	0.1832	0.030	0.1974	0.026	0.2095	0.019
Share ad. pages	0.3656	0.535	0.2374	0.716	0.2162	0.741
Share ad. pages^2	0.7595	0.386	1.0160	0.314	1.1037	0.285
Content conc.	0.0377	0.289	0.0552	0.157	0.0522	0.176
Content conc.^{2}	-0.1568	0.057	-0.1960	0.029	-0.1938	0.029
Wald–tests for joint significance						
	Test-stat.	***p*–value**	**Test-stat.**	***p*–value**	**Test-stat.**	***p*–value**
α's	14.8812	0.001	14.0588	0.001	13.3040	0.001
Ed. pages	12.0301	0.002	9.4700	0.009	10.9340	0.004
Ad. shares	6.4825	0.039	6.3849	0.041	6.8125	0.033
Quarter–dummies	502.9093	0.000	529.2904	0.000	496.4205	0.000
Year–dummies	18.7775	0.002	17.7829	0.003	16.9669	0.005
Content conc.	7.6175	0.022	6.9685	0.031	8.2418	0.016
Content shares	23.4175	0.322	22.6083	0.365	24.1969	0.284
Miscellaneous						
J–test	11.5205	0.715	13.8164	0.539	16.3990	0.356
# of obs.	821		821		821	

Table 3 presents GMM estimates for the dynamic model as in Equation 2. The table presents the long–run coefficients. Corresponding asymptotic standard errors have been calcluated using the 'Delta–method'. The instruments used in this estimation are described in Subsection 3.3. Parameter α relates to cover prices, $\alpha_{\text{no own income}}$ is associated with the interaction between cover price and the share readers that regularly uses the internet. This variable varies both over time and across magazines. The abbreviations I use in the table are the following: 'ed. pages' – number of editorial pages, 'Share ad. pages' – relation of advertising pages to total number of pages, 'Content conc.' – Hirshman–Herfindahl index of magazine content concentration.

Table 4: GMM estimation results for the static model (ii): primary interest parameters

	Simple dummy		**Simple dummy & lagged dummies**		**Simple dummy & lags & interaction**	
	Coeff.	***p*–value**	**Coeff.**	***p*–value**	**Coeff.**	***p*–value**
'Total' awareness	0.0039	0.791	0.0074	0.628	0.0091	0.570
Group–awareness	0.0538	0.002	0.0506	0.003	0.0499	0.004
Website_{jt}	-0.0562	0.207	-0.0557	0.413	-0.1163	0.156
Website_{jt-1}			-0.0456	0.471	-0.0101	0.892
Website_{jt-2}			0.0266	0.599	0.0077	0.924
Website_{jt-3}			-0.0110	0.851	0.0295	0.742
Website_{jt-4}			0.0403	0.540	0.0532	0.610
Website_{jt-5}			0.0185	0.769	0.0027	0.978
Website_{jt-6}			0.0071	0.902	0.0143	0.872
Website_{jt-7}			0.0108	0.834	-0.0038	0.963
$\text{Website}_{jt} \cdot \text{share online}_{jt}$					0.0062	0.287
$\text{Website}_{jt-1} \cdot \text{share online}_{jt-1}$					-0.0055	0.320
$\text{Website}_{jt-2} \cdot \text{share online}_{jt-2}$					0.0008	0.785
$\text{Website}_{jt-3} \cdot \text{share online}_{jt-3}$					-0.0018	0.497
$\text{Website}_{jt-4} \cdot \text{share online}_{jt-4}$					-0.0012	0.695
$\text{Website}_{jt-5} \cdot \text{share online}_{jt-5}$					0.0012	0.673
$\text{Website}_{jt-6} \cdot \text{share online}_{jt-6}$					-0.0004	0.863
$\text{Website}_{jt-7} \cdot \text{share online}_{jt-7}$					0.0008	0.736
Wald–test for joint significance of website–effect						0.644
	Test-stat.	***p*–value**	**Test-stat.**	***p*–value**	**Test-stat.**	***p*–value**
Joint significance	—	—	5.2879	0.726	10.341	0.848

Table 4 presents continues the presentation of the GMM estimates results of the static model from Table 2 by displaying the parameter estimates that relate to the effects of website provision on magazine demand. The dummy variable The variable Website_{jt-k} denotes a dummy variable that is coded one if the jth magazine had a website at time period $t-k$. The variable $\text{share online}_{jt-k}$ denotes the share of magazine j's readers that was online in time period $t-k$.

Table 5: GMM estimation results for the dynamic model (ii): primary interest parameters

	Simple dummy		Simple dummy & lagged dummies		Simple dummy & lags & interaction	
	Coeff.	p–value	Coeff.	p–value	Coeff.	p–value
'Total' awareness	-0.0210	0.274	-0.0254	0.247	-0.0220	0.315
Group-awareness	0.0550	0.002	0.0518	0.006	0.0525	0.005
Website_{jt}	-0.0605	0.217	0.0028	0.976	-0.0621	0.637
Website_{jt-1}			-0.0780	0.424	-0.0415	0.785
Website_{jt-2}			-0.0155	0.867	-0.1028	0.465
Website_{jt-3}			-0.0592	0.515	0.1589	0.318
Website_{jt-4}			0.0657	0.534	0.0542	0.740
Website_{jt-5}			0.0490	0.651	0.0471	0.777
Website_{jt-6}			0.0023	0.978	-0.0970	0.448
Website_{jt-7}			0.0038	0.949	0.0435	0.633
$\text{Website}_{jt} \cdot \text{share online}_{jt}$					0.0033	0.703
$\text{Website}_{jt-1} \cdot \text{share online}_{jt-1}$					0.0048	0.602
$\text{Website}_{jt-2} \cdot \text{share online}_{jt-2}$					0.0055	0.256
$\text{Website}_{jt-3} \cdot \text{share online}_{jt-3}$					-0.0106	0.071
$\text{Website}_{jt-4} \cdot \text{share online}_{jt-4}$					0.0018	0.705
$\text{Website}_{jt-5} \cdot \text{share online}_{jt-5}$					0.0003	0.956
$\text{Website}_{jt-6} \cdot \text{share online}_{jt-6}$					0.0046	0.336
$\text{Website}_{jt-7} \cdot \text{share online}_{jt-7}$					0.0017	0.649
Wald–test for joint significance of website–effect						
	Test-stat.	**p–value**	**Test-stat.**	**p–value**	**Test-stat.**	**p–value**
Joint significance	—	—	4.6156	0.798	24.197	0.284

Table 5 presents continues the presentation of the GMM estimates results of the dynamic model from Table 3 by displaying the parameter estimates that relate to the effects of website provision on magazine demand. The dummy variable The variable Website_{jt-k} denotes a dummy variable that is coded one if the jth magazine had a website at time period $t-k$. The variable $\text{share online}_{jt-k}$ denotes the share of magazine j's readers that was online in time period $t-k$.

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