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E-shopping in the Netherlands: does geography matter?

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Abstract. Why consumers shop via the Internet, is a frequently asked question. As yet, the impact of spatial variables on e-shopping has received little attention. In this paper we report our investigation of the spatial distribution of Internet users and online buyers in the Netherlands for the time period 1996 – 2001 and the impact of spatial variables (residential environment and shop accessibility) on e-shopping. Two hypotheses are tested empirically. The first is that e-shopping is a predominantly urban phenomenon, because new technology usually starts in centres of innovation (innovation-diffusion hypothesis). The second is that people are more likely to adopt e-shopping when their accessibility to shops is relatively low (efficiency hypothesis). Our findings indicate that Internet use and online buying are still largely urban phenomena in the Netherlands, but that there is a trend towards diffusion to the weakly urbanised and rural areas. Not only the innovation diffusion hypothesis, but also the efficiency hypothesis is confirmed by our findings. People living in a (very) strongly urbanised area have a higher likelihood of buying online, but people with a low shop accessibility buy more often online. The analysis also shows that the support for the two hypotheses depends on the type of product. Airline tickets are still mainly bought in very strongly urbanised areas, whereas compact discs, videos, DVDs, and clothing are bought relatively more often in weakly urbanised areas. In conclusion, geography seems to matter for e-shopping.

1 Introduction

The use of the Internet is expanding very quickly. In 2002, with more than 5000 Internet users per 10 000 inhabitants, Internet use was highest in the USA, South Korea, Singapore, the Scandinavian countries (including Iceland), and the Netherlands (ITU, 2003). The Internet offers many opportunities to participate 'at a distance' in such activities as telecommuting, e-banking, and online shopping. With the emergence of the Internet, a new shopping channel has become available for all parts of the shopping process, such as searching for product information, communication and selection, transaction, delivery (of digital goods), and after sales. We define online shopping, or e-shopping, as *searching and/or purchasing consumer goods and services via the Internet* (Mokhtarian, 2004). In this paper we focus on B2C (business-to-consumer) e-commerce, which means that person-to-person websites such as eBay are not included. Because the majority of products that are bought online are non-daily goods [for example, books, compact discs (CDs), and clothing], this study is primarily about the adoption of e-shopping for this product category.

E-shopping can be seen as a disruptive process innovation that can make existing business models obsolete. The history of retailing is replete with these innovations, such as the introduction of department stores and mail order. In the early days,

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e-shopping was mainly the domain of pure-play (that is, virtual) e-tailers and major mail order companies, of which the latter could easily adopt the new technology because the process of selling over distance was already part of their routine (Boschma and Weltevreden, forthcoming). This stage was followed by the exodus of many pure-play e-tailers, who were unable to achieve profitability, and the rise of traditional retailers that pursued a dual or multichannel strategy by operating an online store alongside their physical stores (Wrigley et al, 2002).

Among US Internet users, those who had ever bought online has grown from 48% (about 41 million Americans) in 2000 to 61% (about 67 million Americans) in 2002—an increase of 63% (Pew Internet and American Life Project, 2004). In the Netherlands nearly half (48%) of the Internet users (8.5 million people) have ever bought a product online (Thuiswinkel.org, 2004). The total amount of online retail sales in 2002 in the Netherlands was nearly €980 million, which is approximately 1.2% of the total retail sales (Thuiswinkel.org, 2004). The share of e-shopping in total retail sales is thus rather small. However, the growth figures are impressive. Whereas the average annual increase of total retail sales was only 3.8% between 1999 and 2002, online retail sales underwent an average annual growth of 138% in the same period. Further growth of this new form of commerce could have implications for the spatial distribution of economic activities. E-shopping, for instance, could alter consumers' physical shopping patterns, a change which would have implications for the function of shopping centres. Insight is therefore needed both into the spatial diffusion of e-shopping and into the factors that determine the adoption of e-shopping.

Research concerning the adoption of e-shopping has been driven largely by disciplines outside geography, such as marketing. To date, little geographical research has been conducted concerning the spatial distribution of e-shoppers and the explanatory value of spatial variables for e-shopping behaviour. In this paper we have sought to fill these gaps. Our goal was therefore twofold. First, we have described how Dutch Internet users and online buyers were spatially distributed in 1996 and 2001. Second, we have ascertained the explanatory value of spatial variables (residential environment and accessibility to shops) for e-shopping behaviour in the Netherlands in 2001.

According to Aoyama (2003, page 1206) "the sociospatial dimensions that shape technological adoption in a society involve an interplay between consumer behavior and urban form, the relationships of which are at times contradictory, at times cumulative." Anderson et al (2003) formulated two hypotheses concerning the impact of spatial variables on e-shopping. On the one hand, e-shopping can be treated as a mainly urban phenomenon, because new technology usually starts in centres of innovation (see also Graham and Marvin, 1996). Consumers in urban areas are more likely to shop online, because they are younger, better educated, have higher incomes, and are more time constrained. Furthermore, they have a higher social status, make more use of the media, are more inclined to take the initiative, have a more cosmopolitan orientation, actively seek information about innovative products, have higher product awareness, have more contacts with 'agents of change' and are more influenced by others, as Rogers (1983), one of the founding fathers of the innovation-diffusion literature, concluded. The *innovation-diffusion hypothesis* postulates that new innovations follow a conventional pattern from large to small settlements (Hägerstrand, 1967). On the other hand, consumers with a relatively low shop accessibility will adopt e-shopping more rapidly. Via the Internet, consumers with low shop accessibility, such as people living in the country, have access to a larger variety of goods and services and can save both travel time and shopping time. This assertion is referred to as the *efficiency hypothesis*. However, Anderson et al have not tested these hypotheses empirically. This paper reports a first attempt to do so.

In the next section we provide a short review of the determinants of e-shopping and its potential impact on in-store shopping. In section 3 we describe our data and methodology. The spatial distribution of Internet users and online buyers is discussed in section 4, followed by the results of our multivariate analyses in section 5 of e-shopping in general and online buying of certain products in particular. We conclude by summarising the main findings and some points of discussion.

2 Literature review

Most researchers who have investigated the factors affecting the adoption of e-shopping are marketing researchers, who pay scant attention to spatial attributes (for example, Lee, 2002; Lohse et al, 1999; Morganosky and Cude, 2000; Sim and Koi, 2002; Verhoef and Langerak, 2001; Vrechopoulos et al, 2001). Very few geographers have examined e-shopping from a spatial perspective. After combining several datasets, Zmud and Arce (2000) found in a large-scale survey that most online shoppers in the USA reside in metropolitan areas and on the East Coast. However, the authors did not control for sociodemographic or behavioural variables. In their comparative study of Minneapolis, in the USA and Utrecht, in the Netherlands Farag et al (2005) found that Dutch respondents who live far from shops are less likely to buy online. This result suggests that the adoption of e-shopping could probably be better explained by the innovation-diffusion hypothesis than by the efficiency hypothesis. However, Sinai and Waldfogel (2004) found that the further people live from their nearest book or clothing store, the more books or clothing they buy online or via catalogues, relative to their offline expenditure. This finding supports the efficiency hypothesis. Several datasets were combined in this study, containing 29 027 households in metropolitan areas in the USA (Sinai and Waldfogel, 2004). Unfortunately, Sinai and Waldfogel drew no distinction between online shopping and catalogue shopping. This could be a problem because the choices for each channel could be influenced by different factors. Furthermore, differences exist with respect to the means of conveying information and maintaining customer relationships (for example, personalised product offerings) between the two channels (Anderson et al, 2003). Therefore, it is important to distinguish between the shopping modes.

The factors capable of affecting e-shopping can be divided into four sets of characteristics: shopping motives, product characteristics, shopping mode characteristics, and individual characteristics (Farag et al, 2003). The shopping motives (recreational or functional, for example) of individuals affect the decision whether to buy online or to buy in-store (Dijst, 2004; Li et al, 1999). Recreational shoppers are usually attracted more to 'the real thing', whereas time-pressed functional shoppers are more inclined to shop via the Internet. Product characteristics also affect e-shopping. Search goods, such as books and CDs, are more suited to purchase via the Internet than experience goods, such as fresh vegetables (Lee, 2002; Vrechopoulos et al, 2001). Furthermore, consumer intentions to shop online for intangible products, such as computer software or airline tickets, are higher than for tangible products, such as furniture or clothing (Vijayasarathy, 2002). With respect to shopping-mode characteristics, such as the security of transactions and the ease of returning merchandise, e-shopping scores relatively poorly in comparison with in-store shopping, but it does very well on time-saving and flexibility in shopping hours (for example, Lee, 2002; Raijas, 2002). Personal characteristics can be divided into sociodemographic characteristics, attitudes, and past experience. E-shopping is done mainly by young male graduates in professional occupations and on high incomes (for example, Lohse et al, 1999; Sim and Koi, 2002; Vrechopoulos et al, 2001). Another type of profile is prevalent for online grocery shoppers: young, highly educated women with high incomes and at least one child

(Morganosky and Cude, 2000; Raijas, 2002). A positive attitude towards e-shopping, such as the perceived quality of vendors on the Internet, positively affects the intention to buy online (for example, Liao and Cheung, 2001; Shim et al, 2001; Sim and Koi, 2002). The frequency of Internet use, Internet search for product information, and mail-order experience also positively affect the intention to buy online as well as actual online buying behaviour (for example, Liao and Cheung, 2001; Lohse et al, 1999; Shim et al, 2001; Sim and Koi, 2002).

E-shopping facilitates a spatial and temporal fragmentation and recombination of several stages of the shopping process (Mokhtarian, 2004). For example, information can be obtained about a certain product through in-store shopping and the product can be subsequently purchased online. Conversely, the Internet may be used to obtain information about a product, which is then bought in a store. In their study of the impact of online shopping on city-centre shopping behaviour of 3218 Dutch Internet users, Weltevreden and van Rietbergen (2004) found that for the last three online purchases 20% of all Internet users first searched for information in the city centre. The reverse, however, is also apparent. For their last three purchases in the city centre, 15% of all Internet users gathered information online. The coexistence of these two options makes it clear that it is necessary to study consumers' online search behaviour and not only their online buying behaviour. To date, most researchers have focused on explaining online buying rather than online searching. More precisely, their datasets have contained figures on the intention to buy online (for example, Lee, 2002; Li et al, 1999; Lohse et al, 1999; Sim and Koi, 2002; Verhoef and Langerak, 2001). In this study we have not limited ourselves to intentions, but have analysed both actual online searching and actual online buying behaviour. To obtain a better understanding of the adoption of online buying, we have also studied its frequency. However, a limitation of our data involves a lack of some important factors, such as shopping motives and attitudes towards e-shopping, as discussed above.

3 Methodology

3.1 The Dutch retail and transport context

Some background information is given below of the Dutch retail and transport context. First, the Netherlands is a small and strongly urbanised country. The contrast between urban and rural areas in the Netherlands is therefore less than in other major Western countries such as the USA, Canada, France, and Germany. Second, compared with other Western nations, the Netherlands has a more traditional retail structure. Uncontrolled retail growth at the fringes of urban areas was prevented by a restrictive retail planning policy that was in force for more than five decades, and traditional shopping centres were protected. A traditional functional retail hierarchy was perpetuated, without any large-scale hypermarkets or shopping malls (Evers, 2002). At the present time, approximately 51% of all shops in the Netherlands are located in the centres of towns and cities (Locatus, 2003). Furthermore, the Netherlands differs from other West European countries in terms of the share of total distance that is covered by slow transportation modes. In 1990 the share of walking and cycling in the total distance travelled was 12% for the Netherlands compared with 4% for Western Europe as a whole (Schwanen et al, 2004). Of all shopping trips in the Netherlands more than half are made on foot or by bicycle: these modes account for 20% of all the kilometres travelled for the purpose of visiting shops (Dieleman et al, 2002).

3.2 Data employed

To investigate the impact of spatial variables on e-shopping, we used Dutch e-shopping datasets that have been collected annually from 1996 until 2001 by Multiscope. With a panel of more than 100 000 people, Multiscope is one of the leading agencies in online market research in the Netherlands. Respondents, who are all Internet users, were recruited via advertisements in electronic magazines, popups and banners on websites, and from the panel formed by the agency over the years. One must be aware that recruitment via popups and banners could cause self-selection by respondents. As a result, a bias in the data may occur because people with an affinity for the research are more likely to participate (Nauta, 2003). However, this problem also occurs in offline research. To test the reliability of the data, the 2001 Multiscope sample was compared with a nationwide representative sample from Statistics Netherlands (2003; 2004). Overall, both samples show the same pattern with regard to the spatial distribution of Internet users and online shoppers in the Netherlands. In the course of time there were small differences in data-collection methods. Nevertheless, we were able to compare Internet use and online buying in the Netherlands in 1996 and 2001, because the 1996 and 2001 questionnaires had a number of questions about e-shopping in common. In addition, because both datasets included the respondents' four-digit zip codes, we were able to include spatial variables. The 1996 questionnaire resulted in 1172 usable responses. In 2001 a total of 2190 people completed the questionnaire satisfactorily. For the multivariate analyses only the 2001 dataset has been used, because it provides the most detailed information about the e-shopping behaviour of Dutch Internet users. Unfortunately, some important factors, such as attitudes towards e-shopping and in-store shopping, are not available in the dataset.

3.3 Operationalisation of variables

In order to test the innovation-diffusion hypothesis, we used a classification of Dutch municipalities with five categories representing different levels of urbanisation. The classification is based on the number of street addresses per square kilometre (Statistics Netherlands, 2004):

1. very strongly urbanised ($\geqslant$2500 street addresses per km^2): Amsterdam, Rotterdam, The Hague, for example;
2. strongly urbanised (1500 – 2500 street addresses per km^2);
3. moderately urbanised (1000 – 1500 street addresses per km^2);
4. weakly urbanised (500 – 1000 street addresses per km^2);
5. nonurbanised ($\leqslant$500 street addresses per km^2).

Figure 1 (see over) is a map of the Netherlands that displays the location of the five types of residential environment. Most of the (very) strongly urbanised areas are located in the western part of the Netherlands, referred to as the Randstad Holland. The weakly urbanised and nonurbanised areas of the Netherlands are located largely in the north and the southwest of the country.

An important assumption of the innovation-diffusion hypothesis is that different types of people live in urbanised and rural areas. We checked whether this was indeed the case for our sample. Chi-squared tests of sociodemographic and behavioural variables across the residential environments indicate that in (very) strongly urbanised areas residents are significantly more often young, highly educated, single or a couple without children, hold a job, own a credit card, and have more Internet experience than residents in weakly urbanised and rural areas. However, the inhabitants of less urbanised settlements more often have home shopping experience (via catalogue or telephone, for example) than do residents in (very) strongly urbanised settlements. We can, therefore, conclude that different types of people live in urbanised and rural areas:

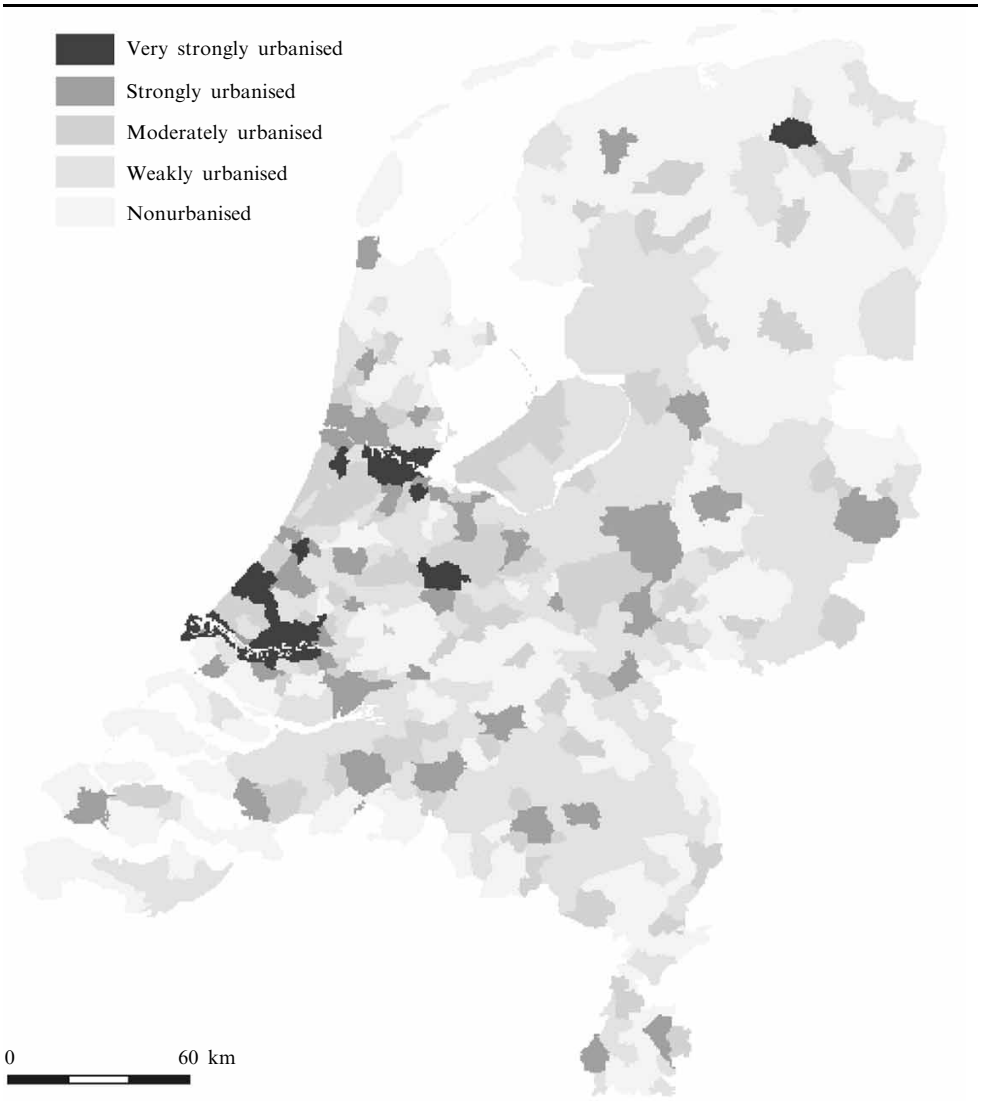

Figure 1. Urbanisation in the Netherlands in 2001 (source: Statistics Netherlands, 2004).

their sociodemographic and behavioural characteristics would lead urban residents to be considered more likely to innovate than rural residents.

To test the efficiency hypothesis, we developed several shop-accessibility measures using Flowmap version 7 (Van der Zwan et al, 2003). We used retail data from the Netherlands Institute for Spatial Research that had been collected by Locatus, a research agency that collects retail data in the Netherlands. This dataset contains the total number of shops for both daily and nondaily shopping goods and the total floor space in square metres per zip code. The retail data also include the number of shops per zip code differentiated by retail category. Analyses could therefore be conducted for individual products that are frequently bought online. We were able to develop the shop-accessibility measures by combining the retail data at the zip code level (destination) with the respondent's zip code (origin) and a roadmap of the Netherlands (street-network-based travel distances). We used a regular proximity count, which calculates the total number of shops for nondaily goods a respondent can reach by car from the place of residence in a certain time distance, ranging from 5 to 45 minutes.

As the Netherlands is a small and strongly urbanised country, we did not include the total number of shops a respondent could reach by car in more than 45 minutes. Neither did we calculate accessibility measures for daily goods, because consumers in our sample bought mainly nondaily goods via the Internet. This is consistent with the findings of other e-shopping surveys (for example, NIPO, 2001; Statistics Netherlands, 2003). Besides proximity counts, we also calculated gravity measures, which give comparable results with the proximity counts in the analysis discussed below. For that reason these gravity measures have been left out of the analysis. Additionally, we looked not only at the number of shops, but also at the amount of floor space in square metres that a respondent could reach by car; again, this yielded similar results.

In order to analyse the impact of spatial variables on e-shopping, we took into account the adoption of online searching and online buying, as well as the number of online purchases made in 2000. We calculated binomial logistic and ordinary least squares regression models to explain these dimensions of e-shopping. In all the analyses we used sociodemographic, spatial, and behavioural variables. The sociodemographic variables include gender (male = 0, female = 1), age (in years, continuous variable), level of education (low, medium, high) income (low, medium, high), household composition (singles, households without children, households with children), and employment situation (0 = nonworker, 1 = worker). The spatial variables include shop accessibility (the number of shops for nondaily goods within reach of the respondent's home in a certain amount of time by car), and residential environment (five urbanisation categories, see figure 1). Finally, the behavioural variables include Internet experience (Internet experience in years, continuous variable), frequency of Internet use (in hours per week), credit card ownership (0 = no, 1 = yes), and home shopping experience (via catalogue, telephone, television, or fax (0 = no, 1 = yes). All discrete variables on a nominal or ordinal level were turned into dummy variables for the multivariate analysis. The final binomial logistic regression models were constructed after log-likelihood tests had been carried out to check whether the statistical significance of the model deteriorated when insignificant variables were left out. For this reason, some nonsignificant variables have been left in the final models.

4 The spatial distribution of Internet users and online buyers in the Netherlands

In this section the spatial distribution of Internet users and online buyers in the Netherlands is described for the years 1996 and 2001. In addition, we compare the distribution of Internet users and online buyers with the distribution of the total population in the Netherlands (see table 1, over). This descriptive analysis was performed to give a first indication of whether the innovation-diffusion hypothesis could be supported for online buying.

In contrast with the population as a whole, in 1996 Internet users and online buyers were both concentrated in (very) strongly urbanised areas. Also, in that year 40% of the total population and approximately 60% of the Internet users and online buyers were located in the (very) strongly urbanised areas. In 1996 the weakly urbanised and nonurbanised areas, with 43% of the total population, accommodated only approximately 20% of the Internet users and online buyers. As mentioned in section 2, we have distinguished between *searching* online and *buying* online. Buying products via the Internet can be further characterised by frequency. The occurrence of these different types of e-shopping behaviour by urbanisation level is shown in table 2 (see over).

Half the sample searches online without buying online. Slightly more than half of the sample had bought online, and one fifth had done so frequently. Nearly half of the sample had made their first online purchase before the year 2000. Of the people who had ever bought online, approximately 5% did not buy online again. Most online

Table 1. The spatial distribution of online buyers and Internet users compared with the total population in the Netherlands in 1996 and 2001.

Residential environment	1996 (%)			2001 (%)			Change 1996–2001 index: 1996 = 100		
	online buyers	Internet users	total population[a]	online buyers	Internet users	total population[a]	online buyers	Internet users	total population[a]
Very strongly urbanised	32.0	31.2	18.2	27.1	24.3	18.8	84.6	77.9	103.3
Strongly urbanised	29.2	27.4	21.7	33.1	34.5	22.3	113.3	125.9	102.7
Moderately urbanised	21.0	20.6	17.2	18.9	19.3	17.5	90.0	93.4	101.3
Weakly urbanised	10.8	13.2	20.5	13.9	13.6	19.9	129.2	102.5	97.1
Nonurbanised	7.1	7.5	22.3	7.1	8.3	21.5	100.1	110.6	96.3
Total	100.0	100.0	100.0	100.0	100.0	100.0			
N	353	1 087	15 567 100	1 086	2 098	15 987 070			

[a] Source: Statistics Netherlands, 2004.

Table 2. Characterisation of e-shoppers by residential environment in 2001 (in row percentages).

Residential environment	Searching online		Buying online		Frequency of buying online[a]	
	yes	total	yes	total	frequent	total
Very strongly urbanised	60	100	58	100	19	100
Strongly urbanised	52	100	50	100	19	100
Moderately urbanised	45	100	51	100	22	100
Weakly urbanised	46	100	53	100	26	100
Nonurbanised	51	100	43	100	28	100
Total	51	100	52	100	21	100
N	973		2110		735	
χ^2	9.888*		14.254**		4.496	
Dependent variable	Yes = searched online and never bought online		Yes = ever bought online		Frequent = at least 1 purchase per 2 months	

*$p < 0.05$, **$p < 0.01$.
[a] Among the people who ever bought online.

searching is done in (very) strongly urbanised areas. In very strongly urbanised areas people are more likely to buy online (58%). However, as table 2 shows (although the differences are not statistically significant), people living in nonurbanised areas buy most frequently online (28%); the comparative share of people living in (very) strongly urbanised areas was 19%.

An important question is: what do people purchase when using the Internet as a shopping mode? Table 3 presents an overview of the five products most frequently purchased online according to residential environment. Other less frequently bought products include cinema or theatre tickets, flowers, gifts, games, and collectors' items.

Table 3. Purchase of products by urbanisation category in 2001 (percentage of online buyers per urbanisation category).

	Books	CD/Video/DVD	Clothing	Travel tickets	Hardware and software
Very strongly urbanised	30	32	11	20	16
Strongly urbanised	27	30	10	14	17
Moderately urbanised	33	34	15	13	20
Weakly urbanised	33	36	14	11	16
Nonurbanised	29	29	16	5	12
Total	30	32	12	15	17
N	1090	1091	1090	1092	1091
χ^2	3.459	3.270	5.041	14.766**	3.130

**$p < 0.01$.

Daily goods such as groceries, and health and personal care products were hardly ever bought online by Dutch e-shoppers in 2001.

Table 3 shows that, in the Netherlands, goods such as CDs and books, which are the most often searched for online, also have the highest proportion of online purchasers; this finding is in accordance with the results of Lee (2002) in Singapore and Vrechopoulos et al (2001) in Greece. Online buying seems to be related to residential environment. In general, with the exception of clothing, the residents of nonurbanised municipalities are less likely to have bought products online than are the residents of other municipalities. This finding could be explained by the greater home shopping experience (for example, via catalogue) in the less urbanised areas of the country. Originally, this shopping mode mostly offered clothing. Ward (2001) found that online shopping and catalogue shopping tend to be positively correlated, and asserts that online shopping is a closer substitute for catalogue shopping than for in-store shopping. There seems to have been a shift from catalogue shopping to online shopping (Thuiswinkel.org, 2004). Table 3 also shows that buying travel tickets online is quite popular in the very strongly urbanised settlements.

On the basis of these descriptive results, it seems that Internet use and online buying are marginally stronger in urban areas in the Netherlands. However, a small trend towards more convergence between the urbanisation categories can be observed. This convergence seems to confirm the innovation-diffusion hypothesis. On the other hand, we have shown that the frequency of online buying tends to be higher in less urbanised areas. The inhabitants of these areas seem to compensate for low shop accessibility by shopping via the Internet. These results should, however, be treated with some caution, because they could also be influenced by small differences between the data-collection methods used in 1996 and 2001. Furthermore, these results have not been corrected for sociodemographics or behavioural attributes. This correction is the subject of the next section.

5 E-shopping and the explanatory value of spatial variables

From the short review of the literature presented in section 2, it is evident that, besides spatial attributes, sociodemographics and behavioural attributes are also related to e-shopping. We estimated some models to determine which of the two hypotheses (the innovation-diffusion hypothesis or the efficiency hypothesis) was most capable of explaining the spatial distribution of e-shopping. First, we discuss three models of searching online, buying online, and frequency of online buying. We then discuss the models for buying specific products online.

As shown by ρ^2 and R^2, the performance of the three models is relatively poor, especially for searching online and the frequency of buying online (see table 4). Consequently, only part of the variation in e-shopping can be attributed to differences in the personal, household, residential environment, or behavioural variables included in the literature and in our models. The model for online searching shows that men, more highly educated people, and those with Internet experience are significantly more likely to search for product information online. People living in very strongly urbanised areas are significantly more inclined to search online than are people living in other areas.

The model for online buying confirms findings from earlier research in the sense that being male, having a high educational level, a credit card, Internet and home shopping experience, and using the Internet frequently, positively affect the probability of buying online. The relationship between online buying and age is not linear: up to the age of 33 years the likelihood to buy online increases; after that age, it decreases. Table 4 also shows that, all else being equal (that is, controlling for sociodemographic and other confounding factors), people in very strongly urbanised areas are more likely to buy online. Hence, in the Netherlands, not only online searching, but also online buying is more often done in urbanised areas. Again, the analysis seems to confirm the basic idea of the innovation diffusion hypothesis, namely that urban consumers are more inclined to adopt innovations and that others living elsewhere follow in due course.

The results of the descriptive analysis concerning the frequency of buying online were also confirmed by the multivariate analysis. If people's accessibility to shops decreases, the number of products bought online increases. In an additional analysis, we found that for people living in nonurbanised areas the number of products bought online increases. Finally, the frequency of online buying is higher for workers, people with Internet and home shopping experience, and frequent Internet users (see table 4). People with a medium-level income buy online less frequently than do people with a low or high level income. Perhaps people with a low income (students, for example) use the Internet more often to buy products at a cheaper price, whereas people with a high income can afford to buy products more frequently online. Thus, in the first case, the Internet may more often replace in-store shopping, whereas in the second, it may more often supplement it. No significant effects were found of household type on e-shopping.

We have also estimated models for several products frequently bought online. Table 5 (see over) includes the models for buying travel tickets, CDs/video/DVDs, and clothing.[1] Although the performance of these models is relatively poor, some interesting conclusions can nevertheless be drawn. The models show that different types of consumers are interested in the three product types. Highly educated people and credit card owners are more inclined to buy travel tickets online. These characteristics are not related, however, to online buying of CDs or clothing. The probability of buying CDs, videos, and DVDs is high for men, young people, households without children, and people with a lot of Internet experience. Clothing is most often bought online by young to middle-aged women with a low to medium level of education. It is striking that Internet experience does not affect the online buying of clothing, whereas it does affect the other product types. This seems to indicate that many of the people who buy clothing online formerly bought it by catalogue. Even though they may not have much Internet experience, they are encouraged by their mail order companies to use this new form of technology; catalogue firms were among the first to appreciate the advantages of the Internet.

[1] We also analysed books and computer hardware and software, but did not find any significant relationships between the spatial variables and online buying of these products.

Table 4. Regression analyses results of e-shopping in 2001.

	Searching online			Buying online			Frequency of buying online	
	B	odds ratio	χ^2 change	*B*	odds ratio	χ^2 change	*B*	β
Sociodemographic variables								
Female	−5.12**	0.600	17.283	−0.465***	0.628	24.351		
Age in years				0.132***	1.141	16.395		
(Age in years)^2				−0.002***	0.998	19.831		
Low educational level	−0.489*	0.613	31.791					
High educational level				0.214#	1.239	50.612		
Medium income							−0.609#	−0.081
High income	0.149	1.161	243.167	0.074	1.077	432.582		
Worker	0.092	1.096	9.682	0.121	1.128	12.797	1.036**	0.132
Spatial variables								
Very strongly urbanised area	0.451*	1.570	33.063	0.215#	1.240	65.166		
Shops (×1000) in 30 minutes by car							−0.037**	−0.109
Behavioural variables								
Internet experience in years	0.191***	1.210	21.399	0.172***	1.188	41.608	0.170*	0.100
Hours of Internet use per week				0.021***	1.021	13.017	0.038*	0.101
Credit card ownership	0.122	1.129	12.677	0.647***	1.910	45.829		
Home shopping experience	0.136	1.145	10.283	0.292**	1.339	50.238	0.593*	0.079
Constant	−0.218	0.804		−3.090***	0.046		3.204***	
Type of model	Logistic regression			Logistic regression			OLS regression	
Dependent variable	1 = ever searched online (N = 381) 0 = never searched online (N = 324)			1 = ever bought online (N = 854) 0 = never bought online (N = 731)			Number of purchases in 2000[a] (continuous)	
Number of cases	705			1585			647	
Degrees of freedom	8			11			6	
R^2							0.055	
Adjusted R^2							0.046	
χ^2	55.333			239.223				
Log-likelihood at convergence	−458.696			−974.250				
Log-likelihood at constant	−486.362			−1093.861				
ρ^2	0.057			0.109				
Adjusted ρ^2	0.040			0.099				

#$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. [a] Among the people who ever bought online.

Table 5. Logistic regression analyses results of online buying of different products.

	Travel tickets			CD/Video/DVD			Clothing		
	B	odds ratio	χ^2 change	*B*	odds ratio	χ^2 change	*B*	odds ratio	χ^2 change
Sociodemographic variables									
Female				−0.324#	0.723	6.987	0.578**	1.782	10.749
Age in years				0.164**	1.178	7.882	0.136*	1.146	4.409
(Age in years)^2				−0.002**	0.998	9.386	−0.002#	0.998	3.685
High educational level	0.658**	1.930	18.107	−0.224	0.800	24.438	−0.470#	0.625	21.870
High income	0.072	1.075	77.250	0.311	1.365	184.884	0.084	1.087	105.930
Household with children				−0.549**	0.578	24.168			
Worker				−0.124	0.884	5.058			
Spatial variables									
Weakly urbanised area				0.317#	1.373	6.746			
Moderately urbanised area							0.0458#	1.581	4.139
Very strongly urbanised area	0.421*	1.523	16.943						
Music stores (× 1000) in 10 minutes by car				−0.011#	0.989	18.936			
Clothing stores (× 1000) in 20 minutes by car							2.6×10^{-4}	1.000	12.807
Behavioural variables									
Internet experience in years	0.076#	1.079	10.467	0.066#	1.068	6.607			
Hours of Internet use per week				0.017*	1.017	4.005			
Credit card ownership	1.017***	2.764	26.667	0.367	1.444	11.741	−0.029	0.971	4.994
Home shopping experience	0.240	1.272	34.718	0.024	1.024	37.607	0.266	1.304	25.894
Constant	−3.388***	0.034		−3.593***	0.028		−4.945***	0.007	
Dependent variable	1 = bought travel tickets online (N = 134) 0 = did not buy travel tickets online (Internet buyers only; N = 728)			1 = bought CD/video/DVD online (N = 258) 0 = did not buy CD/video/DVD online (Internet buyers only; N = 574)			1 = bought clothing online (N = 105) 0 = did not buy clothing online (Internet buyers only; N = 744)		
Number of cases	862			832			849		
Degrees of freedom	6			13			9		
χ^2	60.495			46.941			21.725		
Log-likelihood at convergence	−342.181			−491.686			−306.819		
Log-likelihood at constant	−372.428			−515.156			−317.682		
ρ^2	0.081			0.046			0.034		
Adjusted ρ^2	0.065			0.020			0.006		

#$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

The impact of spatial attributes also varies by product category. The likelihood of buying travel tickets online is higher in the very strongly urbanised settlements. However, for the other two product categories, consumers can be found in moderately urbanised areas (for clothing) or in areas with a low shop accessibility for music stores (for CDs and so forth). This analysis shows that the innovation-diffusion hypothesis applies best to travel tickets, whereas the findings for CDs, videos, and DVDs match the efficiency hypothesis better. We find, as did Sinai and Waldfogel (2004), that people tend to buy certain products more online if they live further away from the stores that sell those products. However, we did not find this effect for books and clothing as they did, but for music. These different results can be attributed to differences in research method, sample characteristics, and the fact that Sinai and Waldfogel (2004) did not distinguish between buying online and buying by mail order.

6 Conclusions

Although e-shopping has recently received considerable attention, especially in marketing literature, very little research has been done as yet to investigate the effect of spatial variables on e-shopping. The title of this paper poses the question whether geography matters for understanding e-shopping in the Netherlands. We investigated for the time period 1996 – 2001 the spatial distribution of Internet users and online buyers in the Netherlands and the impact of spatial variables on e-shopping. We combined data from e-shopping surveys of Internet users with geographical data about residential environment and shop accessibility.

Two hypotheses were formulated concerning the impact of spatial variables on e-shopping. On the one hand, the innovation-diffusion theory predicts that e-shopping is more likely to occur in urban areas, because new technology usually starts in centres of innovation, where consumers live who are more inclined to adopt innovations. On the other hand, the efficiency hypothesis predicts that e-shopping is more likely to occur when people's accessibility to shops is relatively low. Although the impact of the spatial attributes (type of residential environment and shop accessibility) varies for the different stages of the e-shopping process and for the type of product, we found indications that geography does indeed matter for e-shopping.

Our findings indicate that Internet use and online buying tend to be urban phenomena in the Netherlands, although a small trend can be observed of more diffusion of Internet use and online buying into the weakly urbanised and rural areas. E-shopping seems to be following a traditional innovation-diffusion pattern, which suggests that it is likely to grow in these areas in the near future. We also found that both residential environment and shop accessibility had an impact on e-shopping, after sociodemographic and behavioural variables had been controlled for. That is to say, our findings supported both the innovation-diffusion hypothesis and the efficiency hypothesis. On the one hand, people living in a very strongly urbanised area are more likely to search online and/or to buy online. On the other hand, people with low shop accessibility, as in less urbanised or nonurbanised areas, buy more products online. The analyses also show that the support for the two hypotheses depends on the type of product. Buying travel tickets online supports the innovation-diffusion hypothesis, whereas buying CDs and similar products online is more likely in areas with a low shop accessibility.

If e-shopping becomes more widespread in the Netherlands, physical shops may experience a loss of revenues. This revenue decline is expected to be larger in rural areas than in urban areas because consumers with a low shop accessibility buy more (nondaily) products online. This may lead to the closing of shops or a process of cumulative deterioration, which is characterised by growing online sales combined with a declining shop accessibility in rural areas. Weltevreden and van Rietbergen (2004)

found that for nondaily goods, such as books and CDs, 8% to 12% of all e-shoppers already buy those products less often in-store because of online shopping. On the other hand, Farag et al (2005) found that online buyers make more shopping trips than do nononline buyers, which seems to imply that more shopping trips are likely to occur if e-shopping continues its popularity, rather than fewer shopping trips. Thus, a change in travel patterns given the trends in e-shopping would entail generation rather than substitution. However, which process ultimately will take place depends largely on the product involved and the (locational) characteristics of the e-shopper.

With regard to the importance of geography for understanding e-shopping, progress in future research lies in three areas. First, future research should include a more complete set of explanatory variables, such as attitudes towards e-shopping and in-store shopping. A limitation of this study is the incomplete dataset. The effects of spatial attributes on e-shopping that we found, could perhaps be proxies for such attitudinal effects. Individuals might self-select into residential locations consistent with their attitudes. Additionally, different dimensions of choice behaviour (searching online and buying online, for example) should be analysed jointly in order to reduce the chance of bias in model estimations. Second, a future study could incorporate more refined and behaviourally sound accessibility measures at the neighbourhood level. Most conventional accessibility measures "ignore the role of individual time-budget and space–time constraints in determining personal accessibility" (Kwan, 1999, page 212). To overcome this problem, researchers should seek to include space–time accessibility measures in their analyses (Dijst and Kwan, 2005). Third, future research should feature a comparison between countries that vary in urbanisation patterns. The Netherlands is a small, highly urbanised country, where even in rural areas consumers have relatively good shop accessibility in comparison with larger countries such as Germany, the United Kingdom, Canada, or the USA. In these countries, with more spread out populations and high Internet use, the impact of spatial variables on e-shopping could be greater than in the Netherlands.

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