

This article was downloaded by: [Swets Content Distribution]

On: 14 October 2008

Access details: Access Details: [subscription number 902276281]

Publisher Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Transport Reviews

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713766937>

### E-Shopping and its Relationship with In-store Shopping: Empirical Evidence from the Netherlands and the USA

Sendy Farag <sup>a</sup>; Kevin J. Krizek <sup>b</sup>; Martin Dijst <sup>a</sup>

<sup>a</sup> Urban and Regional Research Centre Utrecht (URU), Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands <sup>b</sup> Urban and Regional Planning Program, Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis, MN, USA

Online Publication Date: 01 January 2006

**To cite this Article** Farag, Sendy, Krizek, Kevin J. and Dijst, Martin(2006)'E-Shopping and its Relationship with In-store Shopping: Empirical Evidence from the Netherlands and the USA',*Transport Reviews*,26:1,43 — 61

**To link to this Article:** DOI: 10.1080/01441640500158496

**URL:** <http://dx.doi.org/10.1080/01441640500158496>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## E-Shopping and its Relationship with In-store Shopping: Empirical Evidence from the Netherlands and the USA

SENDY FARAG\*, KEVIN J. KRIZEK\*\* and MARTIN DIJST\*

\*Urban and Regional Research Centre Utrecht (URU), Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands \*\*Urban and Regional Planning Program, Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis, MN, USA

(Received 19 April 2004; revised 7 January 2005; accepted 7 March 2005)

**ABSTRACT** *Despite considerable examination of the impact of telecommunications on travel, little empirical evidence sheds light on the impact of e-shopping on travel—a recent and increasingly popular form of telecommunications. This paper analyses determinants of online buying and their relationship with in-store shopping, using empirical data obtained from Minneapolis, USA, and Utrecht, the Netherlands. Based on chi-square tests and logistic and ordinary least-squares regressions, the results indicate that online buying is affected by sociodemographics and spatial characteristics of people, their Internet experience, and their attitudes towards in-store shopping. US respondents who prefer to see products in person are less likely to buy online. Dutch respondents are more likely to buy online as travel times to shops are shorter. At first sight, this counterintuitive result might be related to an urban, innovative lifestyle that supports e-shopping. A more detailed analysis of Dutch online buyers reveals that they make more shopping trips than non-online buyers and have a shorter shopping duration. The results indicate that the relationship between online buying and in-store shopping is not one of substitution but of complementarity.*

### Introduction

New forms of information and communications technology (ICT) are emerging as primary forces influencing people's daily activities. Such developments include computers equipped with faster and cheaper microchips, increased transmission speeds for the Internet, a growth in the number of web-pages on the Internet, and portable wireless equipment. Published work to date examining relationships between ICT and travel has been pursued from a variety of perspectives. One need only to refer to previous reviews (e.g. Salomon, 1986; Mokhtarian and Salomon, 2002; Golob, 2001) to glean a better understanding of the range of issues associated with this general line of inquiry. But such reviews are limited in part

---

*Correspondence Address:* Sendy Farag, Urban and Regional Research Centre Utrecht (URU), Faculty of Geosciences, Utrecht University, PO Box 80115, NL-3508 TC Utrecht, the Netherlands. Email: s.farag@geo.uu.nl; m.dijst@geo.uu.nl

because the bulk of most of the literature focuses on one aspect of ICT–travel relationships: the work commute.

Everyday use of ICT is now infiltrating shopping and banking, as evidenced by the following statistics showing burgeoning rates of use. For example, the Boston Consulting Group (2002) estimates that online retailing in North America alone totalled US\$27 billion in 1999 and US\$45 billion in 2000. While this figure still comprises a relatively insignificant margin of total retail sales (1.7%), its amount has increased by over 67% since 1999. While most e-commerce forecasters anticipate that the sheer growth in proportion of sales will likely subside, the availability of such services is likely to be of increasing impact on retailing. One need only examine trends in personal use. Among US Internet users alone, those who had ever bought online has grown from 48% (about 41 million people) in 2000 to 61% (about 67 million people) in 2002—an increase of 63% (Pew Internet and American Life Project, 2004). In the Netherlands, nearly half (48%) of Internet users (8.5 million people) have ever bought a product online. The total turnover of online purchases in 2003 rose by 32% to €1.24 billion compared with 2002 (Thuiswinkel.org, 2004).

While e-shopping is widespread in many developed countries, little research to date has empirically tackled this phenomenon head on. This paper, therefore, focuses on one dimension of the ICT–travel relationship: shopping via the Internet and its potential to affect household in-store shopping. It analyses the determinants of online buying as well as their relationship to in-store shopping. To do so, the paper employs data from two independent administered surveys: one in the city of Utrecht, the Netherlands; the other one in and around the city of Minneapolis in Minnesota, USA. Although the sampling and survey methods were different, similar research questions relating to electronic and in-store shopping make a comparison between the USA and the Netherlands ripe for analysis.

Such a comparison can increase one's insight into the impact of different socio-cultural and urban contexts on e-shopping. The USA and the Netherlands differ fundamentally in their urbanization pattern. In the Netherlands, smaller cities and medium-sized towns predominate; many cities have historic cores with high densities and mixed land use that stimulate walking, cycling and the use of public transport (Schwanen *et al.*, 2002). The two countries also differ in retailing structure. Since 1973, Dutch retail policy has been highly effective in prohibiting the establishment of out-of-town hypermarkets and shopping malls. These were encountered as a threat to the vitality of town centres and likely to generate extensive private car use. As a consequence, in contrast to the USA, many shops in the Netherlands are still within the built-up areas of cities and towns, and within walking and cycling distance for local residents (Evers, 2002).

The next section reviews the determinants of e-shopping and its potential impact on in-store shopping. The third section describes the surveys and employed methodology. The determinants of online buying are analysed in the fourth section; the relationship between online buying and in-store shopping is analysed in the fifth section. A concluding section summarizes the main points.

## Background Literature

E-shopping has been parsimoniously defined as an activity to buy or receive information about consumer goods via the Internet (Mokhtarian, 2004). Using this definition as the basis, two questions help the focus of the analytical part of this paper: (1) the importance of different factors influencing online purchasing behaviour, and

(2) the relationship between online buying and in-store shopping. A quick review of the literature suggests several background factors are important to consider.

First, online purchase behaviour is related to sociodemographics. Previous study has shown that in general, most online buyers are male; however, most online grocery shoppers are female (Casas *et al.*, 2001; Vrechopoulos *et al.*, 2001; Morganosky and Cude, 2000; Raijas, 2002; Farag *et al.*, 2003). Age is inversely related to e-shopping in a non-linear manner; people up to the age of 40 are inclined to buy online, while the probability of buying online decreases after that age (Vrechopoulos *et al.*, 2001; Farag *et al.*, 2003). Not surprisingly, individuals with a higher income and education shop online more often (Casas *et al.*, 2001; Vrechopoulos *et al.*, 2001; Sim and Koi, 2002). Other factors appear to be inconclusive. Some studies find a positive relationship between shortage of time and the intention to buy online, while others do not find such a relationship (e.g. Verhoef and Langerak, 2001; Sim and Koi, 2002).

Besides sociodemographics, the supply of shopping opportunities in one's residential environment could affect e-shopping. The Internet could compensate for rather scarce retail opportunities offered in non-urban settings. Farag *et al.* (2005) tested the impact of residential environment and shop accessibility on e-shopping for the Netherlands, controlling for sociodemographics and behavioural attributes. They found that residents of strongly urbanized areas have a higher likelihood of buying online, but that people with a low level of shop accessibility buy more often online. However, Krizek *et al.* (2004b) suggest that the spatial attributes such as retail accessibility or distance to central business districts do not strongly influence the propensity to engage in online behaviour.

Finally, behavioural and attitudinal variables affect e-shopping. Internet experience and frequency of Internet use have a positive effect on buying online (Liao and Cheung, 2001; Sim and Koi, 2002). A positive attitude towards e-shopping, such as the perceived quality of vendors on the Internet, also stimulates the use of the Internet for shopping purposes (Shim *et al.*, 2001; Sim and Koi, 2002). The possibility to obtain products cheaply is also an important motivation for e-shopping (Swinyard and Smith, 2003).

Based on this short review of the literature, formulated below are hypotheses describing the impact of four clusters of variables that affect online buying. The first line of enquiry investigates online purchase behaviour. It is expected that the variables have the following relationships to the prevalence of online buying, here measured by 'ever bought online', where '+' is a positive impact and '-' is a negative impact:

Sociodemographics: + male; - age; + education; + income; + time-pressured.

Spatial: + low accessibility of shops.

Behavioural and attitudinal: + Internet experience; - prefer to previewing products before buying.

The second focus of this paper is the relationship between online buying and in-store shopping. As articulated by Salomon (1985, 1986), these interactions could play out in a variety of ways:

- Substitution of shopping travel refers to the elimination of trips—trips that are no longer required as a result of participation in e-shopping.
- Modification refers to travel that is likely to be altered: in the context of this publication primarily by a shift in the duration of shopping and types of shops visited.

- Generation refers to any generation of shopping travel that would not have occurred but for the existence of e-shopping.
- Neutrality refers to those instances in which e-shopping has no foreseeable effect on household travel behaviour.

Even four categories, however, are not exhaustive (Mokhtarian, 2004). For example, the Internet could be used to prepare for in-store shopping. Prices and brands are easily compared via the Internet and also often much quicker than in a store. Therefore, searching online could be the starting point of a shopping cycle in order to gain basic information about a product. If people prefer to preview an item themselves before they purchase, then a substitution of online shopping for in-store shopping is unlikely (the 'complementarity effect' of e-shopping).

Handy and Yantis (1997) and Krizek *et al.* (2004a) examined the potential substitutability of three different types of activities: movie watching, shopping (non-grocery) and banking. Relying on a US-based survey in three cities, they explored individual participation in and choices about each activity. The results suggest complex relationships between in-home activities and those requiring physical travel. For the most part, they found that out-of-home versions of movie-watching, shopping and banking offer qualities that are not currently duplicated by the in-home versions. This absence of substitution effects is also hypothesized by Dijkstra (2004), suggesting that e-shopping could lead to a reevaluation of other motives linked with in-store shopping such as meeting other customers or enjoying the recreational aspects of shopping. Further support by Underhill (1999) suggests that consumers prefer using their senses for many types of shopping, for example trying on a shirt, smelling perfume, sitting in a chair (also Dholakia *et al.*, 2000). Casas *et al.* (2001) found that Internet shoppers in Sacramento, California, do not make less but in fact make more shopping trips than non-Internet shoppers. They attribute this result to the active lifestyle of Internet shoppers.

However, research from Germany by Luley *et al.* (2002) suggests one could expect a slight reduction in the frequency of trips as a consequence of online shopping. An early study of Keyzers and Wagenaar (1989) of users of a grocery teleshopping service in a Dutch middle-sized town also showed a substitution of shopping trips. Cairns *et al.*'s (2004) overview of the literature concerning the travel impacts of home shopping mainly suggests a potential reduction in the number of shopping trips and in car use. Although no information is available for shopping, Viswanathan and Goulias (2001) indicated that Internet use in general was associated with a reduction in the duration of trips.

Based on the scarce literature, evidence on the impact of e-shopping on in-store shopping is limited and in some cases contradictory. Our hypothesis is that online buying will have a decreasing effect on trip frequency and the duration of shopping activity, but that this relation is different for daily (e.g. groceries) and non-daily shopping (e.g. books and clothes), because most products that are purchased online are non-daily products.

## Methodology

*Research Designs of Utrecht, the Netherlands, and Minneapolis, Minnesota, USA*

Our analyses are based on primary data collection efforts in the USA and the Netherlands; each was administered independently of one another yet

contained similar questions relating to Internet and in-store shopping. The US survey was based in and around the city of Minneapolis, Minnesota. The data were collected as part of a larger research project funded by the Minnesota Department of Transportation which aimed to gauge the impact of ICT on travel behaviour. The responses analysed in this research represent a subset of the larger research effort. The Netherlands survey was administered in and around the city of Utrecht and was funded by Utrecht University to gain more insight in the relationship between e-shopping and in-store shopping. Slight differences exist between the characteristics of the survey (e.g. sample size, sample strategy, content of survey instrument). However, similar research questions about the phenomena under investigation here provide a compelling opportunity for cross-cultural analysis. Rarely do research efforts have the opportunity to explore in detail burgeoning phenomena from two international settings.

The Netherlands is among countries with the highest Internet use in the world. More than 75% of Dutch households own a computer and 61% have Internet access (Central Bureau for Statistics, 2003). E-shopping is mostly done in the core cities of the heavily urbanized Western part of the country: Amsterdam, Rotterdam, Utrecht and The Hague (Farag *et al.* 2005). The setting explored here—Utrecht (population 260 625)—lies in the heart of the Netherlands. Three communities in Utrecht were selected that differed in degrees of shop accessibility so that an analysis could be made of the impact of the quantity and quality of shops in the immediate surroundings of people on online shopping behaviour. Vogelenbuurt (219 households) is near the centre of Utrecht, thereby exhibiting 'high' shop accessibility; Lunetten (282 households) is a first-ring community a bit further from the centre, and thereby has 'medium' shop accessibility; and De Meern (296 households) is a suburban community farthest (7 km) from the centre and therefore deemed 'low' shop accessibility. The three communities are similar in the per cent of households with children, their educational level and income level. In March 2003, 2517 households were initially targeted, but many people were not at home during the research period. In total, 1396 households were approached face-to-face by interviewers, of which 807 households participated yielding a response rate of 58% from both Internet and non-Internet users. The survey consisted of the following five parts: (1) general Internet use, (2) searching online, (3) buying online, (4) average shopping travel and (5) sociodemographics. Attitudes towards in-store shopping and online shopping were asked as well.

For the US setting, Internet use, attitudes and general travel patterns were gauged from a direct mail survey administered in November 2002. The survey was sent using a clustered sampling strategy to households distributed in three areas. These areas were identified in advance as having a relatively high probability of home Internet availability (both dial-up and high-speed). One area was in a residential urban area of South Minneapolis (i.e. the Kingfield neighbourhood). The remaining two areas were suburban in character: Apple Valley is a municipality (population of 45 527) 40 km south of downtown Minneapolis; Lakeville is a municipality (population of 43 128) 51 km south of Minneapolis. Of the 2000 total surveys sent, 446 heads of households participated, yielding a response rate of 23%. The sample was equally distributed across the three areas and comprised both Internet and non-Internet users. Each of the above described survey instruments is available from the authors upon request.

*Sample Comparison*

While the Minnesota and Utrecht surveys differ in design and administration, almost a dozen similar questions enable direct comparisons between each sample. The present analysis was narrowed to Internet users, who were the focus of this study. In both samples, this amounted to 80% of the respondents (in the Netherlands case,  $n = 634$ ; in the US case,  $n = 360$ ). In terms of sociodemographic characteristics, each sample showed a relatively mature population. More males (56%) in the USA completed the survey versus 41% in the Netherlands. The average age in the USA was 46 years versus 42 years in the Netherlands. Approximately two-thirds of the respondents in both samples were married or living together. Slightly more of the US households had children (50 versus 40%). About 45% of the respondents in each sample were defined as having a relatively high income (i.e. in the USA this was gross household income greater than US\$60 000; in the Netherlands this was a net household income greater than €28 800, i.e. approximately US\$35 000). Comparing similar measures of car ownership provided an interesting challenge because it is widely recognized that rates of car ownership are considerably less in the Netherlands than in the USA (fewer than 3% of Minneapolis households own no cars, and fewer than 1% of our sample). Because the Dutch walk and cycle more often for daily travel, only a minority of the households in the sample own two or more cars. To best capture meaningful differences between these samples, it was chosen to bifurcate this measure by aggregating 0 and 1 car households and comparing them to two plus car households. Even after doing so, the US population still exhibited surprisingly higher auto ownership rates, although, a relatively surprising number of single car households was found in the USA (28%), the bulk of which came from the sub-sample in the urban-oriented (Minneapolis) neighbourhood. In terms of Internet use and experience, there are notable differences between the two samples. US respondents have more Internet experience (4.7 years) than Dutch respondents (4.1 years) and they also use the Internet more frequently; 74% use the Internet at least once per day versus 62% of the Dutch respondents. The Internet is most frequently used at home, although many US respondents also use it frequently at work (46 versus 19% of Dutch respondents). The type of Internet connection at home varies greatly between the two samples: 47% of the Dutch sample uses a fast connection such as cable or digital subscriber line (DSL) versus 27% in the USA.

The US sample mirrors the population of the larger Minneapolis metropolitan area reasonably well in terms of sociodemographics. Compared with regional census figures, the surveyed sample has a slightly higher rate of middle-aged respondents (36–65 years). In terms of Internet use, an overwhelming majority (87%) expressed more than 2 years of experience with the Internet. This is higher than the estimated 60% of the overall population from the Upper Midwest of the USA (which is also close to the national average) who indicated more than 2 years of familiarity with the Internet (Pew Internet and American Life Project, 2004). Heightened Internet experience is largely a reflection of the sampling strategy, pulling households from neighbourhoods in the Minneapolis area that had higher rates of Internet availability. The Dutch sample of Internet users mirrors in general the Dutch population of Internet users for gender, age, Internet experience, income and having children (Central Bureau for Statistics, 2003). In terms of comparing the US sample with the Dutch sample, however, they do not differ considerably from each other in important sociodemographic characteristics other than gender.

### *Operationalization of Variables*

This research operationalized online buying in two ways. For the descriptive analysis, two categories of individuals were identified: those who have and have not bought online. In the multivariate analysis, the frequency of online buying for those who ever bought online was also analysed. In-store shopping is operationalized as the average number of trips (per week for daily shopping; per month for non-daily shopping) and the average shopping duration in minutes per trip. The multivariate analyses controls for sociodemographic, spatial, behavioural and attitudinal variables, all of which were operationalized in the same manner in both samples. The sociodemographic variables include gender (male = 0, female = 1), age (years, continuous variable), education (low, medium, high), income (low, medium, high) and car ownership (no car or one car = 0, two cars or more = 1). Five types of households were classified to capture varying degrees of time pressure (as determined by the amount of hours worked by both partners and the presence of children): (1) one-income households without children (including both couples and singles), (2) one-income households with children, (3) dual-income households without children, (4) dual-income households with children and (5) other households (students, pensioned, etc.).

The spatial variables include travel time to shops for daily (e.g. groceries) and non-daily (e.g. clothes) goods. In the Dutch survey, the travel time was asked in the number of minutes from home to the shops one usually visits for daily and non-daily shopping (the usual mode for shopping was asked as well). In the US questionnaire, respondents were asked if they have daily and non-daily shopping stores within walking distance of home or within a short drive from home.

The behavioural variables include Internet experience (years, continuous variable), frequency of Internet use (0 = infrequent Internet user, 1 = frequent Internet user, which is defined as a person who uses the Internet at least once a day), and Internet connection type (0 = slow connection: dial up modem, or ISDN, 1 = fast connection: DSL or cable).

Finally, the attitudinal variables include two statements that were measured on a five-point scale ranging from strongly disagree to strongly agree. The first statement measures preferences for in-store shopping; the second measures the importance of seeing products in person before buying (both coded as: 0 = disagree or neutral, 1 = agree). Table 1 describes the frequency distribution of the variables included in the analyses.

## **Determinants of Online Buying**

### *Characterization of Online Buyers*

Attention is now turned to examining differences in online purchasing behaviour by the four groups of explanatory factors mentioned above. In terms of distribution of the sample, this amounts to three-quarters of US respondents who have ever purchased a product online versus 57% in the Dutch case. Of those people who ever bought online, 30% indicated in the US survey to purchase online at least once a month on average. In the Dutch survey, respondents had bought in the past year on average 4.6 times online (standard deviation = 4.4). To help examine explanatory factors, Table 2 shows chi-square tests describing differences between online and non-online buyers.

**Table 1.** Frequency distribution of variables in the analyses

	USA				The Netherlands			
	<i>n</i>	%	Mean	SD	<i>n</i>	%	Mean	SD
<i>Gender:</i>								
Male	203	56			262	41		
Female	157	44			374	59		
<i>Age (years)</i>	360		46.3	12.31	629		42.07	15.91
<i>Education:</i>								
Low	35	10			198	31		
Medium	130	36			104	17		
High	198	55			330	52		
<i>Income:</i>								
Low	39	11			110	20		
Medium	144	41			201	35		
High	169	48			259	45		
<i>Household type:</i>								
One income no kids	105	31			138	23		
One income plus kids	38	11			144	24		
Two incomes no kids	67	20			75	12		
Two incomes plus kids	116	34			86	14		
Other	17	5			164	27		
<i>Car ownership:</i>								
No car or one car	100	28			506	81		
Two cars or more	253	72			121	19		
<i>Travel time daily shopping from home:</i>								
Within walking distance	130	36						
Not within walking distance	230	64						
Travel time (min)					600		5.57	3.09
<i>Travel time non-daily shopping from home:</i>								
Within a short drive	319	88						
Not within a short drive	42	12						
Travel time (min)					626		15.50	7.75
<i>Internet experience (years)</i>	358		4.72	2.61	628		4.11	2.29
<i>Frequency of Internet use:</i>								
Infrequent	93	26			241	38		
Frequent	271	74			398	62		
<i>Internet connection type:</i>								
Slow	242	73			313	53		
Fast	88	27			273	47		
<i>In-store shopping is fun:</i>								
Disagree or neutral	224	62			281	45		
Agree	136	38			350	55		
<i>In-person product viewing is necessary:</i>								
Disagree or neutral	120	33			253	40		
Agree	241	67			375	60		

Initial analysis suggests that there are statistically significant differences between online and non-online buyers for each explanatory factor. The confidence level at which the chi-square test results are accepted as being statistically significant is

**Table 2.** Characterization of US and Dutch online buyers (in row percentages)

	USA				The Netherlands			
	Never bought online	Ever bought online	<i>n</i>	$\chi^2$ ( <i>p</i> )	Never bought online	Ever bought online	<i>n</i>	$\chi^2$ ( <i>p</i> )
<i>Gender:</i>								
Male	18	82	203	6.6	34	66	260	12.6
Female	29	71	157	(0.014)	48	52	374	(0.000)
<i>Age (years):</i>								
< 25	0	0	0	22.0	49	51	123	5.1
26–35	10	90	63	(0.000)	43	57	108	(0.442)
36–45	21	79	113		40	60	168	
46–55	22	78	102		44	56	95	
56–65	31	69	58		35	65	72	
> 65	54	46	24		38	62	45	
<i>Education:</i>								
Low	40	60	35	6.9	47	53	198	11.6
Medium	23	77	130	(0.031)	54	46	103	(0.003)
High	20	80	198		37	63	329	
<i>Income:</i>								
Low	41	59	39	24.6	52	48	109	23.2
Medium	31	69	144	(0.000)	50	50	198	(0.000)
High	12	88	169		31	69	260	
<i>Household type:</i>								
One income no kids	27	73	105	14.1	40	60	136	38.5
One income plus kids	11	89	38	(0.002)	51	49	144	(0.000)
Two incomes no kids	19	81	67		28	72	76	
Two incomes plus kids	20	80	116		23	77	86	
Other	53	47	17		55	45	164	
<i>Car ownership:</i>								
No car or one car	27	73	100	1.1	46	54	504	10.5
Two cars or more	22	78	253	(0.292)	30	70	120	(0.005)
<i>Travel time daily shopping from home:</i>								
Within walking distance	21	79	130	0.5				
Not within walking distance	24	76	230	(0.495)				
≤ 5 min					42	58	450	0.3
> 5 min					46	54	155	(0.569)
<i>Travel time non-daily shopping from home:</i>								
Within a short drive	24	76	319	1.9				
Not within a short drive	14	86	42	(0.165)				
≤ 10 min					36	64	220	6.4
11–20 min					45	55	317	(0.040)
> 20 min					49	51	86	
<i>Internet experience (years):</i>								
≤ 1	40	60	40	45.4	82	18	61	71.7
2–3	44	56	66	(0.000)	51	49	210	(0.000)
4–5	15	75	94		38	62	215	
6–7	6	94	88		24	76	87	
> 7	10	90	70		17	83	46	

**Table 2.** (Continued)

	USA				The Netherlands			
	Never bought online	Ever bought online	<i>n</i>	$\chi^2$ ( <i>p</i> )	Never bought online	Ever bought online	<i>n</i>	$\chi^2$ ( <i>p</i> )
<i>Frequency of Internet use:</i>								
Infrequent	44	56	93	32.1	64	36	239	71.6
Frequent	16	84	271	(0.000)	30	70	394	(0.000)
<i>Internet connection type:</i>								
Slow	27	73	242	10.7	48	52	310	13.5
Fast	10	90	88	(0.001)	33	67	272	(0.000)
<i>In-store shopping is fun:</i>								
Disagree or neutral	18	82	224	6.5	37	63	279	6.6
Agree	29	71	136	(0.011)	47	53	350	(0.010)
<i>In-person product viewing is necessary:</i>								
Disagree or neutral	4	96	120	34.5	42	58	252	0.0
Agree	32	68	241	(0.000)	43	57	373	(0.967)

95%. Males buy more often online (in both samples) and so do younger respondents (in the US sample). As expected, higher education and higher income respondents mostly buy online. This is not surprising considering the capital cost required for a home computer and (fast) Internet access. Because e-shopping could be considered a time-saving strategy, it is interesting to see that online purchasing differs by household type. For the Netherlands, dual-income households buy more often online than other types of households. For the US, one-income households with children mostly buy online, followed by dual-income households.

Households in the Netherlands with two or more cars have a greater predilection of e-shopping, perhaps as an additional time-saving strategy. In the USA, however, where car use is considerably more widespread, car ownership does not reveal any statistically significant differences in terms of e-shopping, despite the surprising percentage of households owning one or no car (28%). This difference between Utrecht and Minneapolis could be explained by differences in opportunities to park a car. Shops in the Netherlands are predominantly within the built-up areas of cities and towns, which offer fewer opportunities to drive and park a car (free of charge) than many out-of-town shopping centres in the USA, particularly since two-thirds of the US sample is from suburban settings. Consequently, in the Netherlands e-shopping may reduce the hassle of driving and finding a place to park the car.

Travel time to shops was compared for daily and non-daily goods among online and non-online buyers. One would expect that individuals with large travel times to shops would shop more online, since they can gain more in travel time. However, this does not seem to be the case. In the US case, no significant difference was found; while in the Dutch case it was found that online buyers with short travel times actually shop significantly more online than individuals with larger travel times. An argument for this result could be the differences in life styles between people who live in or near a city centre which offers in the Dutch traditional retailing structure a large supply of non-daily products, and people who live more remote from the city centre or in a suburb. Perhaps the former are more likely to be early adopters of innovations,

such as e-shopping, than the latter (Farag *et al.*, 2005). Furthermore, young urban residents could be more interested in specific products that are offered on the Internet such as computer equipment and mobile phones than middle-aged suburban residents.

Other than gender, education and income, the most consistent similarity between the two samples not surprisingly relate to Internet experience and Internet connection type. Online buyers have more years of Internet experience than non-online buyers, as well as a higher frequency of Internet use. Internet connection type differs among online and non-online buyers; users with a fast Internet connection buy more often online than users with a slow (e.g. dial-up) connection. Based on our data, the direction of causality between, on the one hand, a fast Internet connection and frequency of Internet use and, on the other hand, online buying is hard to determine.

Finally, attitudes toward in-store shopping were investigated. Online buyers seem to enjoy in-store shopping less than non-online buyers. For the US case, online buyers also find in-person product viewing less important than non-online buyers.

#### *Results of Logistic Regression Analyses Explaining Online Buying and its Frequency*

Because the results described above do not control for multivariate effects, binomial logistic regression models were estimated to examine the effect of each variable on online buying whilst controlling for the effects of all the other variables (Table 3). To provide insight into the adoption of e-shopping, the frequency of online buying was also studied. Originally, the models for the US and Dutch cases included the same explanatory variables. However, the low levels of explanation that these models offered led us to search for the best ones for each data set. Final models were specified based on chi-square tests and conceptual plausibility; therefore, some insignificant variables remain in the final models. Table 3 shows two models for online buying and two for the frequency of online buying for both countries. For example, in the first model for online buying in the USA, the parameter  $B$  of  $-0.029$  indicates a small decline in the likelihood of online buying with an increase in age. The odds ratio expresses the effect of the independent variable on the likelihood of online buying in comparison with the likelihood of the reference category. For instance, the ratio of 11.313 for high income indicates that high-income categories are 11.313 times more likely to buy online than low-income categories, which is the reference category not shown in Table 3. The chi-square statistics provide an indication of the relative weight of the variables in the model.

Sociodemographic variables are important in explaining online buying, although the set of included variables differs between the two samples. In the Dutch case females are less likely to buy online, while in the USA case older respondents are less likely to buy online. In both cases, people with high incomes are most likely to buy online. Dutch household types with relatively more time (e.g. students, pensioned) are least likely to buy online, which is as expected. This finding is consistent with the results of the descriptive analysis (Table 2). Time-saving and the convenience of e-shopping could be important motives to buy online. A supplementary analysis shows that Dutch dual-income households with children prefer online shopping the least. This result seems to indicate that e-shopping is mainly done by this household type for functional reasons (e.g. time





saving) than for recreational reasons (shopping via the Internet as another means to shop). There is no support for the hypothesis that residents with longer travel time to shops are more likely to buy online. Actually, the opposite result is found for Dutch respondents: people with a short travel time to shops for non-daily goods are more likely to buy online. As discussed above, this could be explained by differences in lifestyles between urban and suburban residents in the traditional Dutch retailing structure. Internet experience and the frequency of Internet use both contribute to explaining online buying. Greater Internet experience (measured in years) and frequent Internet use increase the likelihood to buy online. In the US case, a fast Internet connection is also positively related to online buying, although the direction of causality is unclear. Finally, attitudes toward in-store shopping affect online buying in the US sample. Respondents who prefer to view a product in person before purchasing it are less likely to buy online.

The impact of sociodemographics, accessibility of local shops, Internet experience and attitudes toward in-store shopping on frequency of online buying were also analysed (Table 3). US respondents more frequently buy online (24% make purchases more than once a month online) than Dutch respondents (23% buys more than once every 2 months online). Approximately the same variables that explain online buying also explain the frequency of online buying (Table 3). In the US case, females are more likely to buy often online than males. In an additional analysis, it was found that females like e-shopping better than males. Another explanation is the type of product bought online. Groceries, for example, are mostly bought online by females (Morganosky and Cude, 2000; Raijas, 2002). US respondents with a medium education (a college diploma) are least likely to buy frequently online. In both samples, one's experience with the Internet positively correlates with the frequency of online buying. As already stated, the direction of causality is difficult to determine.

In general, the variables that affect online buying do not differ much between the US and Dutch samples. In both samples, sociodemographic and behavioural variables correlate with online buying mostly in expected directions. An effect (not as expected) of the spatial variables on online buying was only found in the Dutch sample, while an effect (as expected) of the attitudinal variables was only found in the US sample.

### **Relationship between Online Buying and In-store Shopping**

This section focuses on exploring the relationships between online buying and in-store shopping. It first describes various combinations of e-shopping and in-store shopping, followed by an analysis of the effect of online buying on the frequency of shopping trips and duration of shopping trips. The first combination between e-shopping and in-store shopping investigated was searching for product information online and then buying the product in a store. In both samples, nearly one-third of the respondents had done this at least once a month, 40% had done this at least once a year and one-third had never done so. Apparently, the difference in retail structure between the USA and the Netherlands does not have an effect on the occurrence of this combination. In the Dutch survey, respondents were also queried about how often they search product information in a store and then buy the product online. This 'reverse complementarity effect', however, is rarely pursued; more than three-quarters of the respondents reported never having done this.

The third combination of online buying and in-store shopping analysed involved making a shopping trip that otherwise would not have been made due to searching product information online. Only 10% of the respondents in both samples reported that this occurred at least once a month, and nearly two-thirds of respondents reported that this has never occurred. This finding suggests that it seems unlikely e-shopping will generate substantial new trips.

The following analysis focuses on how sociodemographic, spatial, behavioural, and attitudinal variables shape the overall frequency and duration of shopping travel. Such analysis did not uncover any significant results for the US case, most likely due to the small number of cases (87) included in the analysis. For this reason, this paper focuses on the ordinary least-squares regression models for the Dutch case only. The impact of online buying on trip frequency and shopping activity duration was analysed by controlling for the effects of variables mentioned above. The neighbourhood where the respondent resides was added as an additional spatial variable in the analysis (Vogelenbuurt = 1, De Meern and Lunetten = 0). The frequency of shopping trips and the duration of store visits were investigated for non-daily shopping and daily shopping separately (Table 4) to test the hypothesis that online buying will relate differently to non-daily shopping travel compared with daily shopping travel. Non-daily shopping includes, for example, shopping for clothes, books, CDs or gifts, while daily shopping includes shopping for groceries and other sundries. On average, respondents report making three non-daily shopping trips per month and three daily shopping trips per week. The average shopping duration per trip for non-daily shopping is nearly 2 hours, while for daily shopping it is slightly more than 30 min. Table 4 shows standardized regression ( $\beta$ ) coefficients that enable a comparison of the strength of the effects of variables.

Analysis shows that the frequency of non-daily shopping trips increases if people buy frequently online (Table 4, significant  $\beta = 0.609$ ). It seems that frequent online buyers like shopping in general, whether it is in-store or online. This finding renders it unlikely that e-shopping will substitute for in-store shopping trips on a large scale. A rather counterintuitive result is that experienced Internet users make fewer shopping trips after controlling for the effect of the frequency of online buying. It is difficult to speculate on the reasons why this is the case. Perhaps two types of Internet users exist: those who shop frequently online and also frequently make shopping trips, and those who do not make shopping trips frequently. Overall, it seems that e-shopping is related to generation or complementarity rather than to substitution. The results further show that households with relatively more time (e.g. students, pensioned) make more non-daily shopping trips than other households, while people who have more travel time to shops make fewer trips. The frequency of non-daily shopping trips increases if respondents live in Vogelenbuurt (which is very near the city centre, thus rendering it easy to visit stores), and if respondents find it important to see products in person.

Besides complementarity effects, evidence was also found for modifications of shopping behaviour. The average non-daily shopping duration decreases if people buy frequently online. It seems plausible that since frequent online buyers visit stores more often, they would need less time to spend inside the stores, thus leading to a relatively short store visit duration. The results further indicate that females have a longer non-daily shopping duration compared with males, while individuals with low incomes have a shorter shopping duration than individuals with higher incomes. The non-daily shopping duration

**Table 4.** Ordinary least-squares regression analyses results of in-store shopping in the Netherlands

	Non-daily in-store shopping			Daily in-store shopping		
	Number of trips		Shopping duration	Number of trips		Shopping duration
	B	$\beta$	B	$\beta$	B	$\beta$
<i>Sociodemographic variables:</i>						
Female			13.685*	0.086	0.276#	0.082
Low income			-17.357*	-0.087	0.798***	0.190
High income					-0.425#	9.241***
Two-income households no children		0.094				-0.078
Other (e.g. students, pensioned)	0.386*					
<i>Spatial variables:</i>						
Travel time non-daily shopping	-0.023*	-0.093	1.886***	0.193		0.114
Travel time daily shopping	0.522**	0.120			0.407**	0.195
Vogelenbuurt						
<i>Behavioural variables:</i>						
Internet experience (years)	-0.089**	0.115				-1.098**
Infrequent online buyer	0.609*	0.105	-12.488#	-0.080	0.571**	0.117
Frequent online buyer			-21.951*	-0.095		
<i>Attitudinal variables:</i>						
Like to shop in-store			22.686**	0.145	0.336*	0.102
Important to see products in person	0.292#	0.075				
Constant	2.601***		77.985***		2.808***	
Dependent variable	Average number of trips per month		Average shopping duration (min) per trip		Average number of trips per week	Average shopping duration (min) per trip
Number of cases	542		540		503	636
d.f.	6		6		6	5
R <sup>2</sup>	0.082		0.098		0.089	0.118
Adjusted R <sup>2</sup>	0.072		0.088		0.079	0.111

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

increases for people who have a long travel time to shops and for people who like in-store shopping.

For daily shopping, the same effect is found as for non-daily shopping: the frequency of shopping trips increases if people buy frequently online (Table 4). This is contrary to expectations. Perhaps frequent online buyers are people who normally used to shop a lot before they started shopping online, and maybe they are active 'on-the-go'-type people, as Casas *et al.* (2001) suggest. Additional analysis showed that people who buy frequently in-store are more likely to buy frequently online. The direction of causality between e-shopping and in-store shopping is difficult to determine since no data are available about in-store shopping habits before e-shopping. Additionally, the analysis shows that the frequency of daily shopping trips increases for females, for individuals with low incomes (who possibly work fewer hours and have more time to shop), for individuals living in Vogelenbuurt (who often shop by walking or cycling, thereby making it difficult to carry many goods) and for individuals who like in-store shopping. The frequency of daily shopping trips decreases for those in dual-income households without children who are often time-pressured.

Online buying does not affect the duration of daily store visits, which is as expected. The daily shopping duration decreases for individuals with a long Internet experience, and it increases for individuals with high incomes, with a long travel time to shops and who find it important to see products in person.

## **Conclusions and Discussion**

Existing studies uncovering the relationships between ICT and travel are burgeoning. Most work has focused on the work commute; considerably less work has focused on non-work travel, and even less on e-shopping behaviour and its impact on in-store shopping. With rapidly rising rates of e-shopping there is a pressing need to understand better the factors that affect such travel and its public policy implications. This analysis fills part of this gap by investigating the determinants of online buying and its relationship with in-store shopping. Two surveys on e-shopping were administered in the USA and in the Netherlands for this purpose.

The findings indicate that online buying can be explained by sociodemographic, spatial, behavioural and attitudinal variables. In general, the variables that affect online buying do not differ much between the US and Dutch samples. In both samples, respondents with high incomes who frequently use the Internet are more likely to buy online. US respondents who find it important to see products in person are less likely to buy online; while Dutch respondents who live far from shops are less likely to buy online. The latter finding indicates that e-shopping could be connected with an urban lifestyle characterized by early adoption of innovations such as e-shopping.

As far as frequency is concerned, findings from this research generally support Mokhtarian's (2004) claim that online buying complements in-store shopping. The Dutch in-store shopping analysis shows that whilst controlling for the effect of, for example, the proximity of shop concentrations, the frequency of shopping trips increases if individuals frequently buy online. Although there might be individual instances of substitution, these findings render it unlikely that e-shopping will substitute in-store shopping trips on a large scale. However, a modification of

in-store shopping could occur. The results indicate that if people frequently buy online, the average shopping activity duration decreases.

However, based on our surveys, the direction of causality between online buying and in-store shopping is difficult to determine. Future research should try to unravel the complicated relations between the online searching for information, online buying and in-store shopping, preferably in a longitudinal study. Also, other research questions ask for answers. Shopping via the Internet, for example, could increase knowledge of the formerly unknown shopping opportunities, which could diminish the chaining of shopping activities and lead to a spread of visited shops (Dijst, 2004). As a consequence, shops outside shopping centres will improve their competitiveness, which could stimulate further congestion, auto-reliant travel and centrifugal forces of land uses in both Europe and North America. However, it is also feasible that specialist outlets in town centres might improve their viability by also selling to Internet customers. In this way they improve their position in relation to 'one-stop for all goods' non-specialist out-of-town hypermarkets. Researchers, modellers and policy officials are likely to demand a more detailed understanding of these impacts of e-shopping on travel and the use of space.

### Acknowledgements

The authors thank Professor P. L. Mokhtarian and Dr T. Schwanen for insightful comments on the paper and useful suggestions on the analysis of the data. The authors also appreciated greatly the stimulating and constructive comments of the reviewers. Yi Li assisted with data analysis portions for the US sample; the US survey was administered by the State and Local Policy Program (University of Minnesota) in cooperation with Frank Douma, Kim Wells and Tom Horan. Students of Human Geography, Utrecht University, are acknowledged for their efforts in the Dutch data collection. Finally, the authors are thankful for the support provided by the STELLA programme, without which such collaboration would not have been initiated.

### References

- Boston Consulting Group (2002) The state of retailing online 5.0. Available at: <http://www.bcg.com> (accessed on 28 February 2004).
- Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A. and Goodwin, P. (2004) *Smarter Choices: Changing the Way we Travel* (London: Department for Transport).
- Casas, J., Zmud, J. and Bricka, S. (2001) Impact of shopping via Internet on travel for shopping purposes. Paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington, DC, USA.
- Central Bureau for Statistics (2003) *The Digital Economy 2003* (Voorburg/Heerlen: CBS). [in Dutch]
- Dholakia, N., Xiao, J. J., Dholakia, R. R. and Mundorf, N. (2000) *The Impact of Retail E-commerce on Transportation: A Conceptual Framework*. Working Paper (Kingston, RI: Research Institute for Telecommunications and Information Marketing). Available at: <http://ritim.cba.uri.edu/wp> (accessed on 28 March 2002).
- Dijst, M. (2004) ICTs and accessibility: an action space perspective on the impact of new information and communication technologies, in: M. Beuthe, V. Himanen, A. Reggiani and L. Zamparini (Eds) *Transport Developments and Innovations in an Evolving World*, pp. 27–46 (Berlin: Springer).
- Evers, D. (2002) The rise (and fall?) of national retail planning, *Journal of Economic and Social Geography*, 93, pp. 107–113.
- Farag, S., Dijst, M. and Lanzendorf, M. (2003) Exploring the use of e-shopping and its impact on personal travel behaviour in the Netherlands, *Transportation Research Record 1858*, pp. 47–54.

- Farag, S., Weltevreden, J., Van Rietbergen, T., Dijst, M. and Van Oort, F. (2005) E-shopping in the Netherlands: does geography matter? *Environment and Planning B* (forthcoming).
- Golob, T. F. (2001) Travelbehaviour.com: activity approaches to modeling the effects of information technology on personal travel behaviour, in: D. Hensher (Ed.) *Travel Behavior Research, The Leading Edge*, pp. 145–184 (Oxford: Elsevier/Pergamon).
- Handy, S. and Yantis, T. (1997) *The Impacts of Telecommunications Technologies on Nonwork Travel Behavior* (Austin, TX: Southwestern Region University Transportation Center).
- Keyzers, E. C. M. and Wagenaar, P. J. M. (1989) *Teleshopping: Time and Space Effects* (Delft: Research Institute for Urban Planning and Architecture). [in Dutch]
- Krizek, K., Li, Y. and Handy, S. L. (2004a) *ICT As a Substitute for Non-work Travel: A Direct Examination*. Working Paper (Minneapolis, MN: Active Communities Transportation (ACT) Research Group, Humphrey Institute of Public Affairs, University of Minnesota).
- Krizek, K., Li, Y. and Handy, S. L. (2004b) *Spatial Attributes and Patterns of Use in Household-related ICT Activity*. Working Paper (Minneapolis, MN: Active Communities Transportation (ACT) Research Group, Humphrey Institute of Public Affairs, University of Minnesota).
- Liao, Z. and Cheung, M. T. (2001) Internet-based e-shopping and consumer attitudes: an empirical study, *Information and Management*, 38, pp. 299–306.
- Luley, T., Bitzer, W. and Lenz, B. (2002) Travel substitution by electronic commerce? A simulation model for the Stuttgart region, *Zeitschrift für Verkehrswissenschaft*, 73, pp. 133–155. [in German]
- Mokhtarian, P. (2004) A conceptual analysis of the transportation impacts of B2C e-commerce, *Transportation*, 31, pp. 257–284.
- Mokhtarian, P. L. and Salomon, I. (2002) Emerging travel patterns: do telecommunications make a difference?, in: H. Mahmassani (Ed.) *In Perpetual Motion: Travel Behaviour Research Opportunities and Application Challenges*, pp. 143–182 (Oxford: Pergamon Press/Elsevier).
- Morganosky, M. A. and Cude, B. J. (2000) Consumer response to online grocery shopping, *International Journal of Retail and Distribution Management*, 28, pp. 17–26.
- Pew Internet and American Life Project (2004) America's online pursuits: the changing picture of who is online and what they do. Available at: <http://www.pewInternet.org/reports/toc.asp?Report=106> (accessed 4 June 2004).
- Raijas, A. (2002) The consumer benefits and problems in the electronic grocery store, *Journal of Retailing and Consumer Services*, 9, pp. 107–113.
- Salomon, I. (1985) Telecommunications and travel, *Journal of Transport Economics and Policy*, 19, pp. 219–235.
- Salomon, I. (1986) Telecommunications and travel relationships: a review, *Transportation Research*, 20A, pp. 223–238.
- Schwanen, T., Dijst, M. and Dieleman, F. M. (2002) A microlevel analysis of residential context and travel time, *Environment and Planning*, 34A, pp. 1487–1507.
- Shim, S., Eastlick, M. A., Lotz, S. L. and Warrington, P. (2001) An online prepurchase intentions model: the role of intention to search, *Journal of Retailing*, 77, pp. 397–416.
- Sim, L. L. and Koi, S. M. (2002) Singapore's Internet shoppers and their impact on traditional shopping patterns, *Journal of Retailing and Consumer Services*, 9, pp. 115–124.
- Swinyard, W. R. and Smith, S. M. (2003) Why people (don't) shop online: a lifestyle study of the Internet consumer, *Psychology and Marketing*, 20, pp. 567–597.
- Thuiswinkel.org (2004) Thuiswinkel.org Home shopping in the Netherlands. Available at: <http://www.thuiswinkel.org> (accessed on 8 March 2004).
- Underhill, P. (1999) *Why We Buy: The Science of Shopping* (New York: Simon & Schuster).
- Verhoef, P. C. and Langerak, F. (2001) Possible determinants of consumers' adoption of electronic grocery shopping in the Netherlands, *Journal of Retailing and Consumer Services*, 8, pp. 275–285.
- Viswanathan, K. and Goulias, K. G. (2001) Travel behavior implications of information and communications technologies (ICT) in the Puget Sound region. Paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington DC, USA.
- Vrechopoulos, A. P., Siomkos, G. J. and Doukidis, G. I. (2001) Internet shopping adoption by Greek consumers, *European Journal of Innovation Management*, 3, pp. 142–152.