The b2c e-commerce landscape of the Dutch retail sector

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Abstract

We analyze the b2c e-commerce adoption by retailers combining a conventional innovation-adoption approach with a detailed geographical analysis. In particular, we propose two hypotheses following the concepts of retail hierarchy and urban hierarchy, respectively. First, the catchment area of the shopping centre where a shop is located, will positively affect the likelihood of Internet adoption. Second, the size of the city where a shop is located, will positively affect the likelihood of adoption. We also compare the adoption probability of retail outlets in core and peripheral regions. Hypotheses are tested with multinomial logistic regressions using data on 27,000 retail outlets in The Netherlands, while controlling for organizational variables. Results show that most hypotheses are confirmed. Shops in city centers are more likely to adopt the Internet than shops located in centers at the bottom of the retail hierarchy. Furthermore, shops in large cities have a higher probability to adopt the Internet than shops in small cities. On the regional level, the likelihood of adopting an information or online sales strategy is higher for shops in core regions than for retail outlets in the periphery.

JEL: D21, L81, O18, O33

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1. Introduction

Business-to-consumer (b2c) e-commerce can be regarded as a disruptive innovation that can make existing business models obsolete (Burt and Sparks, 2003). B2c e-commerce provides retailers the possibility of a new service concept, a new client interface and, in some cases, a new delivery system. The history of retailing is replete of such innovations, like the introduction of department stores, mail order, and other. Yet, the impacts of b2c e-commerce on physical shops and shopping centers are still poorly understood. While many studies have focused on the adoption of e-commerce by consumers, there is still little known about the rate and extent of this innovation adoption process in a geographical context of retailers (Currah, 2002). Atzema and Weltevreden (2004) were one of the first to use a spatial perspective by investigating the Internet adoption of retail outlets in different Dutch city centers. Yet, empirical research analyzing Internet adoption by retailers at different shopping locations and urban settings is scarce, at least to our knowledge.

In this article we aim to fill this gap in research by examining b2c e-commerce adoption among 27,000 retail outlets in The Netherlands. We combine a conventional innovation-adoption approach, which focuses on the characteristics of retail outlets, with a detailed geographical analysis using information on the location and spatial context of the retail outlet. In particular, we distinguish between two hypotheses following the concepts of retail hierarchy and urban hierarchy with shops higher up the hierarchy being more likely to adopt b2c e-ecommerce. First, the catchment area of the shopping centre where a shop is located, will positively affect the likelihood of Internet adoption. Second, the size of the city where a shop is located, will positively affect the probability of Internet adoption. Finally, we will compare the adoption probability of shops in core and peripheral regions. We argue that depending on the costs of logistics, the adoption rate of shops selling goods that can be easily transported by mail or parcel services will be higher in peripheral regions, while the Internet adoption of shops selling goods that require costly transportation will be higher in core regions.

In the following we mean with b2c e-commerce adoption, or Internet adoption, that a retail outlet has an active website. We will distinguish between shops with a website but without online sales (i.e., information strategy) and shops that provide online sales services (i.e., online sales strategy). Most arguments that follow equally

apply to shops adopting a website, without online sales and shops adopting online sales. Wherever we mean only one of the two innovations, we will refer to these explicitly as shops having an information strategy and shops having an online sales strategy. Using multinomial logistic regression analysis we can specifically investigate the effect of the explanatory variables on the probability that one of three alternatives (no website, information strategy, online sales strategy) will be selected.

The outline of this article will be as follows. In Section 2 a brief description of the Dutch retail context will be given so that the results presented in later sections can be contextualized where appropriate. Section 3 provides the theoretical underpinnings of our study. We then turn to the data collection and methodology in Section 4. Multinomial logistic regression models testing our hypotheses are presented in Section 5. We close with conclusions and directions for further research.

2. The Dutch retail context and planning system

Compared to other countries with similar incomes, like France and the United States, The Netherlands has an "old-fashioned" retail structure, characterized by a large number of small-scale shops per capita concentrated in urban areas, and by the lack of large-scale hypermarkets and shopping malls at the edges of major cities. Similar to the United Kingdom, fully enclosed shopping malls have emerged mainly in Dutch city centers, but to a lesser extent and at a smaller scale (Guy, 1994). The reason for this difference can be attributed to a restrictive retail planning policy for more than five decades that prevented uncontrolled retail growth at the fringes of urban areas and protected traditional shopping centers and the functional retail hierarchy (Evers, 2001). City centers are, therefore, still at the top of the retail hierarchy in The Netherlands.

Historically, Dutch land use policy forced large-scale retailers to locate in or adjacent to existing retail concentrations. As an exception to this rule, only a few sectors were allowed to locate outside existing shopping areas on locations specifically designated as so-called "PDV-locations" (i.e., peripheral retail locations). In 1973, only retailers selling explosive or flammable merchandise, cars, boats and caravans were permitted at PDV-locations. In 1984, shops selling furniture and do-it-yourself materials were added to the list of products, which, like cars, boats and caravans, require a considerable amount of floor space. Thus far, the PDV policy has

had variable success. On the one hand, it prevented unwanted retail settlement in peripheral areas. On the other hand, due to the convergence of retail segments, more types of merchandise were sold at peripheral locations, which led to increased competition with the city centre (Borchert, 1998; Van de Wiel, 1996). In 1993, the restrictive policies were relaxed by the introduction of so-called "GDV-locations" (i.e., locations for large-scale retailing) for stores exceeding 1500 square meters of gross floor space. Permission to create this new type of retail location has only been granted to 13 of the larger cities. As one might expect these new opportunities for large-scale peripheral retailing were met with enthusiastic response from real estate developers and some retail firms. Further "GDV-development" can, therefore, influence the spatial distribution of retail trade in The Netherlands (Borchert, 1998).

The dominance of city centers in the Dutch retail hierarchy is not only the result restrictive retail planning policy, but also the product of the settlement system. In The Netherlands 21 cities have more than 100,000 inhabitants, while only five cities have more 200,000 residents. By nature, in settlement systems dominated by large numbers of small cities a larger part of retailing is concentrated in city centers, compared to systems dominated by a few large cities, just because the number of city centers is larger (Borchert, 1998).

Furthermore, The Netherlands is a small and highly urbanized country, where even in rural areas consumers have relatively good shop accessibility in comparison with larger countries such as Germany, Canada, or the USA. As a result, The Netherlands differs from other West-European countries and the USA 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 traveled 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. Together, these modes account for 20% of all kilometers traveled for shopping purposes (Dieleman et al., 2002). The outcomes of this article thus should be interpreted with the Dutch retail context in mind, though the conceptual framework and research methodology can be applied to any country or region.

3. Theoretical framework

3.1 Organization

Obviously, the adoption of b2c e-commerce by retail outlets to a large extent depends on the characteristics of the organization they belong to. To investigate the impact of location on the Internet adoption of shops, we need to control for important organizational variables. Otherwise we will measure composition effects of retail locations instead of the actual impact. The following organizational characteristics are included, which we discuss in more detail below: product, size, and organization type.

3.1.1 Product

The adoption of b2c e-commerce is expected to differ between products. B2c e-commerce adoption varies between retailers of different products because consumers' shopping efforts vary with respect to the type of product (Peterson et al., 1997). In the management literature one uses frequently the distinction made by Copeland (1923) between convenience goods, shopping goods, and specialty goods.

The product classification made by Copeland more than 80 years ago, is not fully appropriate anymore in the Internet era. According to Klein, we do need another measurement system, because media like the Internet "have the potential to alter consumer behavior through direct impact on both the prepurchase and ongoing consumer information acquisition process" (Klein, 1998, p. 195). She brings consumers' information search to the fore and links her ideas to the classical distinction between experience goods and search goods made by Nelson (1970, 1974). Nelson defines goods as search goods when full information for dominant product attributes can be known prior to purchase. Goods are defined as experience goods when full information on dominant attributes cannot be known without direct experience or when information search for dominant attributes is more costly and difficult than direct product purchase. In this article, we distinguish between frequently purchased convenience goods, and shopping goods, which are further divided into search and experience goods.

Particularly for search goods the Internet has the potential to provide information in a more accessible, less costly and more customizable way (Klein, 1998). This makes search goods more suitable to selling online than experience

goods. Search goods sectors — like books, videos & DVDs, and CDs — are among the most popular products bought online by Dutch consumers (Weltevreden and Van Rietbergen, 2004). Therefore, it is among shops selling these kinds of products that we expect the largest b2c e-commerce penetration.

Hypothesis 1a: Shops selling search goods are more likely to adopt the Internet than shops selling experience or convenience goods.

For convenience goods, which are frequently purchased and are part of consumers' daily routines, the Internet is less suitable. It takes more effort to acquire information about those products online than a daily trip to a neighborhood or convenience center. Furthermore, the information demand is lower for convenience goods, compared to search goods and experience goods, leading to the following hypothesis.

Hypothesis 1b: Shops selling experience goods are more likely to have an information strategy than shops selling convenience goods.

Concerning online sales, we expect that shops selling experience goods are less likely to adopt than shops selling convenience goods. This is because the purchase of experience goods requires more personal and physical evaluation by consumers and often come in collections that change more regularly, which make them less suitable for online sales than convenience goods. Especially for time-starved households (e.g., double income families with children), online shopping for convenience goods can be an outcome by reducing their daily trips to the local convenience or neighborhood center.

Hypothesis 1c: Shops selling convenience goods are more likely to have an online sales strategy than shops experience selling goods.

3.1.2 Size

The Internet adoption of retail outlets may also be influenced by the size of the retail organization. Brown (1981) identifies several advantages large firms have over smaller firms regarding the adoption of technological innovations, like the Internet.

Compared to small firms, large firms have a greater ability to raise capital, to bear the costs of the innovation, and bear the risk of failure. Furthermore, larger firms can better afford the specialists needed to develop the website. Ellis-Chadwick and colleagues (2002) add that retailers with the largest store network may have most to loose should they be left as observers, rather than active participants, in b2c e-commerce. However, larger firms not always take the lead in the adoption of new innovations, as the firm size threshold seems to vary for different technologies (Brown, 1981). Nonetheless, studies regarding the Internet adoption by UK and US retailers revealed that the larger its size, the more likely a retailer is to have a website and to offer online selling opportunities (Morganosky, 1997; Ellis-Chadwick et al., 2002; Worzala et al., 2002). The following measurements of size can be identified for retail organizations: number of outlets, total floor space, number of employees, and turnover. In this article, we use floor space of a shop as a proxy for the resources necessary to adopt the Internet.

Hypothesis 2: The larger the floor space of a shop, the higher the probability of Internet adoption.

3.1.3 Organization type

The adoption of b2c e-commerce is also expected to differ between types of retail organizations. There is a distinction between independent and multiple retailers. A definition of multiples commonly used in the UK is a retail organization with more than ten branches (Cox and Britain, 2000). In The Netherlands, multiples are usually defined as organizations with more than seven outlets (Locatus, 2003). One may expect, that independent retailers will react differently to b2c e-commerce than multiple retailers. The former may be less able to adopt an Internet strategy due to cognitive incapacity, and the lack of financial and other resources (Boschma and Weltevreden, forthcoming).

Hypothesis 3a: Shops belonging to multiple retailers are more likely to adopt the Internet than shops belonging to independent retailers.

A distinction should also be made between multiple retailers that have full control over their outlets (i.e., corporate chains), and those that make use of franchising or other forms of cooperation (e.g., voluntary chains, retail cooperatives, et cetera). For franchise organizations and other cooperatives the Internet is not only a channel to service their customers, but also an excellent tool to communicate with their current members and to recruit new ones. Because of this extra advantage franchisors and other cooperatives are more like to establish an information strategy than corporate chains. Regarding online sales, franchisors and other cooperatives are less likely to adopt, because an important interest group (i.e., the associated independent retailers) may feel threatened by selling online (c.f., Watson et al., 2002). A collective website with online sales poses the threat of cannibalizing the in-store sales of individual members.

Hypothesis 3b: Shops belonging to franchise organizations or other forms cooperation are more likely to have an information strategy than shops belonging to corporate chains.

Hypothesis 3c: Shops belonging to corporate chains are more likely to have online sales than shops belonging to franchise organizations and other cooperative forms.

3.2 Location theory: 3 spatial hierarchies

When studying the adoption of Internet by traditional retailers from a geographical perspective, we draw upon two bodies of literature. First, and less often taken into account, we can analyze the effect of shopping locations on Internet adoption. Here, we will use the concept of retail hierarchy to underline the different shopping locations within cities with higher-order shopping centers having larger catchment areas and thus being conducive for innovation adoption. Second, we can investigate to what extent the spatial diffusion of b2c e-commerce adoption depends on differences in city size better known as the urban hierarchy. On a higher spatial scale, also a regional hierarchy can be identified. On the regional level both agglomeration economies, as well as differences in efficiency gains by engaging in online sales play a role.

3.2.1 Retail hierarchy

An important part of retail location theory is based on the central place theory of Christaller (1933). In this theory, goods are classified in terms of thresholds, that is, the population necessary to make the supply of a good profitable. The highest-threshold goods are, therefore, only available in the largest urban centers, while lower order convenience goods are traded locally. Since the catchment area for lower order goods is considerably smaller than for higher order goods a hierarchy of shopping centers emerges, with a few central places supplying the whole range of goods surrounded by larger numbers of towns and villages offering smaller product ranges.

Berry (1967) applied the central place concept of Christaller to intra-urban shopping locations resulting in an urban shopping centre hierarchy. Berry defined five categories, ranging from the convenience centre with the lowest catchment area to the metropolitan central business district with a regional or national function. Higher order centers encompass large numbers of retail outlets and specialized shops, while the lowest centers are only important for the provision of daily goods to the surrounding population of those centers. As a fifth level, we introduce solitary shops within cities. The larger a city, the more hierarchical levels will be present, while in towns and villages typically only the lower levels will be present. Berry's retail hierarchy also exists in The Netherlands. Note that, because of the restrictive retail planning policy in The Netherlands, a large part of retailing is still accommodated in the shopping centre hierarchy (Borchert, 1998).

Internet penetration is expected to be lowest in shopping centers at the bottom of the retail hierarchy since they mainly retail daily goods that are less suitable for Internet commerce (see Section 3.1.1). However, after controlling for the type of product, we still expect that shops in these localities show lower levels adoption than outlets in higher order centers for two reasons. First, higher order centers have larger catchment areas and thus serving large numbers of consumers of which the majority is not resided in the vicinity of the centre. As the Internet provides a medium to communicate over any distance and at relatively low costs, shops with many distant and dispersed costumers will have a higher payoff from adopting the Internet. The position of a shopping location in the hierarchy strongly correlates with the size of the location. Higher order centers generally contain many shops selling very different products. Assuming that retailers within the same shopping area are part of a

communication network, or are able to learn by imitation, an innovation will spread faster in higher-order centers than in lower-order centers (see also Section 3.2.2).

Hypothesis 4a: Shops in shopping centers on the top of the retail hierarchy are more likely to adopt the Internet than shops located in shopping centers at the bottom of the retail hierarchy.

Besides the hierarchy of shopping centers, Berry (1967) also identified three other types of shopping locations that do not fit in the hierarchy: (1) highway-oriented ribbons, (2) urban arterial commercial developments, and (3) specialized functional areas. The growth of these non-hierarchical shopping locations is fostered by the rise of large-scale retailing, suburbanization, and increasing mobility of consumers, breaking down the traditional retail hierarchy (Berry, 1967). Often traditional shopping centers have the same catchment area as the non-hierarchical shopping locations.

Recall that in The Netherlands — apart from PDV and GDV locations — restrictive retail planning policy largely prevented the rise of shopping centers outside the retail hierarchy within cities. Highway-oriented ribbons are virtually non-existent in The Netherlands (Borchert, 1998). Like city centers, the specialized PDV and GDV locations have a large catchment area. For example, consumers are willing to travel large distances to visit a furniture district. For these localities the Internet may also be an excellent tool to reach (potential) customers resided far from the shopping centre at an easy and inexpensive way. Therefore, we assume that shops at PDV and GDV locations have the same likelihood to adopt the Internet.

Hypothesis 4b: Shops at PDV/GDV locations are as likely as city centers to adopt the Internet.

3.2.2 Urban hierarchy

Like any other innovation, the adoption of b2c e-commerce can be considered as a diffusion process that takes place in space and time. Apart from individual shop characteristics, diffusion theories explain the time of adoption of a new innovation by the position of the individual shop in the communication network in which

information about the innovation is exchanged. According to Hägerstrand (1967) and Pred (1977), the likelihood of adoption is thus crucially dependent on the density of the contacts in a shop owner's network. Geographically, this means that, since network relations decrease with increasing distance, shops in densely populated areas are more likely to adopt the innovation at an early stage. Ceteris paribus, shops in larger cities will adopt b2c e-commerce earlier, because communication networks between big cities are better developed than between smaller cities. New innovations thus flow directly from one large city to another, bypassing smaller cities located between them (Richardson, 1973). This hypothesis has become known at the *hierarchical diffusion hypothesis*, with urban hierarchy referring to differences in city size.

Besides information density, large cities provide important advantages for the adopters as large cities have better infrastructure (both in terms of roads and in terms of Internet connectivity), more human capital associated with Internet technology (Moss, 1998) and more specialized and competing Web design companies. Finally, consumers in larger cities are expected to be more open to explore new consumption opportunities. This is because they are relatively younger, more open-minded towards technology, and tend to have a more modern lifestyle (e.g., time-constrained), which all encourage Internet shopping (Anderson et al., 2003; Farag et al., forthcoming).

Hypothesis 5a: The likelihood of Internet adoption by shops is positively dependent on the size of the city a shop is located.

Hierarchical diffusion, however, only takes into account density of communication networks and neighborhood effects. As information exchange decays with distance, shops in cities close to large cities are more likely to adopt an innovation early compared to shops in cities of the same size but far from large cities.

Hypothesis 5b: The likelihood of Internet adoption is higher for shops located in small and medium sized cities near large cities than for shops located in small and medium sized cities far away from large cities.

3.2.3 Regional hierarchy

Internet adoption is not only expected to vary between cities of different size, but also between densely populated (regions with many (large) cities) and peripheral areas (regions with few cities). Agglomeration economies responsible for the hierarchical diffusion of Internet adoption from large to small settlements (Section 3.2.2) also apply to the regional level. Thus, on the regional level a geographical diffusion pattern from core regions to peripheral regions is likely to occur, leading to the following hypothesis.

Hypothesis 6a: The likelihood of Internet adoption by shops is positively dependent on the urban density of the region a shop is located.

The hypotheses formulated so far are all based on spatial diffusion theories following the concepts of retail hierarchy and urban hierarchy. Importantly, these hypotheses refer to many different innovations as these hypotheses are based on general diffusion mechanisms. However, what is specific for Internet adoption — in the form of online sales — is that additional logistic costs are involved in the distribution of purchased goods to the consumer. In this context, the distinction between core urbanized areas and peripheral rural areas is also of great importance. Consumers in peripheral locations have the highest benefits from access to the wide variety of goods provided via the Internet, because they need to travel larger distances for the purchase of goods (Anderson et al., 2003; Sinai and Waldfogel 2004; Farag et al., forthcoming). They can use the Internet to overcome isolation from high-quality retail locations. This argument, however, mainly applies for goods that can be easily delivered by mail (e.g., book, CDs, etc.) or parcel services (e.g., cosmetics, etc.), since the delivery costs of mail and packages are independent of the distance in most countries (including The Netherlands).

By contrast, for heavy, perishable goods like groceries, shops in core areas may be more likely to engage in online selling. To be profitable in terms of logistics, online grocery retailers must have a high density of consumers. According to Murphy (2003), efficient routing is a matter of minimizing driving time and thus costs, and largely depends on the density of ‘customer drops’, which is highest in core areas and lowest in peripheral areas. Visser and Lanzendorf (2003) also stress that a critical

mass of clients and order size in a relatively small area is required for online grocery retailing. This leads us to expect that the likelihood of the adoption of an online sales strategy will be different in core and peripheral areas, yet that the effect depends on the type of good that is transported:

Hypothesis 6b: Shops located in the periphery that sell goods that are distributed by mail and parcel service are more likely to adopt an online sales strategy than shops located in the core area.

Hypothesis 6c: Shops located in the periphery that sell goods that are not distributed by mail or parcel service are less likely to adopt an online sales strategy than shops in the core area.

4. Methodology

4.1 Data collection

For this article we used a subset of the retail location database of Locatus with data of all shops in The Netherlands. The subset contains data about more than 27,000 shops in 14 retail categories (see Section 4.3) representing 20% of all retail outlets in The Netherlands. The following variables are included in the dataset: name; address; formula, sector; floor space; and shopping centre type.

By a time-consuming procedure (December 2004 to March 2005), we searched for the websites of the individual shops in our dataset via Google. Despite the fact that Google is the most accepted and used search engine, searching through more than 8 billion Web pages worldwide, it is not able to find all websites one is looking for. A study recently conducted in Germany revealed that Google was only able to find 61% of all '.de-domains' (Heise Online, 2004). To improve the accuracy of the data, we also searched directly for websites by typing likely domain names in the address bar of the browser. We argued that shop owners largely choose domain names that are closely related with the name of their business. In some cases this strategy resulted in 'hits' that we could not find via the search engine. To further improve the accuracy, the data was re-examined by three trained coders.

It is important to state that in this article we have taken a shop as the unit of analysis and not a retail organization, which enabled us to investigate the Internet adoption of retailers across different shopping centers and urban settings. This means that, for example, a large, international multiple retailer like Hennes & Mauritz is recorded 61 times in our dataset, because it has outlets at 61 locations in The Netherlands.

4.2 Dependent variables

Retailers can choose among many Internet strategies once they decide to establish a Web presence. In this article, we focus on the two main stages in the b2c e-commerce adoption process, that is, an information and online sales strategy (see Table 1). Since retailers can have more than one website, we decided to include the most developed one in our analyses. Shops that have a website "under construction" were considered to have an information strategy, while shops that have an empty domain name were not considered to have an informative website. Furthermore, we speak of an online sales strategy when consumers can order products via the website. The payment need not necessarily be conducted online. Therefore, online photo services are also valued as online sales.

<Insert Table 1 here>

4.3 Independent variables

The descriptive statistics of the independent variables are displayed in Table 1. In this article two product typologies are discerned. The first distinguishes 3 types of goods on the base of consumers' purchase frequency and information demand: convenience goods, experience goods, and search goods. The second typology deals with the logistic intensity of products and differentiates between mail goods, parcel goods, and freight goods. We assigned our 14 retail categories to one of the three product types of both classifications (see Table 2).

<Insert Table 2 here>

In this article we use the floor space of each retail outlet (measured in square meters), which was already present in the original dataset, as a proxy for the size of the organization. In our analyses we use the logarithmic of floor space as it led to a better model fit. Since the original dataset only made a distinction between independents and multiples, we used retail guides (i.e., First Formula, 2004; Locatus, 2003) to obtain the organization type of each multiple retailer. In our analysis we distinguish between four organization types: independents, corporate chains, franchisors, and other retail cooperatives.

<Insert Table 3 here>

The typology of shopping centers was also already present in our dataset (see Table 3). Note that city centers can be very small (5 to 50 stores in villages) or very large (more than 400 stores in, e.g., Amsterdam) and that other levels in the retail hierarchy are only present at a certain urban size. Besides the shopping centers presented in this table, also solitary urban shops, solitary shops at business parks, and solitary peripheral shops are distinguished. To have sufficient numbers of cases in each category to conduct analyses, some shopping locations were put together. We combined city district centers with large neighborhood centers and small neighborhood centers with convenience centers. Furthermore, solitary shops at business parks, solitary peripheral shops, and special shopping centers were combined with PDV/GDV locations, resulting in the typology as presented in Table 1.

Within the urban hierarchy three levels are distinguished, depending on the number of inhabitants (in 1996) of the municipality a shop is located: large cities (> 200,000), medium sized cities (45,000 trough 200,000), and small size cities (< 45,000). Using this definition, there are only four large cities in The Netherlands: Amsterdam, Rotterdam, The Hague, and Utrecht. We extended this typology by differentiating between small and medium sized cities adjacent and not adjacent to those four large cities to examine whether proximity to large urban centers matters for Internet adoption (see urban hierarchy 1 in Table 1).

At the regional level one can make a distinction between the most urbanized parts of The Netherlands, also known as the Randstad Holland, and more rural parts (the periphery). Since the 1950s the Randstad expanded south- and eastwards to

surrounding regions. On the base of employment gravity values, a distinction is made in The Netherlands between the core region (the Randstad), the surrounding intermediary zone, and the periphery, which we will use in our analysis. In general, innovation and employment growth are higher in the core region than in the other two zones (Van Oort, 2004).

5. Results

In this section we present the estimation results for the joint effects of location and organization on the adoption of an information strategy and online selling strategy respectively, using multinomial logistic regression (see Tables 4a and 4b). Multinomial logistic regression was chosen because the dependent variable consists of more than two categories (i.e., no website, information strategy, and online sales strategy). The multinomial logistic regression model estimates the effect of the explanatory variables on the probability (differential odds) that one of three alternatives will be selected. In our models, we use the 'no website' category as the baseline by witch to compare the estimated parameter of the other two categories. The estimates should be interpreted as representing the marginal utility of choosing an information strategy or online sales strategy over no website. Thus, a positive coefficient indicates that the greater the value of the independent variable, the more likely the alternative will be chosen.

To investigate and compare the impact of different geographical variables on Internet adoption, four models are presented in Table 4a through 4b. Model 1 only includes organizational characteristics. In the following models, next to the organizational characteristics, different geographical variables are included. In Model 2 the retail hierarchy is added, while Model 3 includes both the retail hierarchy and urban hierarchy 1. In the fourth model urban hierarchy 1 is replaced by urban hierarchy 2 and the regional hierarchy. This is because urban hierarchy 1 and the regional hierarchy (highly) correlate (all large cities, and almost all the cities surrounding them, lie in the core area). Furthermore, three other models have been estimated to investigate the regional impact on the online sales adoption of 3 types of goods that differ in terms of logistic intensity (Table 5).

A first examination of Tables 4a and 4b shows that the pseudo-*R squares* for all four models are high, ranging from 0.566 in Model 1 to 0.579 in Model 4. Thus, our

independent variables offer a good explanation for retail outlets' decision to adopt one of the three alternative strategies. The large majority of the explained variance can be attributed to organizational variables. Geography only plays a marginal, though significant role in explaining the Internet adoption by retail outlets.

<Insert Table 4a here>

6.1 Organization (hypotheses 1a through 3c)

The results are reported in Table 4a and 4b. Most organizational variables are significant at the .01 level. Except for hypothesis 1b, adding geographical variables (Models 2 through 4) does not substantially change the outcomes of Model 1. Hypotheses 1a dealt with shops selling search goods being more likely to adopt the Internet compared to shops selling convenience and experience goods. This hypothesis is supported by the outcomes of Model 1 in Table 4a. Shops selling search goods have a higher chance of choosing an information or online sales strategy over no website than shops selling experience or convenience goods.

Hypothesis 1b predicts that shops selling experience goods are more likely to adopt an information strategy than shops in convenience goods sectors. This hypothesis only holds for Model 1. When we control for spatial variables (Model 2 through 4), the difference between convenience and experience goods disappears. A possible explanation may be that we largely included convenience goods sectors that sell products, for which an informative website is relatively attractive (e.g., delicatessen, and perfume & cosmetics). Probably the outcomes would be different if we also included more traditional convenience goods sectors like bakers, butchers, and fruit & vegetables retailers. However, the likelihood of choosing an information strategy need not necessarily coincide with a high probability of online sales as well. The probability of choosing an online sales strategy over no website is significantly higher for shops selling convenience goods compared to shops selling experience goods. This is in line with hypothesis 1c.

Hypothesis 2 regarding the size of retail outlets (measured in floor space) is supported by our data. The likelihood of Internet adoption significantly increases with the size of shops. Even after controlling for organization type, size still matters. No

matter the type of organization an outlet belongs to, larger shops always have a higher chance of engaging in b2c e-commerce.

The estimated parameters for organization type strongly support hypothesis 3a. Shops belonging to one of the three multiple retail types all have a higher chance to have an Internet strategy compared to shops belonging to independent retailers. Hypothesis 3b concerning franchise organizations and other cooperative forms having a higher chance of adopting an information strategy is also supported. Franchise organizations have the highest chance of adopting an informative website, followed by other retail cooperatives. Furthermore, franchise organizations have the highest likelihood to engage in online sales compared to the other organization types. Therefore, hypothesis 3c stating that corporate chains are most likely to have online sales is rejected. Thus, franchisors have been able to solve conflicts with their franchisees that are likely to occur when they decide to sell online. Note that comparing corporate chains with other retail cooperatives, hypothesis 3c still holds.

6.2 Retail hierarchy (hypotheses 4a and 4b)

In the second model of Table 4a the retail hierarchy is added. The results of Model 2 indicate that shops in shopping centers higher up in the hierarchy are more likely to choose an Internet strategy than retail outlets in centers at the bottom of the retail hierarchy. Thus, hypothesis 4a is supported. Yet, in Model 2 there is no significant difference in Internet adoption between shops located in city district/large neighborhood centers and shops located in city centers. After adding an urban hierarchy (Model 3 and 4), shops in city centers are more likely to establish a Web presence than shops in city district/large neighborhood centers. This is because both the centers of small villages as well as those of large urban settlements are included in the city centre category. By adding an urban hierarchy one can control for these differences in city center size.

According to hypothesis 4b, there is no significant difference in the chance to adopt the Internet between shops in city centers and shops in peripheral/large scale retail locations. This hypothesis is rejected, since shops in both localities differ significantly from each other with respect to the likelihood of having an information or online sales strategy. Shops in peripheral/large scale retail locations are more likely to have an information strategy than shops in city centers. The latter, however, have a

higher probability to engage in online sales. Thus, city centers are not only the most important shopping locations in The Netherlands, but also the most innovative ones, at least in terms of online sales adoption.

<Insert Table 4b here>

6.3 Urban hierarchy (hypotheses 5a and 5b)

In Models 3 and 4 of Table 4b two urban hierarchies are presented. Our first assumption was that the likelihood of Internet adoption by shops positively depends on the size of the city a shop is located (hypothesis 5a). Both the outcomes of Model 3 and 4 show a hierarchical diffusion pattern of Internet adoption. Shops in large size cities have the highest chance of choosing an Internet strategy over no website, followed by medium size cities, though the standard errors indicate that there is little overlap in the value ranges. Shops in small size cities have the lowest chance to adopt the Internet, which is in line with hypothesis 5a.

Besides hierarchical diffusion also a proximity effect was expected. According to hypothesis 5b, the likelihood of Internet adoption should be higher for shops located in small and medium sized cities adjacent to large cities than for shops located in small and medium sized cities far away from large cities. We only found support for this hypothesis for online sales adoption by shops in small sized cities. Shops in small cities adjacent to large size cities are more likely to choose an online sales strategy over no website than shops in small cities not adjacent to large cities. For medium size cities proximity to large cities does not increase the likelihood of Internet adoption by shops.

6.4 Regional hierarchy (hypotheses 6a through 6c)

On the regional level we also assume a spatial pattern in the diffusion of Internet adoption by retail outlets. According to hypothesis 6a, shops in core regions are expected to have a higher chance of Internet adoption than shops in peripheral areas. To test this hypothesis a regional hierarchy was added in Model 4. This hypothesis is supported by our data as shops in peripheral areas have a lower probability to adopt the Internet, compared to shops in the intermediary and the core region (Randstad).

Thus, agglomerations economies also matter for b2c e-commerce adoption of retail outlets at the regional level.

As explained before, we expect that the regional effect varies between sectors, depending on the logistic costs involved. Two hypotheses have been formulated. First, shops located in the periphery that sell goods that are distributed by mail or parcel services are more likely to adopt an online sales strategy than shops located in the core area (hypothesis 6b). Second, shops located in the periphery that sell goods that are not distributed by mail or parcel services are less likely to adopt an online sales strategy than shops in the core area (hypothesis 6c). To test these hypotheses three other models were estimated for different types of logistical goods.

<Insert Table 5 here>

In Table 5 we present the estimation results for the joint effects of location and organization on the Internet adoption of 3 types of logistic goods: mail goods, parcel goods, and freight goods. Because of insufficient numbers of cases, we had to replace the detailed organization typology 1 by a less detailed classification in Table 5. According to this table, there are no significant differences between regions regarding the adoption of online sales by shops selling mail and parcel goods. Hypothesis 6b is, therefore, rejected. The regional hierarchy, evident in Model 4 (Table 4b), does not apply for shops selling these types of goods, since the likelihood of having online sales is independent of the regional context. This can be explained by the fact that in The Netherlands the price of postal and parcel services is independent of distance.

Contrary to shops selling goods that are distributed by mail and parcel services, the regional hierarchy matters for shops selling freight goods. The chance of adopting an online sales strategy over no website is significantly higher for shops selling these logistic intensive goods located in core areas, compared to their colleagues located in peripheral areas. Hypotheses 6c is, therefore, supported.

7. Conclusions

In this article we investigated the geographical diffusion of two main Internet strategies (information strategy, online sales strategy) among 27,000 retail outlets in The Netherlands. We combined a conventional innovation-adoption approach,

focusing on organizational characteristics, with a comprehensive geographical analysis using information on the location and spatial context of retail outlets. The following geographical variables were discerned: a retail hierarchy, urban hierarchy, and regional hierarchy. After controlling for organizational characteristics, all geographical variables turned out to be significant determinants for retail Internet adoption.

Results indicate that shops in city centers are more likely to choose an information or online sales strategy than shops located in centers at the bottom of the retail hierarchy. On the urban level, a hierarchical diffusion pattern is also visible. Shops in large cities have a higher probability to adopt the Internet than shops in small cities. On the regional level, the likelihood of adopting an information or online sales strategy is higher for shops in core regions than for retail outlets in the periphery. Thus, agglomerations economies matter for retail Internet adoption both at the shopping center, urban, and regional level. Overall, the geographical differences in Internet adoption are larger for the adoption of an online sales strategy than for the adoption of an information strategy. This is understandable, since online selling truly involves a new way of doing business for traditional retailers, which requires specific knowledge and competences. Shops located at central locations can benefit from the agglomeration economies present here, which facilitate the uptake of this radical innovation.

However, which regional context is most suitable for online sales also depends on the logistic characteristics of the product. The chance of adopting an online sales strategy is significantly higher for shops selling freight goods located in core areas than for their colleagues located in peripheral areas. For shops selling mail and parcel goods, the chance of having online sales is independent of the region in The Netherlands where they are located. The latter result can be explained by the fact that the price of postal and parcel services is independent of distance in The Netherlands.

We would recall that in this article we have taken a shop as the unit of analysis and not a retail organization. This implies that retail organizations with more than one outlet are overrepresented in our data. Nonetheless, a shop level analysis is suitable to examine the geographical diffusion of Internet strategies among different shopping locations and geographical contexts.

Regarding the importance of geography for understanding retail Internet adoption, progress in future research lies in three areas. First, in this article a static innovation diffusion analysis was conducted. We only investigated the differences in adoption between different geographical contexts at one point in time. Future research should take a more dynamic approach by, for example, investigating the year that retailers have registered a domain name.

Second, in this article we only investigated the b2c e-commerce adoption of shops in 14 retail categories. While geography seems to play a role in the uptake of Internet in these sectors, its impact on other retail categories may be different or even absent. Future research should, therefore, try to include other categories to investigate whether similar diffusion patterns can be observed.

Third, future research should feature a comparison between countries that vary in urbanization patterns. The Netherlands is a small, highly urbanized country, where even in peripheral areas shopping accessibility is high in comparison with larger countries such as Germany, Canada, or the USA. In these countries, with more spread out populations and high consumer Internet use, the impact of spatial variables on retail Internet adoption could be greater than in The Netherlands.

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Tables & Figures

Table 1: Descriptive statistics

	Minimum	Maximum	Mean
Internet adoption (Dependent)			
No website	0	1	0.394
Information strategy	0	1	0.432
Online sales strategy	0	1	0.174
Product			
Convenience goods	0	1	0.300
Experience goods	0	1	0.556
Search goods	0	1	0.143
Size			
Log10 floor space (in m2)	0.602	4.470	2.216
Organization type 1			
Independents	0	1	0.545
Corporate chains	0	1	0.199
Franchisors	0	1	0.207
Other retail cooperatives	0	1	0.049
Organization type 2			
Independents	0	1	0.545
Multiples	0	1	0.455
Retail hierarchy			
Solitary urban shops	0	1	0.094
Small neighborhood / Convenience centers	0	1	0.076
City district / Large neighborhood centers	0	1	0.120
City centers	0	1	0.648
Peripheral / Large scale retail locations	0	1	0.063
Urban hierarchy 1			
Small size cities not adjacent to large cities	0	1	0.440
Small size cities adjacent to large cities	0	1	0.035
Medium size cities not adjacent to large cities	0	1	0.319
Medium size cities adjacent to large cities	0	1	0.060
Large size cities	0	1	0.147
Urban hierarchy 2			
Small size cities	0	1	0.475
Medium size cities	0	1	0.379
Large size cities	0	1	0.147
Regional hierarchy			
Periphery	0	1	0.365
Intermediary	0	1	0.334
Core (Randstad)	0	1	0.301
Valid *N*	27,596		

Table 2: Sectors differentiated by product characteristics and logistic intensity

Product type	Mail	Parcel	Freight
Convenience goods	-	Drug stores, Perfume & Cosmetics	Supermarkets, Delicatessen
Experience goods	-	Ladies wear, Family wear, Men's wear, Fashion department stores, Sport shops	Furniture
Search goods	Books, CDs	Computers, Toy stores	-

Table 3: A typology of shopping centers

Type	Definition
City centers	The largest and central shopping location in a city (5 stores or more).
City districts	A shopping center with more than 50 stores operating next to a large city center (i.e., 100 stores or more).
Large neighborhood centers	A shopping center with 25 through 50 stores operating next to a city center.
Small neighborhood centers	A shopping center with 10 through 25 stores, or a center with 5 to 10 stores and 2 or more supermarkets operating next to a city center (and city districts/large neighborhood centers).
Convenience centers	A shopping center with 5 to 10 stores and 1 or no supermarket operating next to a city center (and city districts/neighborhood centers).
PDV/GDV concentrations	A shopping center with 5 or more stores with a mean floor space of 500 m² or more per shop. The sectors 'pets, flowers & plants', 'consumer electronics', 'bikes & car accessories', 'do-it-yourself', and 'furniture & home furnishing' must make up at least 50% of the total floor space in these centers.
Special shopping centers	A shopping center that does not belong to one of the other categories (e.g., factory outlet centers, shopping centers at airports, etc.).

Source: Locatus, 2004

Table 4a: Multinomial logistic regression Models 1 and 2 (Ref. cat. = no website)

	Model 1		Model 2	
	Information strategy *B* (s.e.)	**Online sales strategy** *B* (s.e.)	**Information strategy** *B* (s.e.)	**Online sales strategy** *B* (s.e.)
Product				
Convenience goods	0	0	0	0
Experience goods	0.113** (0.053)	-2.144*** (0.072)	0.087 (0.055)	-2.344*** (0.074)
Search goods	1.339*** (0.067)	1.786*** (0.077)	1.347*** (0.068)	1.651*** (0.077)
Size				
Log10 floor space (in m2)	1.397*** (0.045)	1.166*** (0.064)	1.369*** (0.047)	1.193*** (0.066)
Organization type 1				
Independents	0	0	0	0
Corporate chains	2.397*** (0.052)	3.406*** (0.075)	2.404*** (0.053)	3.332*** (0.075)
Franchisors	4.872*** (0.150)	5.800*** (0.158)	4.902*** (0.151)	5.783*** (0.159)
Other retail cooperatives	2.988*** (0.100)	1.992*** (0.140)	3.009*** (0.100)	1.896*** (0.140)
Retail hierarchy				
Solitary urban shops	-	-	0	0
Small neighborhood / Convenience centers	-	-	0.107 (0.091)	0.817*** (0.114)
City district / Large neighborhood centers	-	-	0.183** (0.077)	1.250*** (0.103)
City centers	-	-	0.233*** (0.063)	1.215*** (0.085)
Peripheral / Large scale retail locations	-	-	0.398*** (0.087)	0.842*** (0.129)
Urban hierarchy 1				
Small size cities not adjacent to large cities	-	-	-	-
Small size cities adjacent to large cities	-	-	-	-
Medium size cities not adjacent to large cities	-	-	-	-
Medium size cities adjacent to large cities	-	-	-	-
Large size cities	-	-	-	-
Urban hierarchy 2				
Small size cities	-	-	-	-
Medium size cities	-	-	-	-
Large size cities	-	-	-	-
Regional hierarchy				
Periphery	-	-	-	-
Intermediary	-	-	-	-
Core (Randstad)	-	-	-	-
Intercept	-4.072*** (0.107)	-4.512*** (0.151)	-4.211*** (0.125)	-5.490*** (0.173)
Chi-square	18,819.844***		19,143.187***	
-2 log likelihood intercept only	35,389.402		40,742.338	
-2 log likelihood final	16,569.558		21,599.151	
Pseudo Nagelkerke R square	0.566		0.573	
Number of cases	27,596		27,596	

** = p <0.05; *** = p <0.01

Table 4b: Multinomial logistic regression Models 3 and 4 (Ref. cat. = no website)

	Model 3		Model 4	
	Information strategy *B* (s.e.)	**Online sales strategy** *B* (s.e.)	**Information strategy** *B* (s.e.)	**Online sales strategy** *B* (s.e.)
Product				
Convenience goods	0	0	0	0
Experience goods	0.062 (0.055)	-2.482*** (0.075)	0.052 (0.055)	-2.493*** (0.075)
Search goods	1.342*** (0.068)	1.591*** (0.077)	1.333*** (0.068)	1.580*** (0.078)
Size				
Log10 floor space (in m2)	1.404*** (0.048)	1.251*** (0.067)	1.412*** (0.048)	1.257*** (0.067)
Organization type 1				
Independents	0	0	0	0
Corporate chains	2.393*** (0.053)	3.332*** (0.076)	2.390*** (0.053)	3.330*** (0.076)
Franchisors	4.912*** (0.151)	5.832*** (0.159)	4.910*** (0.151)	5.834*** (0.159)
Other retail cooperatives	3.072*** (0.101)	2.026*** (0.141)	3.070*** (0.101)	2.027*** (0.141)
Retail hierarchy				
Solitary urban shops	0	0	0	0
Small neighborhood / Convenience centers	0.014 (0.092)	0.578*** (0.115)	-0.003 (0.092)	0.555*** (0.115)
City district / Large neighborhood centers	-0.054 (0.082)	0.768*** (0.109)	-0.065 (0.082)	0.755*** (0.109)
City centers	0.238*** (0.063)	1.244*** (0.086)	0.245*** (0.063)	1.251*** (0.086)
Peripheral / Large scale retail locations	0.422*** (0.088)	0.913*** (0.131)	0.425*** (0.088)	0.921*** (0.131)
Urban hierarchy 1			-	-
Small size cities not adjacent to large cities	0	0	-	-
Small size cities adjacent to large cities	0.009 (0.098)	0.292** (0.131)	-	-
Medium size cities not adjacent to large cities	0.331*** (0.041)	0.767*** (0.057)	-	-
Medium size cities adjacent to large cities	0.291*** (0.077)	0.604*** (0.104)	-	-
Large size cities	0.506*** (0.057)	1.052*** (0.080)	-	-
Urban hierarchy 2	-	-		
Small size cities	-	-	0	0
Medium size cities	-	-	0.293*** (0.039)	0.662*** (0.055)
Large size cities	-	-	0.386*** (0.070)	0.799*** (0.097)
Regional hierarchy	-	-		
Periphery	-	-	0	0
Intermediary	-	-	0.156*** (0.042)	0.264*** (0.058)
Core (Randstad)	-	-	0.213*** (0.053)	0.388*** (0.073)
Intercept	-4.439*** (0.128)	-5.980*** (0.177)	-4.533*** (0.130)	-6.114*** (0.179)
Chi-square	19,407.403***		19,434.723***	
-2 log likelihood intercept only	46,309.389		48,904.765	
-2 log likelihood final	26,901.987		29,470.042	
Pseudo Nagelkerke R square	0.578		0.579	
Number of cases	27,596		27,596	

** = p <0.05; *** = p <0.01

Table 5: Multinomial logistic regression logistic goods types (Reference category = no website)

	Mail goods		Parcel goods		Freight goods	
	Information strategy *B* (s.e.)	**Online sales strategy** *B* (s.e.)	**Information strategy** *B* (s.e.)	**Online sales strategy** *B* (s.e.)	**Information strategy** *B* (s.e.)	**Online sales strategy** *B* (s.e.)
Size						
Log10 floor space (in m2)	0.921*** (0.239)	2.361*** (0.236)	1.123*** (0.065)	0.806*** (0.093)	0.923*** (0.084)	2.816*** (0.142)
Organization type 2						
Independents	0	0	0	0	0	0
Multiples	1.036*** (0.216)	3.004*** (0.184)	2.980*** (0.053)	4.157*** (0.074)	3.005*** (0.098)	4.558*** (0.164)
Retail hierarchy						
Solitary urban shops	0	0	0	0	0	0
Small neighborhood / Convenience centers	-0.745 (0.501)	-1.919*** (0.454)	-0.419*** (0.116)	-0.424*** (0.156)	0.698*** (0.164)	1.112*** (0.190)
City district / Large neighborhood centers	-0.111 (0.390)	-1.079*** (0.315)	-0.599*** (0.102)	-0.777*** (0.145)	0.731*** (0.161)	1.165*** (0.202)
City centers	0.644 (0.345)	-0.504 (0.267)	-0.278*** (0.082)	-0.925*** (0.121)	0.798*** (0.108)	1.469*** (0.137)
Peripheral / Large scale retail locations	-0.927 (0.832)	-0.144 (0.489)	0.499*** (0.129)	0.541*** (0.182)	0.641*** (0.119)	-0.542*** (0.191)
Urban hierarchy 2						
Small size cities	0	0	0	0	0	0
Medium size cities	0.633*** (0.160)	0.304** (0.155)	0.331*** (0.044)	0.236*** (0.061)	0.053 (0.090)	0.326*** (0.116)
Large size cities	0.169 (0.258)	0.502** (0.250)	0.575*** (0.080)	0.500*** (0.114)	-0.422*** (0.159)	0.072 (0.206)
Regional hierarchy						
Periphery	0	0	0	0	0	0
Intermediary	0.097 (0.176)	0.097 (0.168)	0.182*** (0.047)	-0.010 (0.066)	0.193** (0.095)	0.538*** (0.119)
Core (Randstad)	0.439** (0.216)	0.256 (0.214)	0.180*** (0.060)	0.015 (0.084)	0.313** (0.122)	0.923*** (0.152)
Intercept	-3.287*** (0.554)	-4.915*** (0.514)	-3.307*** (0.150)	-3.934*** (0.214)	-3.311*** (0.232)	-11.749*** (0.433)
Chi-square	774.531***		9,465.829***		3,672.293***	
-2 log likelihood intercept only	3,382.862		26,694.655		12,458.20	
-2 log likelihood final	2,608.331		17,228.827		8,785.91	
Pseudo Nagelkerke R square	0.395		0.454		0.489	
Number of cases	1,819		19,051		6,726	

** = p <0.05; *** = p <0.01