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Abstract

The paper analyses from an evolutionary perspective how retailers respond and adapt to b2c e-commerce. As such, the paper explores the diversity of behavior of retailers with respect to the adoption of e-commerce. More in particular, it examines empirically the extent to which the adoption of Internet strategies is affected by firm-specific features (e.g., habits of the entrepreneur, routines of firms), network relationships, and geographical proximity. Logistic regression analyses of 643 independent retailers in the Netherlands suggest that geography matters, controlling for other factors. That is, the probability of having an Internet strategy increases significantly when (a) the more knowledge spillovers are locally available; (b) the more demanding local customers are; and (c), the less rivalry is present locally.

1 Introduction

It has been stated more than once that Internet retailing is a potentially disruptive innovation (Burt and Sparks, 2003). Internet technology provides the possibility of an alternative distribution channel, it can make established business models obsolete, and it can pose a real threat to the retailing business in particular locations. E-commerce might, for instance, diminish the relevance of geographical proximity, because physical proximity between retailer and consumer is no longer required (Mitchell, 1995). B2c e-commerce may also dramatically change the composition and nature of retail sectors in cities (Dixon and Marston, 2002; Dixon et al., 2005).

On the other hand, there are constraining forces that may dampen these potentially radical effects of b2c e-commerce. Firms are rationally bounded, meaning they are risk-averse and, thus, quite reluctant to adopt radical technology. Sunk costs may also prevent firms to embrace new technologies. As a result, their response to external changes is neither optimal, nor will they be the same for all firms. This is confirmed by studies of Smit et al. (2002) and Weltevreden et al. (2005a) that found a whole variety of e-commerce strategies among retailers, ranging from small to large disruptions for retailers' physical outlet(s). More in general, retailers are more inclined to use the Internet as a complementary channel, instead of a substitute for in-store shopping (Steinfield et al., 2001; Currah, 2002; Wrigley et al., 2002; Weltevreden et al., 2005a).

There is still little knowledge of what determines the adoption of a particular Internet strategy by a retailer. In this paper, we analyze how and why retailers have responded to b2c e-commerce in the Netherlands. In doing so, we contribute to the literature in two ways. Firstly, we follow suggestions in the literature that research on this topic should move from descriptive to more explanatory studies with a stronger theoretical foundation (Dawson, 2000; Currah, 2002). We adopt an Evolutionary Economic Geography perspective that provides a new analytical framework to capture the adoption process of both retailers and consumers in particular places (Boschma and Lambooy, 1999; Boschma and Weltevreden, forthcoming). Secondly, current research on the adoption of e-commerce lacks a geographical perspective (Leinbach and Brunn, 2001). There exists no systematic attempt to assess the impact of geographical proximity on the adoption of Internet strategies in retailing while controlling for other factors, such as firm-specific characteristics and network relationships of retailers. We estimate the importance of location in three ways: local knowledge spillovers, local rivalry, and local critical demand.

Our objective is to assess which factors contributed most to the choice of a particular Internet strategy. As such, we aim to analyze from an evolutionary perspective the diversity of behavior of retailers with respect to e-commerce, and how this is affected by enabling and constraining structures at the level of individuals (habits), organizations (routines), networks (social relationships) and regions (city centers). Based on a survey of 643 outlets of independent retailers at eight city centers in the Netherlands, we estimate whether firm-specific features, networks relationships of retailers and their location have determined their choice for an Internet strategy. In doing so, controlling for other factors, we explore whether geography matters, as measured by the local vicinity of knowledge, competitors, and critical consumers.

The structure of the paper is as follows. In section 2, we present the analytical framework that is based on evolutionary economic theory. In section 3, we explain how the survey has been conducted, which variables have been measured, and what

kind of methodology will be employed. Section 4 presents the main empirical findings. Section 5 draws the conclusions.

2 E-commerce from an evolutionary perspective

Nelson and Winter (1982) provided a comprehensive evolutionary theory of economic change. Boschma and Lambooy (1999) made an attempt to link this new thinking in economics to theory, key topics and empirical issues in economic geography. In this paper, we further explore how evolutionary theory may be fruitfully applied to the study of the adoption of new technology at the firm level, and how geography may be involved. Since this body of theory deals with the capability of firms to develop and implement new organizational routines, we start at the firm level, being the basic unit of analysis in evolutionary economics. Then, we discuss the role of networks that may provide effective settings for learning. Finally, we introduce the role of geography, and set out in what ways the local environment may influence the adoption of new technology. When doing so, we introduce, among other factors, the demand side that is essential for understanding the adoption of new technology, but which is still poorly treated in evolutionary economics (Witt, 2001).

2.1 Firm-specific features

We reject a neoclassical approach on Internet retailing that treats this new technology as an exogenous event that is universally adopted by rational agents. As Dosi et al. (1988) have explained at length, such a standpoint violates essential features of the innovation process. First of all, it denies the role of uncertainty, which is part and parcel of innovations. It also ignores the importance of real history and real space: the choice for a specific technology is, to a considerable degree, determined by existing knowledge and experience (Gertler, 1988). In addition, new technology should not be treated as something static. Instead, it is changed and adapted when implemented by a firm, depending on the particular context, as embodied in the firm, the network, and the region. Accordingly, firms differ in many respects: they accumulate firm-specific routines, firms participate in network settings to a varying degree, and they are located in different places. An evolutionary approach is well equipped to deal with this issue of heterogeneity of firms: it provides an explanatory framework for why a new technology as Internet retailing takes different forms when adopted, depending on the contexts firms operate in.

Evolutionary approaches employ notion of routines to explain why retailers may be rather reluctant in exploiting this new channel of commerce. Since behavior of agents is routinised, their responses to external change are neither optimal, nor will they be the same for all firms (Nelson and Winter, 1982). Although firms can learn from other firms, organizational change in general, and imitation of successful strategies in particular, are often hard to realize, due to cognitive constraints and firm-specific routines. Firms require not only absorptive capacity but also dynamic capabilities to implement the necessary change in their organization (Teece et al., 1997). From such an evolutionary perspective, we expect no dominant design, but, instead, a whole variety of responses from firms to such a technological change. Rejecting optimal and universal responses, an evolutionary approach provides a framework that explains why some agents are more capable of doing so than others. In other words, it accounts for heterogeneity of firms, as embodied in a variety of e-

commerce strategies in which the Internet is used by retailers as a complementary channel to a varying degree (Steinfield et al., 2001, 2002).

However, there is more to it than just being capable or not. An evolutionary approach also sheds light on what sort of response is more likely to occur, given the context in which the decision making process takes place. Due to the overall importance of routinized behavior, agents change their strategy only in small, incremental steps (Heiner, 1983). Empirical studies show that incremental innovations, instead of major innovations, tend to increase the life chances of firms (Anderson and Tushman, 1990). As Schumpeter describes, changes in an organization are often the result of the (hesitant) recombination or integration of the old (offline) and the new (online): it takes time to gain experience and to incorporate an innovation in existing sets of organizational routines. Concerning our topic of the adoption of e-commerce, this may be witnessed by the fact that catalogue retailers have often been quite successful in embracing this new technology, and incumbent retailers tend to implement Internet strategies that require little or no reorganization of their current activities (Weltevreden et al., 2005a; Boschma and Weltevreden, forthcoming).

Other routine-related factors at the firm level that might affect the varying impact of the adoption of new technology among firms are the age and size of a firm. With respect to age, one expects that the older the firm/entrepreneur, the more competences/routines are built over time, the higher the capability of the firm in that particular area, but the higher the risk of lock-in becomes (Levitt and March, 1996; Brouwer, 2005). This means that when old firms are confronted with radical change (at least totally new to the firm), they will face problems of adaptability. Similar arguments apply to the size of the firm, although this is quite a controversial and largely unresolved issue ever since Schumpeter (1943) claimed that large firms (or better, more concentrated markets) are more conducive to the adoption of innovations (Coombs et al., 1987). Although large firms have greater resources at their disposal, they might lack an ability to implement radical change for reasons of bureaucracy and specialization, among other things.

Besides intra-firm routines presented in a nutshell above, the adoption of new technology by firms may also be affected by external factors. We first turn to the role of networks, and then we explain from an evolutionary perspective how geography may matter in this respect.

2.2 Networks

Since firms do not possess internally all the knowledge and skills they need, they depend on external sources of knowledge. This is especially true when they are confronted with a major new technology. The required knowledge may be readily bought at the market place, but market transactions are often considered not the most effective mechanism to transfer knowledge from one firm to the other, due to, among other reasons, information asymmetry. In a world full of uncertainty, networks are seen as a more effective device by which firms coordinate their activities with other agents (Grabher, 1993). For instance, reciprocal and stable relationships, based on mutual understanding and shared trust, make it easier to exchange knowledge.

Accordingly, networks have some characteristics that enable interactive learning between different agents. These are more enduring and informal relationships in which trust and reciprocity are involved. In that case, there is commitment from both sides, and the risk of opportunistic behavior (being a true risk when agents are prepared to share their knowledge) is reduced to a considerable degree. When applied

to buyer-supplier relationships, conflicts in such strong relationships are resolved through voice-based strategies based on joint-problem solving, rather than exit strategies in pure market relationships. As such, network relationships may act as effective settings through which knowledge is transferred and interactive learning may take place.

Overall, networks may act as mechanisms for knowledge to spill over and diffuse from one firm to the other, due to relational capital. However, this also depends on the routines or competences of firms. Not every firm occupies the same position in a network. Effective transfer of knowledge between firms requires a capacity of firms to identify and exploit new knowledge (Prahalad and Hamel, 1990). Giuliani and Bell (2005) have demonstrated empirically that firms with a high absorptive capacity are more likely to occupy a more central position in knowledge networks, while firms with a low level of absorptive capacity are not, or very poorly connected to these networks through which knowledge circulates and interactive learning takes place.

This may all have implications for the adoption of e-commerce by retailers. Since retailers do not possess internally all the knowledge and skills they need for the adoption of an Internet strategy, they depend on external sources of knowledge. Though entry barriers are not that high as compared to biotechnology for instance, retailers have to acquire knowledge with respect to installing, processing and managing their website. This may be realized in various ways: the new knowledge may be purchased on the market (from consultants, such as web design companies), but can also be acquired by social relationships (families, friends) and/or membership of cooperative organizations (such as trade and shop associations). Geography may also be helpful in this respect. We turn our attention to the issue of geography now.

2.3 Geography

When applying evolutionary thinking to the field of economic geography, key questions are: where do new organizational routines (in our case, different Internet strategies) arise, how do they diffuse in space, and to what extent does geographical proximity affect the adoption of new routines, controlling for other factors (such as firm-specific features and networks) (Boschma, 2004). We restrict our attention to three geographical factors that may affect the choice for a particular technology: co-location induces knowledge spillovers, local competition puts pressure to adopt the latest technology, and so does local critical demand.

Since the 1990s, attention has been drawn to the question whether knowledge spillovers are geographically localized or not (Feldman, 1994; Simmie, 2005). Case studies of particular regions and quantitative studies at a more aggregated level have provided support that knowledge spillovers do not travel over large distances: firms tend to benefit from local sources of knowledge (Feldman, 1999). Various mechanisms may be held responsible for this phenomenon (Capello, 1999). Co-location offers opportunities to learn from other local agents, especially when they share competences (Malmberg and Maskell, 2002). In addition, if the social networks discussed above are geographically bounded, knowledge transfer and interactive learning through these networks will also be geographically localized (Sorensen, 2003). Moreover, since labor mobility often takes place at the regional level, the labor market is another vehicle through which knowledge diffuses locally from firm to firm. Thus, there are good reasons to assume that geographical proximity facilitates inter-firm learning (Boschma, 2005).

Another geographical issue that might influence the adoption of new technology is the co-location of competitors. According to Porter (1990), it implies strong local rivalry that puts additional pressure on local agents to perform. As a result, it fosters the pursuit and rapid adoption of innovations. On the other hand, strong local competition also forces firms with less efficient routines to exit the market, which further raises the capabilities of surviving firms. As such, fierce local competition provides an incentive for local firms to adopt the latest technology without delay. This is especially true in the context of city centers where these incentive and selection forces are expected to be strongest due to the high property costs and rental prices.

Geography may also affect the adoption of a new technology through local demand. This is related to the quantity of local demand, but also, and even more so, to the local level of critical demand (Porter, 1990). According to the incubation hypothesis, the spatial diffusion of a new technology starts in the most urbanized regions, and then trickles down to more peripheral parts in later stages (Pred, 1966; Thompson, 1968). One of the main reasons why cities are considered first adopters or early followers is that these areas house better educated and more affluent (higher-income) people, and thus are more willing to pay the high prices that are common in the first stage of the development of an innovation. Moreover, cities that are well endowed with people with a modern lifestyle (more open-minded and less conservative) give stronger incentives to urban firms to adopt new technology and introduce new products or services (see e.g. Anderson et al., 2003; Foreman et al., 2005a, 2005b). This is in line with a recent study on the spatial diffusion of e-commerce among consumers, which demonstrated that online buying is largely an urban phenomenon (Farag et al., 2006).

This explanation concerning the impact of (local) demand is still quite static. Evolutionary economics offers a more dynamic framework. In addition, an evolutionary economic geography approach of the demand side would concentrate on the analysis of the evolution of behavior of consumers in particular contexts in time and space. It aims to understand the diversity of consumer behavior, and how different behaviors change over time in particular spatial contexts. As opposed to the neo-classical emphasis on the uniform, representative consumer, an evolutionary approach accounts for persistent diversity in behavior between consumers (e.g., between online shoppers, information searchers and offline shoppers), due to individual features (habits, rules) and the wider environment (networks, places).

Due to uncertainty, consumers follow habits and rules when they purchase goods, or when they change their shopping behavior. Instead of focusing on given preferences, an evolutionary approach describes changing preferences based on experimentation (trial-and-error) and learning behavior (e.g., through imitation) in consumption (Witt, 2001). This implies that in places where new forms of consumer behavior (e.g., e-shopping) emerge for the first time, people learn and imitate by observing the experience of other consumers, resulting in a self-reinforcing process. Our hypothesis is that where this dynamic process takes place most prominently, local firms are more likely to respond and adapt to the changing consumer preferences.

2.4 In sum

Building on evolutionary theory, we have described factors that are believed to contribute most to the choice of a particular Internet strategy. Below, we aim to analyze the diversity of responses of retailers with respect to the adoption of e-

commerce, and how these responses are affected by enabling and constraining structures at the individual level (routines, habits), the network level (such as social networks) and the locational level (e.g., does geographical proximity promote inter-firm learning).

3 Methodology

Logistic regression techniques have been employed to determine which factors (i.e., firm- and sector-specific features, geography and networks) had an impact on the selection of a particular type of Internet strategy. Before presenting the main outcomes, we first explain how the survey data have been collected. Then, we describe which variables have been used and which methodology was adopted.

3.1 Data collection

From May to early August 2004, 1,951 independent retailers with one or more outlets were asked to participate in a telephone survey concerning their Internet strategy and its effects on their organization. In the survey, we examined retailers in eight city centers in the Randstad area in the Netherlands (Alkmaar, Almere, Amersfoort, Haarlem, Hilversum, Purmerend, Utrecht, Veenendaal). The reasons why we have chosen city centers are fourfold. Firstly, the majority of retail shops in the Netherlands are concentrated in city centers (Locatus, 2002). So, if we intend to assess the effects of Internet on retailing, these places are likely to be most affected. Secondly, as the number of retailers with an online sales strategy is still relatively small, but is highest in the largest cities of the Netherlands (Weltevreden et al., 2005b), an analysis of retailers at city centers is extremely useful to throw light on the decision of retailers to pursue an online sales strategy or not. Thirdly, because of the high quality of city centers as shopping locations, retailers in those locations will most likely take that into account when considering an Internet strategy. It might well be that the attractiveness of cities may even limit the adoption of e-commerce. Fourthly, city centers are dynamic environments with strong selection forces that will affect the probability of b2c e-commerce adoption. As explained in the following, we will examine the effects of location in three different ways, each of which is expected to be much stronger present in city centers than outside cities.

The sample of retailers was drawn from a database collected earlier that year, which contained data about the total population of retail outlets (i.e., 3,369 shops) in eight city centers, including sector, address, phone number and Internet strategy of each outlet. Since some respondents were too busy to participate in the research via the telephone, a paper and e-mail version of the questionnaire were also available. In total, 84.9 percent was completed by telephone, 11.9 percent by mail, and 3.2 percent by e-mail. The survey eventually resulted in 624 (32%) useable responses, which represent 643 retail outlets in the eight city centers. Goodness-of-fit tests were conducted to test the reliability of our sample of retail outlets. A chi-square goodness-of-fit test investigates whether a sample fits the frequency distribution of the total population (McGrew and Monroe, 1993). Results indicate that the distribution of shops by retail category in our sample fits the distribution in total population of retail outlets in the eight city centers ($\chi^2 = 19.846$, with $p < 0.05$ and $df = 17$). However, the chi-square goodness-of-fit test for Internet strategy distribution shows that our sample does not fit the distribution of Internet strategies in the total population ($\chi^2 = 24.713$, with $p < 0.05$ and $df = 1$). More specifically, there is an under-representation of

outlets with no website, while shops with a website are overrepresented. A plausible explanation is that independents with a website are by and large more interested to participate in a survey concerning Internet adoption.

3.2 Dependent variable

The dependent variable is types of Internet strategies. Elsewhere (Weltevreden et al., 2005a), we made a distinction between twelve types of strategies. However, we needed to bring down this number to three main categories (pre-internet, information and online sales), because of the small number of cases attached to most of the twelve categories.

Pre-internet strategies are strategies in which retailers make no active use of the Internet. That means that they can still have a domain name, but their website is still 'under construction'. With information strategies, we mean retailers that have an active website, which is used to provide company information and, in almost all cases, product information. Online sales strategies are strategies that use the Internet as a sales channel. It is good to remind that our group of retailers all have a physical presence in at least one of the eight city centers, leaving out those retailers that conduct a purely virtual strategy (with no physical outlets). When looking at the division of the 643 retail outlets among the three categories, most of the shops had no active websites (51.9%), followed by the ones having an information strategy (38.9%) and an online sales strategy (9.2%).

3.3 Independent variables

As explained above, our objective is to measure the impact of firm-specific features, network relationships, and locational factors on the adoption of e-commerce by independent retailers. The following independent variables have been included in our estimation models (see also Table 1).

To begin with, we account for the impact of routines at the level of the firm and the entrepreneur, in order to explain their response to b2c e-commerce. As described earlier, a retailer requires a capacity to absorb, interpret, and understand new knowledge: it takes time to gain experience and to incorporate a new Internet strategy. We expect retailers with relevant technical and entrepreneurial experience will face fewer problems in this respect. Concerning technical experience, we expect retailers with Internet experience to be more inclined to embrace a more advanced Internet strategy than retailers lacking such experience. The variable INTEXP measures the number of years the entrepreneur has Internet experience. In order to avoid the risk of mixing up cause and effect, because firms may simply have counted the number of years they employ an Internet strategy, we asked how many years the entrepreneur is on the Internet for private purposes. With respect to entrepreneurial experience, we have measured the number of years the shop owner is active as an entrepreneur. Not quite unexpectedly, this latter variable ENTEXP shows a high correlation with the age variable (correlation 0.654, $p < 0.01$).

To control for the impact of other firm-specific features, we have included two variables, that is, the size of the firm, and the type of products the firm sells. We have constructed a variable SIZE that measures the logarithm of the number of employees. We expect the larger the firm, the higher the probability of adopting e-commerce, because it has more knowledge and other resources at its disposal (see e.g., Brown, 1981).

It is common knowledge that e-commerce adoption widely differs among retail categories (see e.g., Doherty et al., 1999; Hart et al., 2000; Ellis-Chadwick et al., 2002; Weltevreden et al., 2005a, 2005b). In order to account for this, we have defined three types of goods derived from two existing product classifications (i.e., Copeland, 1923; Nelson, 1970, 1974). Search goods (SEAPROD) are products for which full information about product attributes can be known prior to the purchase. Obvious examples are books and CD's. We regard these goods as most suitable for online purchases. A second type of goods is experience goods (EXPPROD). These goods require direct physical experience by consumers during the purchase (e.g., clothing, perfumes), or it is at least more difficult or costly to acquire information about the product because of the complexity of the product or market. Convenience goods are goods that are frequently purchased and part of the consumers' daily routines. Since it takes more effort to acquire information about those products online than a daily trip to a neighborhood or convenience center, the Internet is least suitable for this type of goods. We have constructed two dummy variables, SEAPROD and EXPPROD, with convenience goods as the omitted reference group.

Retailers not just learn from their own experience, they may also learn from their local environment. As stated earlier, we expect that Internet strategies of retailers will converge within a city, but not necessarily between cities, because of three reasons. First, close proximity of retailers facilitates learning and imitation of (successful) Internet strategies: knowledge spillovers often tend to be geographically localized. Second, proximity may also mean intense local rivalry, which puts high pressures on retailers to follow and imitate new strategies of successful local competitors without delay. This is especially true in city centers where the selection environment is harsh. Third, local demand in some cities may be more demanding (i.e., more open-minded towards e-commerce). In such circumstances, local retailers are not only pushed to be more innovative, they also benefit and learn from customers' reactions in their immediate surroundings (Witt, 2001). In order to account for the three ways geography may affect the adoption of Internet strategies, we have measured the following indicators.

Firstly, the variable LOCDEM measures the intensity of local demand concerning e-shopping. We collected data concerning e-shopping behavior of 3,218 Internet users who mainly shop in one of the eight city centers. In this dataset, Internet users are divided into three types, depending on their online activities: e-shoppers (who buy and search online), online searchers (who only search online) and non-e-shoppers (who do not shop online). Since the distribution of LOCDEM was skewed, we looked at the mean of the logarithmic of the shares. LOCDEM has been measured as a dummy variable based on the share of non-e-shoppers in the city of the retailer (0 = above the logarithmic mean of -0.98 (> 10%); 1 = below the logarithmic mean of -0.98 (< 10%)). Secondly, the variable LOCKNOW deals with the effect of local knowledge spillovers. It has been measured as a dummy variable covering the share of shops in a city belonging to independents that had registered a domain name in 2002 (0 = above the logarithmic mean of -0.44 (> 36%); 1 = below the logarithmic mean of -0.44 (< 36%)). So, we expect that the more shops with a domain name in a city in the past, the higher the probability that retailers in this city had adopted an Internet strategy in 2004. Thirdly, the intensity of local competition (LOCCOMP) has been measured as the number of retailers in the same sector in the same city. Since our database contains data for 133 different retail categories, this competition measure may be considered highly accurate and precise. Finally, we have added a geographical

control variable PUBLTRAN. This is a dummy variable that distinguishes between outlets with a good accessibility by public transportation (1) and outlets that are less accessible (0). This variable has been included to test whether there are also intra-city differences in Internet adoption between retail outlets.

Besides their local environment, retailers may also learn from network relationships that may, or may not, extend the boundaries of their city. To account for the impact of network relations on the adoption of Internet strategies, we have developed three variables, each of which accounts for external agents that may have been relevant for acquiring knowledge on e-commerce. The first is SOCREL which measures the importance of relationships of family and/or friends for acquiring knowledge concerning installing, processing and managing their website. In the survey, the respondent could indicate how important this type of relationship had been on a scale from 1 (not important) to 10 (very important). The second variable TRADASS concerns membership of a trade association that has been measured as a dummy variable (0=no member, 1=member). The third variable SHOPASS measures whether the retailer was member of a shop association (0=no member, 1=member). Table 1 gives the descriptive statistics of all variables included in our estimations. In addition, Table A1 in the appendix reports the correlations among the independent variables.

Table 1. Mean, standard deviation, minimum and maximum value for each variable

	Mean	Std. Dev.	Minimum	Maximum	N
INTEXP	5.921	3.414	0	20	643
ENTEXP	14.515	10.771	0.100	52	643
SHOPASS	0.454	0.498	0	1	643
TRADASS	0.491	0.500	0	1	643
SOCREL	5.409	3.111	1	10	643
LOCDEM	0.827	0.378	0	1	643
LOCKNOW	0.425	0.764	0	1	643
LOCCOMP	13.771	16.005	0	81	643
EXPPROD	0.607	0.489	0	1	643
SEAPROD	0.278	0.449	0	1	643
SIZE	0.407	0.325	-0.301	1.778	643
PUBLTRAN	0.593	0.492	0	1	643

3.4 Method

We have conducted multinomial logistic regression analyses to estimate the relative importance of firm-specific features, network relationships and location, because our dependent variable is a variable consisting of three categories (pre-Internet strategy, information strategy and online sales strategy). Logistic regression is used to rank the relative importance of all the independent variables that can be of any type. This methodology applies maximum likelihood estimations in which the dependent variable is transformed into a logit variable, meaning the natural log of the odds of the dependent variable occurring or not. As a result, the estimates describe the probability that, in our case, a certain type of Internet strategy is selected.

There are similarities with OLS regressions. For instance, the standardized logit coefficients correspond to beta weights, the significance of each independent variable can be tested with the assistance of Wald statistics, and a pseudo R-square summarizes the strength of the relationships. The difference with OLS regressions is

that logistic regressions calculate changes in the log odds of the dependent variable, rather than changes in the dependent variable itself. Logistic regressions have also fewer restrictions. For instance, it does not require normally distributed variables, nor does it assume linearity of relationships between variables (Hair et al., 1998; Wrigley, 1985).

Table 2. Multinomial logistic regressions of Internet strategy adoption by independent retailers in Dutch city centers (standard errors in parentheses)[1]

	Model 1		Model 2		Model 3	
	Information	Online sales	Information	Online sales	Information	Online sales
Intercept	-2.510***	-5.322***	-3.050***	-6.836***	-3.041***	-7.540***
	(0.401)	(0.693)	(0.526)	(0.995)	(0.558)	(1.123)
Firm						
INTEXP	0.130***	0.356***	0.130***	0.363***	0.135***	0.379***
	(0.029)	(0.052)	(0.030)	(0.053)	(0.030)	(0.055)
ENTEXP	-0.014*	-0.009	-0.015*	-0.010	-0.015*	-0.007
	(0.009)	(0.016)	(0.009)	(0.016)	(0.009)	(0.016)
Location						
LOCDEM			0.325	1.438***	0.320	1.393**
			(0.246)	(0.545)	(0.247)	(0.546)
LOCKNOW			0.460**	0.439	0.442*	0.413
			(0.225)	(0.382)	(0.227)	(0.387)
LOCCOMP			-0.017***	-0.032**	-0.017***	-0.034**
			(0.006)	(0.016)	(0.006)	(0.017)
Network						
SHOPASS					-0.161	-0.259
					(0.192)	(0.353)
TRADASS					0.320*	0.282
					(0.187)	(0.348)
SOCREL					-0.014	0.081
					(0.029)	(0.055)
Control var.						
EXPPROD	1.172***	-0.133	1.358***	0.259	1.354***	0.296
	(0.320)	(0.524)	(0.332)	(0.549)	(0.332)	(0.554)
SEAPROD	1.471***	1.525***	1.490***	1.663***	1.452***	1.703***
	(0.351)	(0.524)	(0.354)	(0.534)	(0.355)	(0.542)
SIZE	1.380***	1.740***	1.412***	1.785***	1.324***	1.867***
	(0.290)	(0.490)	(0.296)	(0.502)	(0.309)	(0.540)
PUBLTRAN			0.048	0.025	0.090	0.112
			(0.185)	(0.336)	(0.186)	(0.342)
Chi-square	144.009***		163.628***		170.332***	
Pseudo Nagel-kerke R square	0.238		0.266		0.276	
N	643		643		643	

[1] Pre-internet strategies as reference category
* = p < 0.1; ** = p < 0.05; *** = p < 0.01

4 Empirical outcomes

The empirical findings are outlined in Table 2. We estimated three models, starting with the impact on firm-internal features, while controlling for other variables. In model 2, we added the possible impact of networks, while in model 3, the variables measuring the effects of location were included. Pre-Internet strategies have been taken as the reference category.

Model 1 shows that firm-specific features matter. As expected, retailers with personal Internet experience (INTEXP) show a higher likelihood to have more sophisticated Internet strategies. In other words, they are more likely to pursue an information strategy and, even more so, an online sales strategy, as shown in the higher beta coefficient of the latter. In contrast, entrepreneurial experience (ENTEXP) has a negative effect, suggesting a lock-in effect: the more experienced (and older) the entrepreneur is, the less capable the firm is to shift to e-commerce. However, this variable is only significant in the case of information strategies, meaning that the more experienced an entrepreneur is, the less likely it follows an information strategy, as compared to those having a pre-Internet strategy.

What is striking is that the controlling variables are highly significant and robust in almost all cases. First of all, the type of product retailers sell matters a lot, which is fully in line with our expectations. Retailers selling search goods (SEAPROD) have a higher probability to pursue more advanced Internet strategies, as compared to a pre-Internet strategy. Retailers selling experienced goods (EXPPROD) are more likely to have an information strategy, but not an online strategy. In other words, these retailers do provide information through the Internet, but do not offer the possibility to sell their goods on the Internet, as their products are relatively unsuitable to sell online. Secondly, the size of the retailers (SIZE) matters as well. The larger the number of employees, the higher the probability that a retailer will adopt a more advanced Internet strategy. Probably this has to do with larger retailers having more resources that facilitate b2c e-commerce adoption. In addition, since the average size of independent retailing firms is relatively low (only 3.6 fulltime employees, with a maximum value of 60 fulltime employees), this result confirms that one can almost exclude the possibility that independent retailers are too rigid for bureaucratic reasons to respond to e-commerce. As observed above, only an overload of entrepreneurial experience (and a lack of Internet experience) seems to harm the ability of retailers to adapt to e-commerce.

In model 2, we have added geographical variables. As expected, geography matters in several ways. A key result is that local demand (LOCDEM) matters. As expected, the more local consumers are demanding (i.e., the lower the share of non-e-shoppers in the city concerned), the higher the probability a retailer follows an online sales strategy, but this relationship is not significant in the case of an information strategy. Local knowledge spillovers (LOCKNOW) tend to matter to some extent: the higher the share of shops with a domain name in a city in the past, the more likely an information strategy is currently conducted by local retailers. However, this does not apply to the adoption of online sales strategies: as observed above, it is local critical demand that makes the difference in this respect. Local rivalry (LOCCOMP) matters too, but it has a negative impact in our model. Thus, contrary to what we expected, the more local rivalry, the less retailers are inclined to adopt an information and online sales strategy. A plausible explanation is that there may be a sector effect involved. In

general, more e-commerce sensitive sectors such as media goods and consumer electronics retailers on average turned out to have fewer competitors at city centers than less e-commerce sensitive sectors like clothing and shoes retailers.

In model 3, the effects of different types of network relationships are presented. Only membership of a trade association (TRADASS) positively affects the probability of having an information strategy (as compared to pre-Internet strategies), but it has not a significant impact on online sale strategies. So, trade associations may be helpful in encouraging the adoption of information strategies, but the decision to embrace an online sales strategy is dependent on other factors. Social relationships (SOCREL) as a source of ICT knowledge do not seem to influence the choice of Internet strategies, nor does membership of a shopkeepers association (SHOPASS). We did additional analyses to see whether small firms and firms with no Internet experience may have overcome these internal weaknesses by establishing network relationships. Once again, we found no relationship: small firms with network relations had no higher probability to adopt Internet strategies than firms without network relations, nor did firms with network relations but no Internet experience, as compared to firms without network relations and without Internet experience.

5 Conclusions

This study has shed light on the relevance of applying evolutionary theory to empirical research in the field of economic geography. Among other things, it has demonstrated that geographical issues have an impact on the evolution of new organizational routines, as the analysis of the adoption of new Internet strategies in the Dutch retailing sector showed. While local knowledge or buzz stimulated the decision of retailers to purse an information strategy, it was local critical demand that affected positively the adoption of online sales strategies by retailers in Dutch city centers. In addition, local rivalry lowered the probability of retailers to be engaged in Internet strategies. This is not to deny the impact of other factors. On the contrary, firm-specific features like old routines (entrepreneurial experience), new routines (Internet experience) and specialization (search goods) did also affect the decision to adopt Internet strategies. Only network relationships hardly made an impact.

Having said that, we should be more precise in determining the effect of location. In this paper, we have limited ourselves to three variables that were reduced to dummy variables because only eight Dutch cities were included in the analysis. For that reason, our analysis can be considered a first step to show the relevance of geography in the process of b2c e-commerce adoption by retailers. It would also be recommendable to include peripheral regions, instead of cities in the most urbanized part of the country only, because we expect retailers to embrace different Internet strategies than retailers in more urbanized settings (see e.g., Weltevreden et al., 2005b).

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Appendix

Table A1. Pearson correlation matrix of independent variables

	INTEXP	ENTEXP	SHOPASS	TRADASS	SOCREL	LOCDEM	LOCKNOW	LOCCOMP	EXPPROD	SEAPROD	SIZE	PUBLTRAN
INTEXP	1.000											
ENTEXP	-0.182***	1.000										
SHOPASS	0.117***	0.073*	1.000									
TRADASS	0.010	0.026	0.203***	1.000								
SOCREL	0.104***	-0.124***	-0.039	0.013	1.000							
LOCDEM	-0.023	-0.021	-0.054	-0.012	0.020	1.000						
LOCKNOW	0.016	-0.017	-0.117***	0.012	0.031	-0.254***	1.000					
LOCCOMP	-0.078**	-0.015	-0.065*	-0.003	-0.007	0.160***	0.124***	1.000				
EXPPROD	-0.101***	-0.016	0.076*	0.009	0.026	0.020	0.024	0.375***	1.000			
SEAPROD	0.141***	0.029	-0.127***	-0.028	-0.030	-0.010	0.019	-0.268***	-0.771***	1.000		
SIZE	0.066*	0.080**	0.246***	0.267***	-0.077*	-0.056	-0.029	-0.039	-0.007	-0.104***	1.000	
PUBLTRAN	-0.083**	-0.108***	0.044	-0.071*	0.004	-0.052	-0.096**	-0.047	-0.033	0.049	0.066*	1.000

* = p < 0.10; ** = p < 0.05; *** = p < 0.01