

Towards a longitudinal model of e-commerce: environmental, technological and organisational drivers of B2C adoption¹

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Despite the important benefits for firms of commercial initiatives on the Internet, e-commerce is still an emerging distribution channel, even in developed countries. Thus more needs to be known about the mechanisms affecting its development. A large number of works have studied firms' e-commerce adoption from technological, intraorganisational, institutional or other specific perspectives, but there is a need for adequately tested integrative frameworks. Hence this work proposes and tests a model of firms' B2C e-commerce adoption that is founded on a holistic vision of the phenomenon. With this integrative approach, the authors analyse the joint influence of environmental, technological and organisational factors, and moreover, they evaluate this effect over time. Using various representative Spanish data sets covering the period 1996-2005, the findings demonstrate the suitability of the holistic framework. Likewise, some lessons are learned from the analysis of the key building blocks. In particular, the current work provides evidence for the debate about the effect of competitive pressure, since the findings show that competitive pressure disincentivises e-commerce adoption in the long term. The results also show that the development or enrichment of the consumers' consumption patterns, the technological readiness of the market forces, the firm's global scope, and its competences in innovation continuously favour e-commerce adoption.

Keywords: e-commerce, adoption, TOE framework, B2C, longitudinal analysis, Internet

Introduction

Nowadays, firms frequently use the Internet to present their supply of products and establish a dialogue with their stakeholders. But the Internet is still an emerging medium in the commercial distribution of goods and services. According to data from Eurostat and the OECD, less than a third of the firms in advanced countries carry out B2C e-commerce².

The literature recognises business initiatives making intensive use of ICT, and in particular e-commerce through the Internet, as sources of sustainability and economic growth (Brynjolfsson and Kahin, 2000), so it is important to identify the factors influencing the commercial activities that firms undertake with their consumers. In fact,

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² In 2007: 20.3%, 31.1%, and 13.1% in Japan, Australia and Canada, respectively; and 24.4%, 15.1%, and 29.1% in Germany, Finland and the UK, respectively. In Spain the figure falls to only 8.2%.

this new commercial format offers firms important advantages, allowing them to contact and appropriately serve their target markets and segments more cheaply than through conventional physical channels (Sharma and Sheth, 2004; Sheth and Sharma, 2005). On the customers' side, e-commerce also has a number of advantages. It allows consumers to carry out their purchase activities more efficiently by making information about a much wider range of products available (Alba *et al.*, 1997; Bakos, 1997) and offering them systematic automated product comparisons (Häubl and Trifts, 2000; Smith, 2002), and offers them greater convenience and flexibility in their purchase decision processes (Bhatnagar *et al.*, 2000; Chiang and Dholakia, 2003), saving them from having to travel to make their purchases and allowing them to purchase at any hour of the day (Watson, 2002). Researchers have noted other advantages of an emotional or hedonic nature (Childers *et al.*, 2001; Xia, 2002; Martínez-López *et al.*, 2006).

The literature on the development of e-commerce, and in particular the empirical research carried out in advanced economies, has identified a large number of factors influencing or determining this phenomenon. In order to interpret the results of these studies it is useful first to distinguish between three types of study. First, those studies focusing fundamentally on factors to do with the environment or the institutional context (Javalgi and Ramsey, 2001; Brousseau, 2003; Lee *et al.*, 2003; Wong, 2003; Ferguson and Yen, 2006, among others). These works tend to stress external influences such as the competitive pressure, the socio-cultural forces, the regulations, and so on, as the main determinants in the development of e-commerce initiatives. Second, those studies that take a technological perspective and that focus on innovation. These works are founded on models such as the innovation diffusion and technology acceptance models. They tend to consider relative advantage, compatibility, complexity, perceived utility, perceived ease of use, among others, as key determinants of e-commerce (e.g., Kendall *et al.*, 2001). And third, those studies that take a predominantly organisational perspective (Auger and Callauger, 1997; O'Keefe *et al.*, 1998; Bertschek and Fryges, 2002; Riquelme, 2002, among others), which seek the determinants of adoption in an internal context. They stress firm size, the firm's global scope, its organisational competences, and its orientation to innovation, among other factors.

Nevertheless, an alternative approach exists to explain the adoption of technological innovations. This approach, which was initially proposed by Tornatzky and Fleischer (1990), integrates the three previous perspectives. Studies on e-commerce diffusion taking this approach are, however, scarce. Indeed, the literature review for the current work identified just two empirical studies using this framework to explain e-commerce adoption (i.e., Gibbs and Kraemer, 2004; Lee and Kim, 2007) and another four studies to explain e-business adoption (i.e., Xu *et al.*, 2004; Zhu *et al.*, 2004; Zhu and Kraemer, 2005; Zhu *et al.*, 2006). Moreover, all six studies conduct only cross-sectional analyses.

There is consequently a need to find an integrative theoretical approach that apart from the environmental forces, also considers other aspects to do with technological innovation and internal organisational factors to try to explain the global phenomenon of the development of B2C e-commerce. Likewise, and given the lack of integrative longitudinal models (the literature review identified only one work, by Forman, using data from the US market for the period 1996-1998), it would be useful to empirically examine how these mechanisms jointly condition the evolution of the phenomenon over time.

With this purpose, the rest of this article is structured in four sections. The next section reviews the literature on firms' adoption of ICT and marketing and e-commerce systems, and presents an integrative explanatory model of the phenomenon. The third section presents the variables and data required to validate the model of the e-commerce initiatives that firms undertake with their consumers in a market like the Spanish one. The analysis is longitudinal, and takes the year 1996 as starting point, the year that the Internet is considered to have made its appearance as a marketing channel in this market (Meseguer *et al.*, 2003). The fourth section discusses the results obtained in the validation of the proposed model, and the fifth section provides the conclusion of the work, its contributions, and its main limitations.

Conceptual model and hypotheses

To date, many studies on firms' adoption of the Internet for B2C e-commerce have tried to explain this phenomenon at the level of an industry, market or nation (Javalgi and Ramsey, 2001; Oxley and Yeung, 2001; Brousseau, 2003; Lee *et al.*, 2003; Wong, 2003; Ferguson and Yen, 2006; etc.). Using the terminology of Fillis *et al.* (2004) and Kim and Galliers (2004), these works are at the "macro" level. But another large number of studies (Sung and Gibson, 2005; Vilaseca *et al.*, 2007; etc.) try to explain the phenomenon at the firm level, which means they can be conceived as being at the disaggregated or "micro" level (see Table 1).

These authors' assumption of the different levels of approach has repercussions for the research eventually carried out. First, the studies on e-commerce taking a predominantly "macro" orientation tend to reflect the global dynamics of the phenomenon but ignore factors to do with the technology per se. These works also have some difficulty explaining why some firms opt to initiate e-commerce activities while others prefer to stick to conventional marketing formats. Second, "micro" level studies have mainly identified factors to do with the technology or the organisational area, but tend not to consider aspects to do with the environment or the institutions as determinants. Another limitation of "micro" level studies is their difficulty reflecting the open, global nature of the Internet – a means of communication and distribution that interconnects customers and businesses in a knowledge-based economy.

Table 1. Illustrative pool of works on firms' e-commerce adoption in function of level of approach

Level of approach	Author(s) and year	Object of analysis	Scope of analysis	Factors relevant in adoption
<i>Macro level</i>	Javalgi and Ramsey (2001)	E-commerce adoption	Global	- Information technology and telecommunications infrastructure - Social/cultural infrastructure - Commercial infrastructure - Government/legal infrastructure
	Oxley and Yeung (2001)	E-commerce adoption	30 countries	- Supportive institutional environment - Credible payment channels
	Brousseau (2003)	E-commerce adoption	France	- Early adoption of Minitel and EDI - Macroeconomic climate - Distribution channels
	Lee <i>et al.</i> (2003)	Broadband and e-commerce	South Korea	- Deregulation in the Internet market - Internet promotion policies

		adoption		<ul style="list-style-type: none"> - Infrastructure competition - Internet PC “bangs”³ - Social and cultural environment factors
	Wong (2003)	E-commerce adoption	Singapore	<ul style="list-style-type: none"> - Structure of economy - Demographic structure - Infrastructure for physical distribution - Developed ICT workforce - Transparent and trusted financial and legal system
	Ferguson and Yen (2006)	E-commerce adoption	Global	<ul style="list-style-type: none"> - Overall economic development - ICT infrastructure - Administrative policies and incentives - Culture differences, values, beliefs and attitudes
	Ho <i>et al.</i> (2007)	E-commerce adoption	17 European countries	<ul style="list-style-type: none"> - Internet penetration - Telecommunication investment intensity - Education level - Regional contagion
<i>Micro level</i>	Auger and Callauger (1997)	E-commerce adoption	Small and medium-sized manufacturers	<ul style="list-style-type: none"> - Development and maintenance costs - Interest in experimenting with channel - Wish to promote products and build image - Financial considerations - Benefits of obtaining and disseminating information
	O’Keefe <i>et al.</i> (1998)	E-commerce adoption	Small retailers	<ul style="list-style-type: none"> - International scope - Access to target - Cost
	Kendall <i>et al.</i> (2001)	E-commerce adoption	SMEs	<ul style="list-style-type: none"> - Relative advantage - Compatibility - Trialability
	Bertschek and Fryges (2002)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Size - Employees with high educational level - Internationalisation
	Riquelme (2002)	Commercial use of Internet	Firms	<ul style="list-style-type: none"> - Size
	Kraemer <i>et al.</i> (2005)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Internationalisation
	Sung and Gibson (2005)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Security of systems - Privacy of information - Technical e-commerce expertise - Quantity of information about supply - Variety of goods and services
	Hong and Zhu (2006)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Technology integration - Web functionalities - Web spending - Partner usage
	Vilaseca <i>et al.</i> (2007)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Pressure from competitors - Organisational complexity and orientation towards network design - Strategic orientation to market, marketing and relationships - Corporate innovation - Managers’ educational level - ICT equipment held and used

Ideally then, researchers trying to explain the dynamic evolution of the phenomenon of e-commerce among firms in a market or nation should adopt an integrative framework

³ Roughly equivalent to Internet cafés.

like the one Kim and Galliers (2004) propose. These authors recommend considering the joint influence on e-commerce of up to four different types of factor: a) non-technological external factors, which have mainly to do with the commercial or business attractiveness of electronic markets to the firms; b) technological external factors; c) non-technological internal factors; and d) technological internal factors, which have mainly to do with innovation.

This conceptual framework helps resolve the limitations of the previous studies, since it considers the joint influence of technological and non-technological factors. This will allow the analysis to capture differences between organisations operating in the same competitive context. At the same time this framework is consistent with Tornatzky and Fleischer's (1990) theoretical framework – known as the technology-organisation-environment (TOE) framework, for which the relevant factors in the adoption of technological innovations are both the external and internal characteristics of the organisation and technology-related aspects. Moreover, as Table 2 shows, the TOE framework has received empirical support in the area of EDI systems adoption (e.g., Iacovou *et al.*, 1995), open systems adoption (Chau and Tam, 1997), Internet adoption (Teo *et al.*, 1997), and e-business diffusion (Xu *et al.*, 2004; Zhu *et al.*, 2004; Zhu and Kraemer, 2005; Zhu *et al.*, 2006). Specifically in e-commerce, Gibbs and Kraemer's (2004) and Lee and Kim's (2007) empirical studies provide support for the TOE conceptual framework and contribute to explaining the development of e-commerce. The first work uses a sample of 2,139 firms from 10 different countries, while the second uses a sample of 120 firms with their headquarters in South Korea. Various authors have defined and tested other integrative models that consider the simultaneous influence of environmental and internal variables (Raymond, 2001; Ching and Ellis, 2004; Eid and Trueman, 2004; Forman, 2005; Molla and Licker, 2005; To and Ngai, 2006; Chong, 2007; Tan *et al.*, 2007; Rodriguez-Ardura *et al.*, 2008).

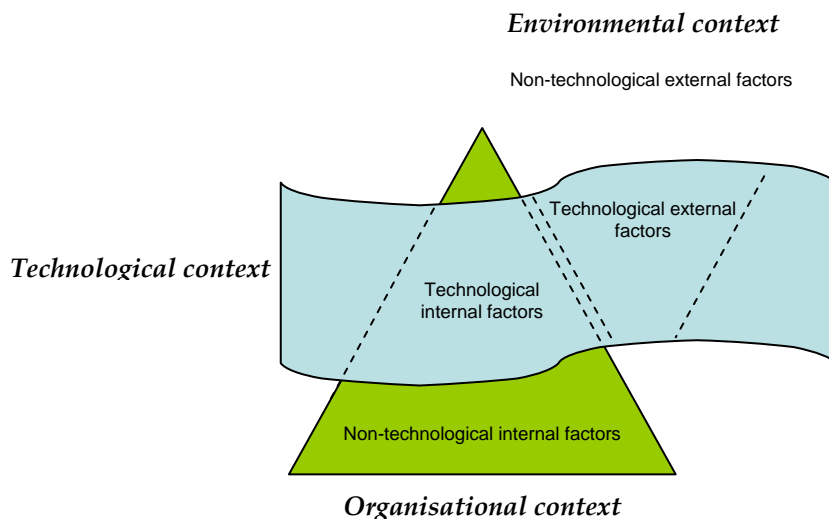
Table 2. Empirical studies of firms' adoption of e-commerce or other ICT taking integrative approach, and dimensions considered

Theoretical framework	Author(s) and year	Object of analysis	Scope of analysis	Dimensions considered
TOE framework	Iacovou <i>et al.</i> (1995)	EDI systems adoption	SMEs	- External pressures - Organisational readiness - Perceived benefits
TOE framework	Chau and Tam (1997)	Open systems adoption	Firms	- External environment - Organisational technology - Characteristics of the open systems technology innovation
TOE framework	Teo <i>et al.</i> (1997)	Internet adoption	Firms	- Organisational factors - Technological factors - Environmental factors
Diffusion of innovations, Organisational learning, ICT adoption literature	Raymond (2001)	Internet adoption	Travel agencies	- Environmental context - Marketing strategy - Managerial context - Organisational context - Characteristics of the technological innovation itself
Diffusion of innovations, technological innovations adoption	Ching and Ellis (2004)	E-commerce adoption	SMEs	- Environmental characteristics - Decision-maker characteristics - Innovation characteristics

literature				
Key success factor concept	Eid and Trueman (2004)	E-commerce adoption	Internationalised firms	<ul style="list-style-type: none"> - Marketing strategy related factors - Web site related factors - Global dimension related factors - Other internal related factors - External related factors
TOE framework	Gibbs and Kraemer (2004)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Environment - Organisation - Technology
TOE framework	Xu <i>et al.</i> (2004)	E-business adoption	Firms	<ul style="list-style-type: none"> - Environmental context - Organisational context - Technological context
TOE framework	Zhu <i>et al.</i> (2004)	E-business adoption	Financial services firms	<ul style="list-style-type: none"> - Environmental context - Organisational context - Technological context
Diffusion of innovations, Internet adoption literature	Forman (2005)	Internet and e-commerce adoption	Firms	<ul style="list-style-type: none"> - External environment - Complementarities with establishment location - Size - Complementarities with ICT investments
Interactionism	Molla and Licker (2005)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Perceived external e-readiness - Perceived organisational e-readiness
Innovation diffusion literature, Resource-based theory, TOE framework	Zhu and Kraemer (2005)	E-business post-adoption	Retail firms	<ul style="list-style-type: none"> - Environmental context - Organisational context - Technological context
Innovation literature	To and Ngai (2006)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Competitive pressure - Channel conflict - Relative advantage - Technical resource competence
TOE framework	Zhu <i>et al.</i> (2006)	E-business adoption	Firms	<ul style="list-style-type: none"> - Environmental context - Organisational context - Technological context
Technology diffusion literature	Chong (2007)	E-commerce adoption	SMEs	<ul style="list-style-type: none"> - External environmental factors - Internal environmental factors
Contingency theory, TOE framework	Lee and Kim (2007)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - IS related factors - Organisational factors - Characteristics of technology innovation
Interactionism	Tan <i>et al.</i> (2007)	E-commerce adoption	Firms	<ul style="list-style-type: none"> - Perceived external e-readiness - Perceived organisational e-readiness
ICT adoption literature	Rodríguez-Ardura <i>et al.</i> (2008)	E-commerce adoption	Spain	<ul style="list-style-type: none"> - Factors of competitive environment - Factors of firm's value proposition

With all this, the conceptual model of the current work is the result of fusing the typology or group of factors proposed by Kim and Galliers (2004) with the TOE framework, as Figure 1 shows. The factors from the different areas or contexts that the model includes are the ones that the literature on firms' adoption and diffusion of ICT has found relevant. Likewise, in order to take account of the particular characteristics of e-commerce, the model also considers factors that the literature has specifically considered to explain firms' adoption of the Internet and e-commerce.

Figure 1. Conceptual model



Non-technological external context

In principle, the environment in which the firm operates seems to influence its propensity to adopt technological innovations like e-commerce. Indeed, the literature provides evidence that firms operating in certain environments make more intensive use of ICT in general (Thong, 1999), and the Internet and e-commerce in particular (e.g., Raymond, 2001; Eid and Trueman, 2004). But the evidence is somewhat weaker in the case of Internet adoption in the area of commercialisation (Sadowski *et al.*, 2002). Indeed, some authors have failed to find evidence of such a relation (Arnott and Bridgewater, 2002).

On the one hand, and following the literature on innovation diffusion (e.g., Kimberly and Evanisko, 1981; Gatignon and Robertson, 1989; Teo *et al.*, 2003), the model includes competitive pressure as a possible determinant of the e-commerce adoption decision. Many studies of e-business systems (Hsu *et al.*, 2006; Jeon *et al.*, 2006; Wang and Cheung, 2004; Xu *et al.*, 2004; Zhu *et al.*, 2006), and particularly e-commerce, include this factor in their analysis, although their results do diverge.

In the specific field of e-commerce, Gibbs and Kraemer (2004), who study 2,139 firms from 10 countries, Forman (2005), who carries out a longitudinal study of 6,156 US firms, To and Ngai (2006), who study 152 firms with headquarters in Hong Kong, and Chong (2007), who studies 115 Australian SMEs, all detect a positive relation between the external pressure coming from the firms in the environment and e-commerce adoption or assimilation. The explanation for this positive influence is conceivably the perception of the firms that have not adopted e-commerce, or another particular technological innovation, that they will find themselves at a disadvantage in the areas in which the innovation is used, such as in marketing communication, commercial distribution or customer relationship initiatives. E-commerce applications help firms improve their marketing response (Payne and Frow, 2005), facilitate greater information transparency (Alba *et al.*, 1997; Rodríguez-Ardura and Martínez-López, 2008), and raise operational efficiencies (Zhu and Kraemer, 2002), helping the firms create or maintain competitive advantages.

These results contrast, however, with the results of works such as Ching and Ellis (2004), who fail to demonstrate the effect of competitive pressure on e-commerce

adoption among 84 SMEs with headquarters in Hong Kong. Xu *et al.* (2004) and Jeon *et al.* (2006) also fail to identify significantly reactive behaviours in response to competitors' decisions to adopt e-business or not. In turn, Hsu *et al.* (2006) find that competitive pressure has a negative effect on the intensity and diversity of use of e-business: firms facing higher levels of competition make less and less varied use of e-business. And Zhu *et al.* (2006) find that strong competitive pressure leads firms to adopt e-business systems quickly. This makes it difficult for them to assimilate the systems gradually or adequately, with negative repercussions for the implementation. Vilaseca *et al.* (2007) obtain a similar result among 2,038 Spanish firms. They find that the competitive environment has a positive effect on the decision to adopt e-commerce, but not on its effective implementation. An explanation for these results could lie in the fact that firms that face excessive competitive pressure will not have enough resources left to adopt innovations. This is consistent with the hypothesis of economists like Schumpeter (1984), who argue that innovation is higher in situations of monopolistic competition than in those of intense competition, since firms with monopoly power are more capable of preventing imitation and obtaining more returns from innovations.

Given the strength of these two perspectives on the influence of the competitive environment – search for new competitive advantages in situations of intense pressure and contribution of innovation to the generation of monopoly profits – and the disparity in the empirical results obtained, the final effect of the competitive pressure on e-commerce adoption is hard to detect.

It is also difficult to evaluate empirically the role of competitive pressure because the operationalisation of this construct, which measures the influence exerted by the firms from the competitive environment as they increasingly adopt e-commerce (Forman, 2005), can lead to unobserved heterogeneity across industries and regions. As Forman observes: “Empirically identifying the role of competitive pressure or spillovers is inherently difficult, however, as constructs for these hypotheses may pick up unobserved heterogeneity across industries and regions. Thus, tests of these hypotheses should be considered preliminary and will await confirmation by future authors” (2005, p. 4). For all this, the first hypothesis will require subsequent confirmation in future research.

H1a: The pressure of the firms from the competitive environment influences the firm's adoption of B2C e-commerce.

The pressure on firms to adopt new technologies comes not only from the competitors, but also from the consumers in the market. Nevertheless, and despite the potential importance of the consumers and the changes that occur in their behaviour patterns in explaining firms' adoption of e-commerce or other technological innovations, authors often ignore this factor (except when examining the consumer's decision to adopt e-commerce). Indeed, for many studies of the diffusion of ICT, e-business systems and B2B e-commerce the pressure of the other firms is the main non-technological external factor, whether through the intensity of the competitive game, the influence of the business partners and suppliers, conflicts in the channel, or other aspects. In these cases, the absence of factors relating to the final demand can be explained by the importance of the intermediate demand in the adoption of applications and technology systems between organisations (Bertschek and Fryges, 2002; Daniel *et al.*, 2002; Hong and Zhu, 2006; Hsu *et al.*, 2006; Jeon *et al.*, 2006; etc.). But even some studies focusing on firms'

adoption of B2C e-commerce ignore the pressure of the consumers (e.g., To and Ngai, 2006). In fact, the literature review for the current work only found five empirical studies that consider the influence of this market force as a potential explanatory variable of e-commerce adoption. These works are: Ching and Ellis (2004), who study 84 SMEs with headquarters in Hong Kong; Lee and Kim (2007), who study 120 South Korean firms; the above-mentioned Gibbs and Kraemer (2004), who study 2,139 firms from 10 countries; Rodríguez-Ardura *et al.* (2008), who study representative samples from the Spanish market; and Ure (2002), who uses bi-annual surveys of around 500 households in Hong Kong.

The increasing sophistication of a country's consumers, considered here as the development or enrichment of the consumers' consumption patterns (Gatersleben and Vlek, 1997), is reflected in the increased consumption of goods and services related to entertainment, leisure, education, culture, and personal development (Gatersleben and Vlek, 1998). Indeed, researchers have associated the development of B2C e-commerce with the existence of segments of consumers with knowledge and skills (Hoffman *et al.*, 1996; Joines *et al.*, 2003; Sexton *et al.*, 2002; Ho *et al.*, 2007), who are ready to use systems that provide them with higher levels of comfort and convenience, free them from routine tasks and provide them with more free time (Bhatnagar *et al.*, 2000; Mathwick *et al.*, 2002; Chiang and Dholakia, 2003), and who attach more importance to the choice and enjoyment of activities in their free time, or who at least particularly value hedonic attributes in their purchase processes (Childers *et al.*, 2001; Wolfinbarger and Gilly, 2001; Martínez-López *et al.*, 2006; Xia, 2002). Conceivably then, the development of e-commerce is associated with the changes that consumers increasingly experience in their needs and behaviours.

H1b: The consumers, through the development or enrichment of their behaviour patterns, favour the firm's adoption of B2C e-commerce.

Technological external context

Apart from the non-technological factors influencing the adoption of technological innovations, it is also important to consider other factors from the competitive environment that capture the unique characteristics of e-commerce and which are consequently closely linked to the actual technological innovation itself.

Frequently, however, studies examining the technological determinants of e-commerce adoption only consider firms' competences or resources in the area of technological innovation, which is really a technological variable linked to the internal context of the organisation itself (see, for example, Ching and Ellis, 2004; Gibbs and Kraemer, 2004; Forman, 2005; To and Ngai, 2006; Chong, 2007; Lee and Kim, 2007).

In fact, an important aspect in firms' adoption of e-commerce has to do with the readiness of the market forces for the adoption of this technological innovation (technological readiness), understood as the degree of willingness or preparation of the set of agents that participate in the market to facilitate the firms' implementation of e-commerce. As a small number of studies of e-commerce carried out under an interactionist or integrative theoretical framework have found (e.g., Molla and Licker, 2005; Tan *et al.*, 2007), the extent to which the market forces, and particularly the consumers and public authorities, are ready to facilitate its implementation, has an important effect on firms' decision to adopt e-commerce.

H2: *The technological readiness of the market forces favours the firm's adoption of B2C e-commerce.*

Non-technological internal context

One organisational aspect that authors have considered to be particularly important in firms' decision to adopt e-commerce is their global scope. The literature on information systems and e-business provides evidence about the influence of the firm's global scope on its adoption of such systems (Xu *et al.*, 2004; Hsu *et al.*, 2006; Jeon *et al.*, 2006). The e-commerce literature has even more frequently considered the firm's global scope as a possible determinant of e-commerce (O'Keefe *et al.*, 1998; Arnott and Bridgewater, 2002; Bertschek and Fryges, 2002, among others).

The relation between the firm's global scope and its adoption of e-commerce systems would conceivably be explained by the global connectivity that the Internet offers. The Internet offers brands visibility among a huge community of interconnected consumers (Hoffman and Novak, 1997), and offers mechanisms to get to know the markets rapidly, however heterogeneous they are, as well as the changes occurring in them. Firms with a global vocation, and fully committed to expand or consolidate their positions in the different markets or geographical areas, can use the Internet to be more effective and efficient in carrying out their activities. As the literature indicates, e-commerce can reduce transaction costs (Wigand and Benjamin, 1996; Garicano and Kaplan, 2001) and search costs (Rodríguez-Ardura and Martínez-López, 2008), increase information transparency (Alba *et al.*, 1997), and hence limit market friction (Bakos, 1997; Brynjolfsson and Smith, 2000). Firms with greater global scope will consequently be more incentivised to initiate e-commerce adoption.

Nevertheless, the idea that the Internet generally facilitates firms' internationalisation processes needs to be qualified. Doing e-commerce globally is difficult (Quelch and Kein, 1996; Steinfield and Whitten, 1999; Eid *et al.*, 2002), particularly for firms with limited resources (Eid and Trueman, 2004). These firms can have difficulty understanding the commercial structure of the foreign markets, their cultural idiosyncrasies, and the legislation that affects them, managing the physical distribution of the goods to distant locations, and providing an adequate after-sales service. Moreover, firms that are already operating efficiently at the international level by adapting their strategies to each market or territory may not wish to exploit the potential of the Internet for fear of revealing their price discrimination policies, product differences between different markets, or differences in any of the other marketing-mix elements (Rodríguez-Ardura, 2008). On the other hand, firms with few resources can use e-commerce to improve their penetration in their local markets (Steinfield and Whitten, 1999).

For all this, some authors doubt that the firm's internationalisation strategy is positively related to e-commerce. Specifically, Eid and Trueman (2004) fail to confirm the contribution of internationalisation-related factors in the successful implementation of B2B e-commerce among 161 UK firms. In turn, Koenig and Wigand (2004) find that e-commerce is not particularly important when a country's firms already have competitive and efficient positions in international markets, as is the case for Germany. And Kraemer *et al.* (2005), who use a broader definition of e-commerce that includes commercial transactions and online services, find that firms' globalisation strategies

have a positive effect on B2B activities, but not on B2C activities, among 2,139 companies from 10 different countries.

Studies that do find such a positive relation are not very numerous but are more frequent than those that do not. In particular, these include: O'Keefe *et al.* (1998), who study a sample of 173 small online retailers; Arnott and Bridgewater (2002), who study 78 firms; and Bertscheck and Fryges (2002), who study 3,000 German firms that carry out B2B e-commerce. Other studies that find a positive relation between internationalisation and e-commerce are: Jaw and Chen (2006), who study 700 SMEs from Taiwan; and Gregory *et al.* (2007), who study 340 Australian export initiatives.

H3: *International or global business activities favour the firm's adoption of B2C e-commerce.*

Technological internal context

Competence in resources, understood as the availability to the firms of the technological resources required to adopt a technological innovation, is an important determinant of that process, as the literature has shown (e.g., Chau and Tam, 1997; Xu *et al.*, 2004; Hsu *et al.*, 2006; Zhu *et al.*, 2006).

Nevertheless, some evidence on e-commerce adoption indicates the importance, in the technological context of the organisation, not so much of the availability of certain technological infrastructures or resources considered essential for the adoption (Eid and Trueman, 2004; Gibbs and Kraemer, 2004; Lee and Kim, 2007), but of their adequate integration, management and use in the firm's business processes. Vilaseca *et al.* (2007) come to this conclusion, in their analysis of 2,038 Spanish firms, as does Forman (2005), in his study of 6,156 US firms. The latter author considers that adopting e-commerce is technically more difficult and more expensive than simply adopting the Internet, a mature technology that requires scant adaptation of the firm's business processes. He finds that the firm's previous investment in technologies facilitates Internet adoption but does not have a significant effect on the organisation's readiness to adopt e-commerce applications.

One explanation for these results seems to lie in the strong impact in the firm of such advanced technological systems as e-commerce, not only in technological terms, but also in organisational and strategic terms. Successful e-commerce adoption would consequently be strongly conditioned by the capacity of adaptation of the entire organisation and its business processes, or as some authors have labelled it, the organisational readiness to adopt this technological innovation (Molla and Licker, 2005; Tan *et al.*, 2007).

Conceivably then, firms with greater competence in the area of innovation adoption, and which are more able to introduce the changes required at all times (in their business processes, organisational design or strategic orientation, etc.), will be better prepared to operate in markets as uncertain, dynamic and unstable as electronic ones, and so will be more likely to adopt these marketing channels (Wang and Cheung, 2004; Vilaseca *et al.*, 2007).

H4: *The availability of organisational competences in the area of technological innovation favours the firm's adoption of B2C e-commerce.*

Methodology

This article uses the case of Spain as a vehicle to examine the mechanisms that affect B2C e-commerce adoption by firms. This choice of context has to do with the authors' interest in examining a paradigmatic case among developed countries. Spain still has some way to go⁴ before it achieves high levels of e-commerce adoption and the Internet consolidates as a marketing and distribution channel for its firms. According to Eurostat data, in 2007 only 8.2% of Spanish firms were engaged in e-commerce activities, 7% below the EU-27 average. Furthermore, the online activities of Spanish firms and consumers have been particularly well documented from early on, often by private, non-profit organisations such as the Spanish Association of E-commerce and Relationship Marketing, and the Spanish Association for Research into the Communications Media (AIMC). This considerably facilitates the longitudinal analysis of the data.

Data

In order to test the hypotheses on the firms from the Spanish market, sufficiently long historic data series were necessary. The authors consequently had to resort to various sources to obtain this information, each of which, in turn, uses various tools. The sources available generally provide information about behaviours rather than perceptions.

Specifically, the historic data series used here come from: the Spanish Continuous Household Budget Survey, the Survey on the Use of ICT and E-commerce in Spanish Companies, the Spanish Survey on Technological Innovation, and the EU Labour Force Survey (which is part of the Spanish Labour Force Survey). All these are official surveys carried out by the Spanish National Statistics Institute (INE). The first of these, which surveys 8,000 households, provides quarterly information about the origin and quantity of households' incomes and how they use the sums in various consumption expenditures. The second survey, using data from 28,800 firms, provides annual information about firms' implementation and use of ICT and e-commerce. The third survey offers twice-yearly information about firms' innovation processes, and uses a sample of 42,480 firms. The final survey, which uses a sample of approximately 64,000 households, offers annual information about, among other aspects, the recent education received by the population.

This work also uses data series from the General Mass Media Survey (EGM) and the Survey on Internet Users, both produced by the AIMC. The EGM is a representative survey of the Spanish population that measures the audiences of the communications media. It takes place in three annual waves, and the most recent edition uses approximately 45,000 personal interviews. The Survey on Internet Users is annual, and surveys Internet users exposed to Spanish websites about their profile and Internet use habits. The latest edition uses a sample of 49,418 people.

The work also uses the annual data provided by the European Information Technology Observatory (EITO) on the dynamics of consumer computer prices, which the

⁴ Levels of both Internet adoption and e-commerce adoption are lower in Spain than in most other European Union countries. And the fact is that this situation is unlikely to change, at least in the immediate future (Jordana *et al.*, 2003).

observatory obtains from the manufacturers and from programmes monitoring the distribution channel. Also the Domain Survey, from the Internet Systems Consortium, which does searches in the Domain Name System in order to offer information about the host servers of the Internet twice a year. The work also uses data from the firm Netcraft, which does automatic monthly explorations of the secure servers on the Internet. Finally, the work uses historic series of OECD indicators in the area of ICT, and Spanish national accounts data (see Appendix 1).

Interpolation

The data is obtained from different sources, and have different periodicities, so it becomes necessary to consider a process to construct times series with data for the same periods of time. Furthermore, taking into account that the phenomenon under analysis is relatively recent, and that in some cases initial time series contained annual data, the authors decided to construct time series with monthly data by using a process of interpolation. This process is used to approximate missing values (when the original data were annual, bi-annual or quarterly) and resulted in series of 109 periods, each one an estimation of the monthly observation of the variables (from December 1996 to December 2005).

Among the different interpolation methods, the authors have chosen the third-order cubic splines interpolation (Dahlquist and Björck, 1974; Stoer and Bulirsch, 1980). Under the assumption that the behaviour of the time series is smooth along time, this method is more suited than others, such as linear interpolation. Using linear techniques would result in a function with “corners” to be used to approximate the values of a time series that is supposed to behave smoothly. Other techniques, like those using Fourier series techniques, are not recommended in this case since the original data provides insufficient data points near a gap (Baltazar and Claridge, 2006).

The authors used the third-order cubic splines interpolation to build (and join) pieces of third-order polynomials that stick together with C^1 continuity (with no “corners”), such that the second derivative of each polynomial is 0 at the extremes. This ensures that the function (or approximation) obtained passes through each of the initial points (original data) from which it was created. In other words, the original data is not approximated; approximations are only given for the missing values⁵.

Measurements

The constructs and measurement items used in the present study were adapted from previous related research or were developed on the basis of a literature review. To measure the pressure of the firms from the environment on e-commerce adoption this work starts from Forman’s (2005) operationalisation: the proportion of firms in the market that already have e-commerce applications. To indicate that concept this work uses the proportion of websites under the Spanish domain (.es) that have secure web servers (meaning the firm can conduct commercial transactions on the Internet).

To measure the pressure of the consumers in the market through the development or enrichment of their consumption patterns this work uses two items, both measured using metric variables: the proportion of the household budget dedicated to leisure and

⁵ The authors use the software *Mathematica 3.0* to carry out the process of data interpolation described.

culture; and the proportion of adults receiving lifelong learning. The first item is conceivably related to the changes consumers experience in their lifestyles, and specifically to the greater importance they attach to leisure and free-time activities (Valette-Florence and Jolibert, 1990; Saunders and Saker, 1994; Leeftang and van Raaij, 1995). The second conceivably has to do with consumers' interest in "continuing the process of renewal of knowledge, skills and values through out life" (Dave, 1976, p. 16). This item is included in the description of the changes in consumption patterns since lifestyle practices work through this mode of learning. Edwards and Usher (2001) provide the theoretical rationale. These authors explain the emergence of lifelong learning as a postmodern form of consumption based on consumers' constant pursuit of performativity (consumers are ever more predisposed towards change and the adoption of new and particular skills, especially to adapt to their job requirements), and on a certain "unruliness" of knowledge. The knowledge is increasingly perceived as individuated, as a form of personal expression and autonomy, and marked by a stylistic self-consciousness.

The readiness in the area of e-commerce of the market forces is an adaptation of a broader indicator (i.e., electronic readiness), which researchers have used in "macro-level" studies to measure a society, nation or market's level of preparation with respect to all ICTs (e.g., Economist Intelligence Unit, 2008). In line with this latter concept, the current work considers e-commerce readiness as an aggregate term measured through five items to do with the infrastructures and access services, the access or penetration among the consumers, and the legal framework (Purcell and Toland, 2004; Maugis *et al.*, 2005): affordability of Internet access (Kiiski and Pohjola, 2002); penetration of the Internet (Traman *et al.*, 2008); penetration of broadband (Corrocher and Ordanini, 2002; Mutula and van Brakel, 2006; Rodríguez Ardura *et al.*, 2008); confidence in the Internet as a means of payment (McConnell International and Witsa, 2001); and existence of a legal framework that protects consumers in their activities on the Internet (Rodríguez-Ardura *et al.*, 2008). The first four items are measured using metric variables, which measure, respectively: the price of computers; the proportion of consumers who are Internet users; the proportion of consumers having broadband Internet access; and the proportion of consumers perceiving online payments as safe or very safe. The final item is measured using a dichotomous variable. This variable scores 0 for the period 1996-2001, and 1 subsequently. The aim is to capture the change caused by the publication of the draft of a law to regulate commercial activities on the Internet in the Spanish market (Act 34/2002 of 11th July on Information Society Services and E-commerce).

To measure the global scope of the firms from the market under analysis this work uses exports as a proportion of GDP.

The final independent variable measures the firm's internal competences in the area of technological innovation. The indicator, elaborated following the methodological guidelines laid down in the Oslo manual (OECD and Eurostat, 2005), measures the proportion of firms engaged in activities involving technological innovation. A technological innovation is defined here as a product (good or service) that is new or substantially improved, which a firm introduces into the market, or a process

(production, or logistical and control) that is new or substantially improved, which a firm introduces in the organisation⁶.

The dependent variable is e-commerce adoption. This can be measured in different ways and with varying degrees of complexity, but the current work measures the initial adoption of e-commerce. From a dichotomous variable (taking value 0 when the firm earns no income through the Internet and 1 otherwise) an indicator is produced to measure the proportion of firms from the market that have adopted e-commerce.

Data analysis and results

Results of measurement model

Two of the independent variables used – the pressure from the consumers through their consumption patterns, and the readiness in the area of e-commerce of the market forces – are measured using multiple indicators, which means their validity and reliability must be evaluated.

To verify the construct validity of the measures the authors carried out a principal components analysis (Nunnally and Bernstein, 1994) with varimax rotation on the items of these two variables. The two resulting factors, which explain 81.8% of the variance, have an eigenvalue greater than 1, and no item from either factor has a loading less than 0.5 in absolute terms, apart from the one measuring the consumers' level of lifelong learning. In this latter case, however, its loading is very close to 0.5, so it is retained, although only in the interpretation of the factor. Furthermore, since no item has a loading greater than 0.5 on both factors simultaneously and since the loading of each item belonging to a factor is greater than 0.8, it can be said that the items are unidimensional (i.e., they are strongly associated with a unique factor). This enforces the idea that they represent a single concept (Hair *et al.*, 1998).

To test the reliability of the first measure (the analysis does not consider the second measure since it eventually consists of a single item) the Cronbach alpha coefficient is calculated from the items with loadings greater than 0.5. The Cronbach alpha is clearly greater than the threshold of 0.7, which confirms the reliability of the first measure (Hair *et al.*, 1998).

Table 3. Factor analysis and reliability test

	Factor loadings		Communality	Cumulative explanation	Cronbach α
	Factor 1	Factor 2			
<i>Technological readiness of market forces</i>					
				63.3%	0.967
Access to Internet		0.961	0.961		
Confidence in online payments		0.959	0.963		
Broadband		0.865	0.866		
Computer prices		-0.906	0.836		
<i>Enrichment of consumer behaviour</i>					
				81.8%	-

⁶ The innovation (novelty or improvement) must be innovative for the firm, but not necessarily for the market. The current work does not consider whether it was the firm itself or other firms that developed the innovation initially.

patterns

Consumption of leisure & culture (Lifelong learning)	-0.926 (-0.457)	0.862 (0.414)
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Finally, and in order to confirm the nomological validity of the measures, the results of the following section are of interest. They show – as theory and prior research suggest – that the two measures have a significant influence in the evolution of the dependent variable in the analytical model. Thus the authors have the required scale validity (Hair *et al.*, 1998).

Results of analytical model⁷

From the analysis of the correlations between the independent variables (see Appendix 2) the initial deduction is that multicollinearity problems should not exist. Thus, and despite the high correlation between three of them (pressure from the firms of the environment, readiness in technological matters of the market forces, and the firm's internal competences in innovation), the determinant of the correlation matrix is clearly different from zero (0.040426), which indicates that a situation of perfect multicollinearity does not exist (Hair *et al.*, 1998).

The dependent variable behaves exponentially during the period under analysis (see Appendix 3), so the authors opted to use a semi-log analytical model (Greene, 1993) based on the estimation of the parameters α and β_i from the following equation:

$$Y = e^{\alpha + \sum_{i=1}^5 \beta_i \cdot X_i + \varepsilon} \quad (1)$$

where Y is the dependent variable, and $\{X_i / i=1, \dots, 5\}$ the set of explanatory variables.

Before estimating the model the authors first take natural logarithms (logarithms to the base e , which are denoted by \ln) of Equation 1. Then, a multiple regression analysis is run for the set of time series data from December 1996 ($t=1$) to December 2005 ($t=109$), with monthly periodicity:

$$\ln Y_t = \alpha + \sum_{i=1}^5 \beta_i \cdot X_{ti} + \varepsilon_t,$$

where $t = 1, \dots, 109$.

The proposed model explains 98% of the variance in e-commerce adoption ($R^2=0.98$), which is an acceptable cut-off (Hair *et al.*, 1998). The model is significant globally, since the analysis of variance gives $F=1013.48$, with $p=0.000$. Moreover, the error term satisfies the Anderson-Darling test of normality ($p=0.000$), and the Breusch-Pagan test confirms that no heteroskedasticity problems exist (the statistic $SQR/2$ equals 0.0075 and is lower than a χ^2 with 5 degrees of freedom and $\alpha=0.05$) (Greene, 1993). However, the Durbin-Watson statistic equals 0.10, close to 0 and clearly inferior to the lower bound d_L ($d_L=1.57$, for a sample size of $n=100$), which indicates certain problems of

⁷ The authors use the statistical software *Minitab 15* to analyse the data and estimate the analytical model.

auto-correlation in the error term. This result, which is to be expected in an analysis using times series, indicates that the estimated coefficients of the model are inefficient, although they are consistent and free of bias (Greene, 1993). With regard to the multicollinearity, the variance inflation factors (VIF) are clearly under 10 (considered a common cut-off threshold) for all the explanatory variables except in one case, where it equals 13.1. Consequently, and as mentioned initially, the model does not suffer from significant multicollinearity problems (Hair *et al.*, 1998).

Table 4. Estimation of “semilog” model

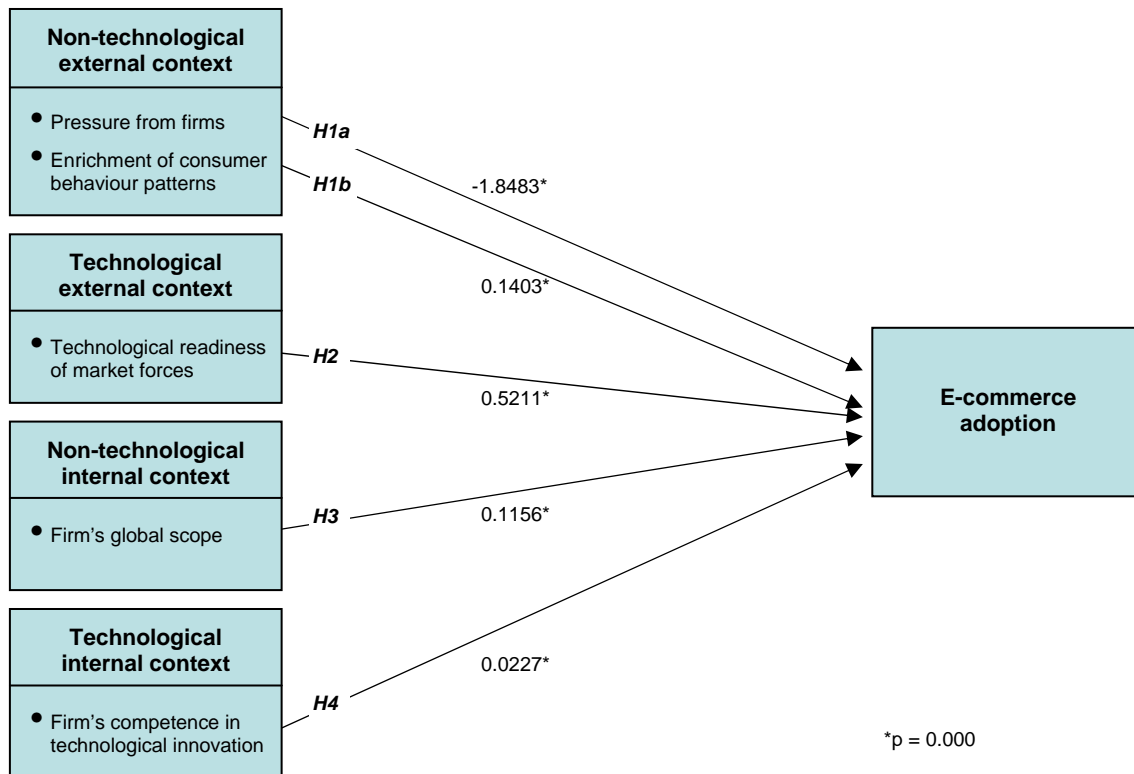
		Non-stand. coeff.	t-value	Sig.	VIF
<i>(Constant)</i>					
Pressure of firms from environment		-3.7526	-14.94	0.000	
Enrichment of consumer behaviour patterns		-1.8483	-6.34	0.000	2.5
Technological readiness of market forces		0.14026	-10.19	0.000	2.2
Firm’s global scope		0.52112	19.05	0.000	8.7
Firm’s competences in innovation		0.115605	13.87	0.000	1.2
		0.022694	5.49	0.000	13.1
Anova					
Source	df	Sum of squares	Mean squares	F	Sig.
Regression	5	46.8828	9.3766	1013.48	0.000
Residual error	103	0.9529	0.0093		
Total	108	47.8357			

According to the results obtained for the coefficients of the indicators, all the factors included in the solution contribute significantly to the evolution of e-commerce adoption (their coefficients are significantly different from zero, $p=0.000$), and so their presence is justified in the explanatory model.

The variable measuring the influence of the firms from the environment has a negative sign, confirming that firms invest in a presence in electronic markets and use the Internet as a commercial distribution channel in situations of less competitive pressure (H1a). With respect to Hypothesis H1b, the results show that the consumers have a positive effect on the evolution of e-commerce: the more radical the transformations in education and consumption the consumers experience, the greater the positive effect on e-commerce adoption.

Similarly, the results show a significant positive relation between the technological readiness of the market forces (consumers and public authorities) and the evolution of e-commerce, as was postulated (H2). The firm’s global scope also contributes to the evolutionary dynamics of e-commerce. As predicted (H3), its contribution is positive, suggesting that the more internationalised or globalised the firm, the more likely it is to use the Internet as a distribution channel for its products. Finally, the results show evidence of a significant relation between the firm’s internal competences in technological innovation and e-commerce adoption (H4).

Figure 2. An integrative model of e-commerce adoption (and results)



Conclusions

This article makes two special contributions to the literature on innovation adoption. First, and grounded in the theory on innovation adoption, the work provides an integrative framework on e-commerce adoption at the market or nation level. Second, the work provides a longitudinal perspective to the study of firms' innovation adoption. For this, the authors examine the e-commerce phenomenon in the context of one national case study (i.e., Spain). Spain is an interesting country in this respect because of its firms' low level of e-commerce adoption, and so this analysis should offer useful insights to other developed countries with low e-commerce adoption rates.

The results from this research show the particular importance of the variables relating to the organisational area in explaining the development of e-commerce at the market or nation level, which gives support to Kim and Galliers' (2004) theoretical framework. They also confirm the joint influence of a number of very diverse environmental, technological and business variables in the development of e-commerce. As Tornatzky and Fleischer (1990) suggest, and as earlier authors confirm for the adoption of ICT, and more recently e-commerce in a small number of works, all of them cross-sectional (e.g., Gibbs and Kraemer, 2004; Lee and Kim, 2007), the current work confirms the validity of this integrative framework for explaining firms' decisions to adopt e-commerce in one particular market.

This work also confirms that a longitudinal approach like the one carried out here is appropriate for understanding a phenomenon like e-commerce, which has experienced numerous and radical changes in its short life to date. Thus, the results of this study complement those of other studies that have taken an integrative approach in examining the determinants of e-commerce adoption but have conducted only cross-sectional analyses.

The results provide evidence that the e-commerce initiatives of the firms belonging to the competitive environment disincentivise e-commerce adoption in those firms that have not yet adopted this channel. This result would appear to explain why in situations of scarce competition, firms can dedicate more resources to developing innovations like e-commerce. It would however be useful to examine this issue further in future research, and also consider the heterogeneity of the firms from different sectors and regions.

Another factor from the non-technological environment shown here to influence e-commerce adoption has to do with the changes the end-users experience in their behaviour patterns. The results show that the firms adapt to the evolution of the market by designing marketing channels that more closely match consumers' higher educational levels and new spending and consumption patterns.

The results also confirm that when firms take their adoption decisions they take very much account of the end-consumers' level of readiness with respect to electronic channels as well as the measures taken by the public authorities to facilitate their implementation.

The results identify two determinants of e-commerce adoption in the organisational context. On the one hand, the greater the firm's global scope the greater its need to incorporate electronic channels to carry out its business activities. On the other, greater readiness in technological innovation also favours e-commerce adoption. This means that firms that are starting out in e-commerce need to be decisively open to new markets and innovative to be able to operate in a context as dynamic and uncertain as the Internet. The most internationalised or global firms and the ones that are the quickest to introduce frequent changes in their products, methods or organisational values are the most likely to consider that they can benefit from electronic channels.

These results are important for institutions concerned with improving e-commerce adoption levels, but also for company managers.

The environment, and particularly the technological readiness of the forces at work in the market, has emerged as an important driver of e-commerce adoption. This finding emphasises the importance of establishing a positive environment that favours e-commerce. This ranges from a legal framework providing the right support for communication and commercial exchanges online, to measures and incentives that facilitate or speed up the penetration of the Internet and related technologies.

The results suggest that managers should assess the environmental and organisational conditions within which they intend to develop e-commerce initiatives. On the one hand, managers planning to roll out e-commerce initiatives can decide whether the firm's environment is favourable for e-commerce adoption. On the other, the managers need to assess the adequacy of certain organisational characteristics (e.g. global scope and competences in technological innovation) for e-commerce activities. If the organisational conditions are not ideal, managers may consider introducing new strategies and organisational designs that contribute to creating an organisational climate that is favourable to e-commerce.

The main limitation of the current work is that it considers only two organisational variables: the firm's global scope and its competences in innovation. The work could usefully have considered other important organisational aspects such as organisational structure and complexity, quality of human resources, resources available, and so on (Tan *et al.*, 2007).

Another limitation relates to the fact that the work only studies the e-commerce adoption decision, not the extent of the adoption or the actual importance this channel eventually has for the organisation. On the other hand, this model should ideally be validated at the multi-country level, and at the multi-sectorial level in each country.

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Appendix 1. Measurement items for key variables

Variables	Indicators	Data source	Periodicity
<i>Pressure of firms from competitive environment</i>	- Proportion of websites under Spanish domain (.es) that have secure web servers	- Internet Systems Consortium, <i>Domain Survey</i> - Netcraft, <i>SSL Survey</i>	- 6-monthly - Annual
<i>Pressure of consumers through enrichment of their behaviour patterns</i> (aggregate term measured through following 2 items)			
Importance of leisure and activities that people do in free time	- Proportion of family budget dedicated to leisure	INE, <i>Spanish Continuous Household Budget Survey</i>	Quarterly
Interest in renewal of knowledge and skills	- Proportion of adults receiving lifelong learning	INE, <i>Spanish Labour Force Survey</i>	Annual
<i>Technological readiness of market forces</i> (aggregate term measured through following 5 items)			
Cost of Internet access	- Price of computers	EITO, <i>European Information Technology Observatory yearbook</i>	Annual
Penetration of Internet	- Proportion of consumers who are Internet users	AIMC, <i>General Mass Media Survey</i>	3 waves in year
Penetration of broadband	- Proportion of consumers having broadband Internet access	OECD, <i>Broadband Statistics</i>	Annual
Confidence in online payments	- Proportion of consumers perceiving online payments as safe or very safe	AIMC, <i>Survey on Internet Users</i>	Annual
Legal framework that protects consumers	- Dummy variable	-	-
<i>International or global scope of firm</i>	- Exports as proportion of GDP	<i>Spanish National Accounts</i>	Annual
<i>Competences of firm in area of technological innovation</i>	- Proportion of firms that have introduced new or substantially improved products or processes	INE, <i>Spanish Survey on Technological Innovation</i>	Annual
<i>E-commerce adoption</i>	- Proportion of firms earning some income from sales on Internet	INE, <i>Survey on the Use of ICT and E-commerce in Spanish Companies</i>	Annual

Appendix 2. Pearson correlations (P values) between explanatory factors

Factors	(1)	(2)	(3)	(4)	(5)
(1) Pressure of firms from environment	1				
(2) Consumer behaviour	0.181 (0.059)	1			
(3) Technological readiness of market forces	0.649 (0.000)	-0.000 (1.000)	1		
(4) Firm's internationalisation level	-0.096 (0.323)	-0.147 (0.128)	0.008 (0.936)	1	
(5) Firm's competences in innovation	0.755 (0.000)	0.352 (0.000)	0.869 (0.000)	-0.182 (0.058)	1

Appendix 3. Evolutionary dynamics of e-commerce adoption (%)

