Telecommunications Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Telecommunications Policy

journal homepage: www.elsevier.com/locate/telpol

Drivers and barriers to cross-border e-commerce: Evidence from Spanish individual behavior

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ARTICLE INFO

Keywords:
Cross-border e-commerce
Domestic e-commerce
Digital skills
Customer reviews
Online opinion seeker
Logistic model

ABSTRACT

This paper explores the determinants of the individual's decision to perform cross-border e-commerce (CBeC). The European Union (EU) is especially interested in the promotion of CBeC because it is an important tool in its strategy to achieve the Digital Single Market in Europe. In this paper official data is used from a representative survey of 16,209 individuals on ICT usage by households and individuals that was carried out in Spain by the National Institute of Statistics (INE) for the year 2016. Using a standard neoclassical utility maximization framework, and logistic regression techniques, the results show that being a male is positively related to the probability of practicing CBeC. Education is positively and significantly related to the probability of being involved in CBeC with EU countries. Computer and Internet Skills are significant and positive factors in explaining CBeC (either with EU countries or with the rest of the world). The variable "how often the consumer sees other customer reviews before buying online", has a positive effect. Foreign nationality also increases the likelihood of using CBeC. To promote CBeC in Spain measures towards developing digital skills, Internet trust and use of online information reviews of goods and services are discussed.

1. Introduction

Being able to shop for goods and services online offers customers several benefits, many of which did not exist until recently. Some of them are: access to an increasing variety of products and sellers from all over the world, a decrease in the asymmetry of information, a reduction in search costs, an ability for comparison, the fostering of competition between sellers, it saves time, it allows better spending planning, it gives voice to the individual consumer through the possibility of public customer reviews and social media sharing, and as an online purchase is a computer mediated transaction it improves its traceability and makes more efficient contracts possible. In the case of cross-border e-commerce, it is worth mentioning that different studies conclude that consumers also benefit from online commerce because of the substantial reduction in distance-related trade costs (Martens, 2013).

However, there are still barriers that deter consumers from taking full advantage of e-commerce. Besides limitations related to Internet penetration and equipment of Information and Communication Technologies (ICT), others emerge from internet users' concerns and perceptions. Some of the main barriers for domestic and cross-border e-commerce are highlighted by Gefen (2000), Gomez-Herrera, Martens, and Turlea (2014), Cardona, Duch-Brown, Francois, Martens, & Yang, 2015a and PayPal (2016): little

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https://doi.org/10.1016/j.telpol.2018.03.006
Received 22 December 2017; Received in revised form 15 March 2018; Accepted 16 March 2018

familiarity and trust in the vendor, crossing language barriers, need of a secure way to pay, cost-efficiency of parcel delivery, and costs shown in different currency, among others. Governments and the main stakeholders on the supply side are aware of the concerns of the consumers and the benefits that could come from dealing with them.

Given the importance of e-commerce within the Digital Single Market (DSM) strategy, the EU has engaged in opening digital opportunities for people and businesses, particularly in boosting cross-border e-commerce through a wide range of initiatives. To deal with these existing barriers, the EU consults with several expert groups, reports and studies to ground their strategies, decisions and proposals for the future. The European Commission (EC) wants to encourage a wider choice of goods and services online, better consumer protection, more transparent and affordable parcel delivery across borders, privacy and personal data protection, as well as improving the Value Added Tax (VAT) environment for e-commerce businesses (European Commission, 2017a,b,c).

At a country level, Spain, like other countries in the EU, has recently improved its Internet penetration at an affordable price. This a necessary condition, but not a sufficient one to generalize its use (Garín Muñoz, Lopez, Perez Amaral, Herguera García, & Valarezo Unda, 2018). In Spain only 25% of individuals used the Internet to make an online purchase from other countries (EU or other countries from the rest of the world) in the last year.

In relation to the supply side, most of the attention goes to the biggest players worldwide, Amazon and Alibaba, which are not only leading e-commerce in their own countries and abroad, but transforming and influencing entire industries, businesses and technologies such as retail, logistics and transportation, manufacturing, cloud computing, entertainment, digital advertising, social media, search engine business, Internet of things (IoT), automation, robotics, artificial intelligence, payments, video streaming, and physical shops. As The Economist (2017) states in its special report “E-commerce: The New Bazaar”, the two giants are paving the way to become true conglomerates.

The decline of traditional retailing in the U.S. and in some of Europe's biggest markets shows this industry as one of the most affected. The share of e-commerce in the total retail trade was 8.5% worldwide and 10% in the U.S. in 2016, still far from the 18% of South Korea. Due to the prospects towards automation, robotization and artificial intelligence, it is clear that the destruction of jobs—which are difficult to compensate by the creation of new ones in e-commerce related activities—is an imminent threat.

Economies of scale, patient shareholders (in the case of Amazon) and well identified core investments, are some of the main ingredients to become an undisputed leader of e-commerce. Although it seems difficult to compete against the giants, what is happening in China could be an example for Western economies to follow. To challenge Alibaba's dominance, its main competitors, JD and Tencent have joined forces (The Economist, 2017).

In this paper we use representative data on 16,209 individuals to study the determinants driving an individual to perform cross-border e-commerce (CBeC) in Spain. Besides the general CBeC (i.e. when an individual buys online from a country other than Spain), we distinguish two more types of CBeC: whether the foreign vendor belongs to the European Union, CBeC_EU; or to the Rest of the World (outside the EU), CBeC_RW. Notice that for a particular individual these are non-exclusive types of CBeC: she may buy from vendors in the EU, from vendors in the Rest of the World, or from both. Three separate logistic models are built to assess the determinants for each of the three types: CBeC, CBeC_EU and CBeC_RW.

The rest of the paper is structured as follows. Section 2 presents a literature review. Section 3 describes the current situation of CBeC in Spain and other countries within the EU. Section 4 describes the main characteristics of the data to be used. In Section 5 the three logistic models are presented, showing how the selected variables influence the probability of buying online outside Spain. Section 6 concludes with the main conclusions, the policy recommendations, the caveats, and further research.

2. Literature review

2.1. Previous research

The EC has devoted significant effort to fostering CBeC, while it has received relatively little attention in academic literature. Most of the EC literature and policy measures on cross border e-commerce deal with the supply side, while here we concentrate on the demand side.

Correa, García, and Tabanera (2015) use ICT-H data up to 2014 to estimate a model of e-commerce in Spain using a logit specification. Determinants of individual adoption of e-commerce in Spain are studied by Garín Muñoz and Pérez-Amaral (2011), using the 2007 ICT-H data. A multinomial logit specification (MNL) is used to estimate relevant effects over the dependent variable (type of participation in online shopping in the last three months).

Previous studies (Cardona et al., 2015a; Falk & Hagsten, 2015; Manyika et al., 2016; Martens, 2013) highlight the impact that e-commerce and cross-border e-commerce already have on the economy and their potential growth and future broader positive effects. The challenges and opportunities for both sides of the market (supply and demand), the increase of price competition, the gains in efficiency in the retail sector, the positive effects on production in other sectors, the benefits for individuals and household consumers, labour productivity and GDP growth, are just some of the implications that support the strong commitment of the EC to remain actively developing and implementing policies to foster the Digital Single Market.

2.2. uropean Commission reports and guidelines

The European Commission in its European Digital Single Market strategy (DSM) states the intention to reduce barriers that firms and consumers face when entering into a cross-border contract in the EU (European Commission, 2017a,b,c). In its DSM strategy the following measures have been adopted during 2016 (European Commission, 2016):

- Eliminating geo-blocking to facilitate the purchasing of any good or service across the EU without any interference or restriction on any consumer. The purpose is to eliminate any undue discrimination against consumers in relation to the prices or contracting conditions because of the place of residence or nationality of the end user. The geo-blocking involves the reform of several Directives since it affects not only goods, but services and contents as well.
- Making parcel delivery more affordable is another objective of the EU (European Commission, 2012). Specifically, the EU wants to make prices and conditions for contracting parcel delivery more transparent, so that prices reflect real underlying differences in costs of providing the service. In a survey conducted by the European Commission it was found that a substantial proportion of internet users did not finalize an online contract because of fears of high delivery costs. As a next step within a long process of studies, consultations, proposals, debates and negotiations, in October 2017 the Transport and Tourism Committee of the European Parliament approved draft rules which aim to improve quality and pricing of cross-border parcel delivery services (European Parliament, 2017).
- The European Commission promotes harmonized consumer protection across the EU and simplification in the burden of different VAT rates among countries. Suppliers of goods and services that need simplified rules when trans-border trade occurs inside the EU.

In addition, the EC has published guidelines on the implementation of the Directive on unfair commercial practices (European Parliament and Council, 2005), to implement EU-wide common principles so that consumers can trust any EU provider with the same ease as a domestic online supplier. National Consumer Protection Authorities shall coordinate among the EU's practices and monitor any after-sales conditions attached to contracts provided trans-border that may involve an undue discrimination.

Europe's Digital Progress Report (DPR) 2017 combines information from the Digital Economy and Society Index (DESI) and qualitative information about the country-specific policies, to build country profiles about their progress in digitization: connectivity, human capital, use of internet, integration of digital technology and digital public services. Digital Public Services is where Spain has obtained its greatest progress, while lower levels of growth on digital skills and a weak demand weigh down its position in relation to the other member states (European Commission, 2017a,b,c).

Based on 2016 ICT-H data, ONTSI (Observatorio Nacional de Telecomunicaciones y de la Sociedad de la Información) presented a study for Spain. The research found that 82.7% of people accessed the Internet at some time and that almost 23 million people aged 16 to 74 connect to Internet every day. The highest digital capacities coincide with younger people and those with higher education while there is also a direct link between high digital capacities and the employed or student population. The lowest values of technological capacities correspond to older people, with low income and low education level, and who are either pensioners or dedicated to housework (ONTSI, 2016).

3. E-commerce and cross-border transactions in Spain

Eurostat data on Information and Communication Technologies (ICT) usage in households and by individuals show that in 2008, 19% of the individuals aged 16 to 74 bought online in Spain, while nine years later the proportion rose to 44%. On the other hand, in 2008 only 5% of the individuals purchased online from another country in the EU. Nine years later the proportion has more than quadrupled. While internet penetration rose during the same period, the online purchasing participation rose at a much faster rate.

In the EU-28 an average of 84% of the population (aged 16 to 74) had used Internet in the last 12 months, and 55% had ordered goods or services via the Internet in 2016, as seen in Fig. 1. In Spain the proportion of Internet users is 81% and 44% used Internet for e-commerce in the last year; a proportion that goes down to 35% if those who purchased online in the last 3 months are considered (Eurostat, 2017).

Fig. 2 summarizes the evolution of e-commerce penetration rates in Spain among people aged 16 to 74. Distances between the compared categories are roughly maintained year after year. The highest penetration is for CBeC (any country abroad, 25%),

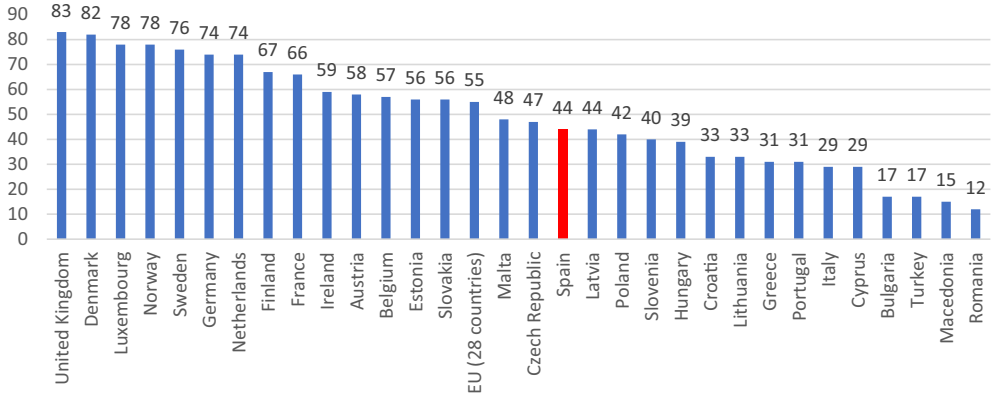

Fig. 1. Penetration rates of e-commerce in the EU-28 countries.
Source: Data of 2016, from Eurostat, 2017. Penetration rates as percentage of people aged 16 to 74.

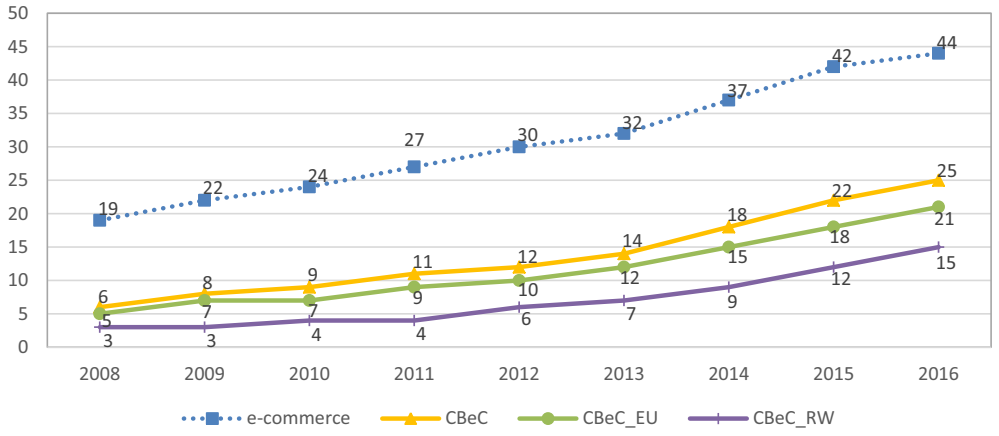

Fig. 2. Evolution of the penetration rates of E-commerce by geographical location of the seller.
Source: Eurostat, 2017. Penetration rates calculated as percentages of people aged 16 to 74.

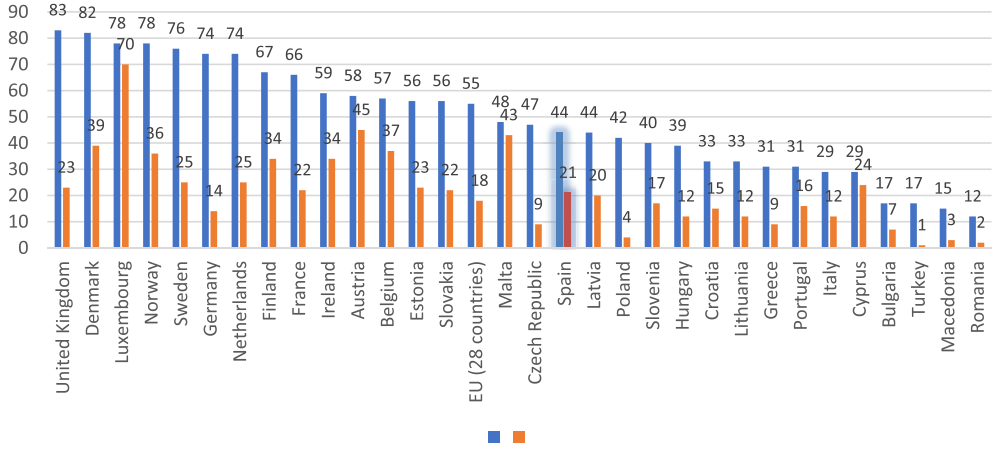

Fig. 3. Penetration rates of e-commerce and cross-border e-commerce with other EU countries.
Source: Eurostat, 2017. Penetration rates as percentage of people aged 16 to 74.

followed by CBeC_EU (21%), and CBeC_RW (15%).[1]

Fig. 2 shows how the behavior of residents in Spain has evolved during the period 2008–2016 in relation to E-commerce. A significant improvement in all the categories is observed along the 9-year period. However, Fig. 3 shows that Spain is still below the leading EU countries in terms of transactions with other EU countries.

The above information suggests that residents in Spain are more open than the average to make purchases in other EU countries, but there is still plenty of room to improve.

4. The ICT-H survey data

The data in this paper comes from the survey of 2016 on Equipment and Use of Information and Communication Technologies in Households (ICT-H) carried out by the Spanish National Statistical Institute (INE, 2016). Since the survey follows the methodological recommendation of the Statistical Office of the European Communities (Eurostat), it is comparable among EU member States which follow the same standards.

INE's annual continuous survey 2016 ICT-H is a household panel study. It has been carried out since 2002, but it is only homogeneous from 2006 onwards. The data are available online at www.ine.es (INE, 2016).

From an initial sample size of 23,887 households in 2016, there remain a total of 16,209 valid respondents after processing. They represent 16,029,823 dwellings and 34,389,822 people. The aim of the survey is focusing on people aged 10 (residents in family

[1] Question 40 of the survey asks each individual who has bought online products or services in the last twelve months if: (a) They have bought from national vendors, (b) They have bought from other countries of the European Union, (c) They have bought from vendors from the rest of the World, (d) The country of origin of the vendors is unknown. These four options are not exclusive of each other. An individual performs CBeC_EU when checking option (b); CBeC_RW when checking (c); and CBeC when checking (b) or (c).

Table 1
Penetration Rates of e-commerce in Spain by categories (2016).

	e-commerce	CBeC	CBeC_EU	CBeC_RW
Gender				
Male	55.2	34.2	28.9	21.5
Female	51.4	27.1	21.7	15.4
Age				
16-24	58.7	37.9	27.5	23.5
25-34	63.5	37.7	33.2	24.1
35-44	60.1	35.2	29.4	21.0
45-54	49.2	27.2	23.2	16.1
55-64	40.3	20.0	16.1	10.7
65 <	26.6	11.5	9.1	6.5
Education				
No studies/Primary	14.5	5.7	2.9	4.0
Secondary studies	45.5	24.7	18.9	15.2
Bachelor's degree	67.4	39.3	34.0	23.5
Master or PhD	79.3	51.0	46.1	29.9
Habitat				
> 500,000	58.6	35.7	30.7	21.6
100,000–500,000	54.8	30.6	24.4	19.7
20,000–100,000	51.4	29.1	23.6	17.9
< 20.000	48.5	26.5	21.3	15.3
Household members				
One	49.6	29.7	25.4	17.2
Two	52.8	30.9	26.1	18.3
Three	53.1	29.3	23.8	18.4
Four	56.9	33.0	27.7	19.9
Five or more	47.3	28.1	21.3	16.4
Nationality				
Spanish	54.6	30.9	25.6	18.8
Foreigner	42.7	29.1	23.8	16.3
Occupation				
Employed	61.4	35.4	30.1	21.6
Unemployed	40.2	22.8	17.5	12.8
Retired	32.5	15.3	13.4	8.7
Student	60.6	39.5	30.7	23.7
Housekeeper	23.5	9.6	6.6	6.4
Other	35.2	19.3	14.2	13.1
Income				
< 900	29.7	15.0	11.0	8.1
900-1599	44.6	24.4	18.8	16.0
1600-2499	61.5	34.8	28.6	21.6
2500-2999	73.4	44.1	38.5	27.0
3000 <	79.7	50.8	43.8	28.8
TOTAL	53.3	30.7	25.4	18.5

NOTES. Weighted data: The sampling weight is the number of subjects in the population represented by each observation. Penetration rates as a percentage of individuals aged 16 to 74, who used Internet within the last year. An individual is considered as an eBuyer in any of the categories if he or she has carried out an online purchase within the last 12 months.

dwellings) and above and collects data about ICT equipment and services at home.

The statistics in this paper are calculated using the respective weight for each individual. Applying the weight corrects a possible sample selection bias. The design weights are computed as the inverse of the inclusion probabilities and then scaled such that their sum equals the net sample size (Garín Muñoz et al., 2018). Doing so, inferences can be made more accurately than in similar works in which this procedure is not used (Pfeffermann, 1993).

Some previous works focused on CBeC (supply or demand side) using ad-hoc cross-section questionnaires, but were usually not representative, while our sample is representative by design.

For comparison and given that in order to be cataloged within any of the three types of CBeC it is necessary to pass a first stage (i.e. to buy online), Table 1 shows the penetration rates for eBuyers who purchased online during the last year, in addition to the types of CBeC that are the main objective of this paper.

The concern of whether or not an e-commerce buyer can identify where is she buying from, is partially mitigated by a report about consumer perceptions of CBeC in the EU (Cardona, Duch-Brown, & Martens, 2015b), based on data of a survey carried out in the EU-28 in 2015, they find that 77% of the respondents correctly assess whether a website is located domestically or not.

In our 2016 sample, as shown in Table 1, the last row of penetration rates by socio-economic and demographic characteristics suggest that there are differences between the distinct groups that are analyzed. 53.3% of people who used internet within the last year bought online, while only 30.7% did so outside the borders, and 25.4% bought from other European countries.

Weighted data in Table 1 shows that there is still a gender gap in the adoption of e-commerce where the greatest difference is

observed for the three types of CBeC, where the distance in terms of penetration rates between males and females are 7.1 (CBeC), 7.2 (CBeC_EU), and 6.1 (CBeC_RW) respectively.

Penetration rates are higher for the younger groups and tend to decline for older groups. Notably, education is related to the penetration rates. For instance, the penetration rate of CBeC for the group which has a level of education with a master's or PhD degree is more than 8 times higher than for the group whose level of education is primary or below.

In relation to household size, no discernible differences are observed between groups of different sizes, while the differences are bigger when it comes to the number of inhabitants of the population, where the higher the habitat size the higher the penetration rate. Penetration rates of diverse types of e-commerce are more similar among Spanish and non-Spanish nationals.

Being employed, being a student or having a higher income, as might be expected, is related to higher participation rates. It is remarkable that within occupation comparisons the highest penetration of CBeC goes for the group classified as student, and the lowest penetration for all types of e-commerce users is for the group of housekeepers (representing a total of 2,772,032 people: 17,237 men and 2,754,795 women).

5. Theoretical and empirical models

A sound basis for modeling the economic decisions made by the individuals is the discrete choice model framework that describes choices between two or more discrete alternatives. Such choices contrast with standard consumption models in which the quantity of each good is assumed to be a continuous variable. Instead of analyzing “how much” as in situations with continuous variables, discrete choice analysis tries to answer the question: “which one”. Techniques such as logistic regression can be used for empirical modelling of discrete choice. Estimation of such models is usually done via maximum likelihood methods.

Discrete choice models analyze choices made by consumers among a finite set of alternatives. The models have been used to examine telecommunications equipment and services demands among others. In the paragraphs below, the decision-making unit is assumed to be an individual. The discussion below follows Nobel Laureate in Economics 2000 McFadden (2001) who is a pioneer in developing the theoretical basis for discrete choice.

Discrete choice models relate the choice made by each individual to the attributes of the individual and the attributes of the alternatives available to the person. The model approximates the probability that a person chooses a particular alternative. The models could be used to forecast how individual choices will change under variations in the attributes of the alternatives and/or socio-demographics.

In practice, we cannot observe all factors affecting individual decisions as their determinants are partially unobserved or measured with error. In particular, discrete choice approach uses stochastic specifications to account for unobserved variables related to choice alternatives, taste heterogeneity, individual dynamics, and also heterogeneous choice alternatives.

A special case is the random utility maximization model (RUM) of Marschak (1959). Discrete choice models can be derived from utility theory and are useful because they give a precise meaning to the probabilities P_i, where i is the subscript for individuals.

U_i denotes the utility (or net benefit or well-being) that individual i obtains from choosing one alternative (buy or not buy). The behavior of the individual is utility-maximizing: individual i chooses the alternative yielding the highest utility. The choice of individual i is denoted by a dummy variable, y_i:

$$y_i = \begin{cases} 1 & U_i(buy) \geq U_i(not\ buy) \\ 0 & otherwise \end{cases} \quad (1)$$

The choice made by individual i depends on many factors, some of which are observed and some of which are not. For convenience, a linear approximation can be expressed as

$$U_i = \beta\, z_i + \varepsilon_i \quad (2)$$

where

- z_i is a vector of observed variables relating to individual i that depends on attributes of the alternative, interacted perhaps with attributes of the individual, s_i, such that it can be expressed $z_i = z\,(x_i, s_i)z$ for some numerical function z,
- β is a corresponding vector of coefficients of the observed variables, and
- ε_i captures the impact of all unobserved factors that affect the person's choice.

The individuals considered in this paper are those e-commerce users who purchased (or not) online goods or services in the last year with ages between 16 and 74 years. Conditional on being ecommerce users, this paper considers three types of e-commerce: CBeC, CBeC_EU, and CBeC_RW. Each one, is modeled using a binary dependent variable for each of the estimated empirical models. The models considered below are specific cases of the combination of models 1 and 2 above. Here each type of CBeC is modeled independently, which is a convenient simplification.

In our sample most of the individuals buying at least once outside the EU also buy within the EU; 71.84% of buyers outside the EU also buy within the EU. They are not mutually exclusive events. The behavior of each of the three types of e-commerce is approximated using distinct logit models.

The dependent and explanatory variables of the cross-border e-commerce models are the following:

Dependent variables	
CBeC	1 if the individual buys online from sellers from a country other than Spain; 0 otherwise.
CBeC_EU	1 if the individual buys online from sellers from other EU countries; 0 otherwise.
CBeC_RW	1 if the individual buys online from sellers from other countries from the rest of the world; 0 otherwise.
Sociodemographic	
Gender:	1 if male; 0 if female.
Age	Considered groups: 16–24, 25–34, 35–44, 45–54, 55–64, and 65 or more years old.
Education	It is measured by level of study: primary or less, secondary, bachelor's, and master's or PhD
Nationality	1 if foreigner; 0 if Spanish.
Individual skills	
PC Skills	None, low, medium and high. This index was built based on the computer related specific tasks (weighted according to their degree of difficulty) the respondents declared they carried out.
Internet Skills	Low, Medium, High, Very high. This index was built based on the Internet related tasks (27 items were used to determine the 4 levels of Internet Skills) the respondent declared they carried out.
Online Opinion Seeker	Hardly ever, Sometimes, Always. This variable is based on the frequency the respondents declared they used information from online reviews of other customers before buying online.
Risk	
Internet Trust	Low, Medium, High. These levels have been reported by the respondents.
Economic	
Income	Grouped by different ranges: less than 900, 900–1599, 1600–2499, 2500–2999, more than 3000 euros per month. These categories reflect the monthly household income.

Two of the explanatory variables are binary: Gender and Nationality; all the others are categorical.

The explanatory variables are classified as: sociodemographic (Gender, Age and Nationality), individual skills (Education, PC skills, Internet skills and Online Opinion Seeker), risk (Internet trust) and economic (Family Income). The individual skills variables play the role of reducing the costs of transactions, Internet trust is supposed to decrease the cost, income might increase the benefits, and the sociodemographic variables may have more ambiguous signs, except for Nationality which may signal higher benefits (access to a wider offer of products and services) and/or lower costs (foreign language, for instance).

Internet Trust measures the declared trust of an individual for using the Internet for any purpose in general. Online Opinion Seeker measures the ability of an individual to acquire and process reviews by other customers to make an informed decision about a specific supplier, good or service (Park, Lee, & Han, 2007). Internet Trust relates essentially to the trust on a specific channel, while Online Opinion Seeker relates to the trust on a specific supplier or good. The variables above are used to model the occurrence of each of the e-commerce options using the logistic function.

The results of the estimation of the different models are contained in Table 2. The first column contains the explanatory variables used along the different models. The next three columns contain the odds ratios of each category of each variable, with respect to the base category, and the z statistic of the individual significance of the odds ratio. The z is standard normal under the null of no effect, with a 95% confidence interval of plus and minus 1.96. Only odds ratios that are significantly different from 1 are shown in the table. This model is conditional on being an e-commerce user.

The columns under the header “CBeC” contain the estimations of the odds ratios for the model of buyers who purchase goods or services outside the national borders, and its z-statistics.

The columns under the header “CBeC_EU” correspond to the odds ratios and z-statistics of the buyers that purchase in the European Union.

And the columns under the header “CBeC_RW” correspond to the odds ratios z-statistics of buyers that purchase in any other country outside the EU.

The choice of these specific models corresponds to the questions posed by the previous international literature. Several of them correspond to the purchases by households from foreign or national suppliers. The number of observations for each model may not be totally intuitive. Their variation across models depends on the availability of data for each variable used in each model within the ICT-H sample.

The comments for Table 2 are organized by variables, to facilitate the comparability across models.

GENDER: The effect is higher for males than for females in the three models.

AGE: Someone's age does not affect the odds of making purchases abroad, as seen with being e-commerce user in the model proposed by Garín Muñoz et al. (2018).

EDUCATION: Higher levels of education are associated with higher odds ratios in the CBeC and CBeC_EU models. However, they are insignificant in the CBeC_RW model, suggesting a more homogeneous behavior across the diverse groups of education.

PC SKILLS: The level of skills using computers has a significant and positive effect on the three models.

INTERNET SKILLS: This variable is mostly significant with positive signs and relative magnitudes on the three models.

INTERNET TRUST: This variable has significant odds ratios in CBeC while for CBeC_RW model only the highest category is significant. This may be interpreted as what is important for becoming an e-commerce user is trust, but once this barrier is crossed, its effect is negligible, except for the high level of trust.

ONLINE OPINION SEEKER: This variable is relevant when deciding to become a cross-border e-commerce user (any of the three

Table 2
Models for adoption of Cross-border Ecommerce.

		CBeC		CBeC_EU		CBeC_RW	
		Odds ratios	z	Odds ratios	z	Odds ratios	z
Gender	Female						
	Male	1.42	4.60	1.52	5.63	1.33	3.30
Age	16–24						
	25–34	–	–	–	–	–	–
	35–44	–	–	–	–	–	–
	45–54	–	–	–	–	–	–
	55–64	–	–	–	–	–	–
	> 65	0.64	−2.29	–	–	–	–
Education	Primary/less						
	Secondary	–	–	2.17	2.79	–	–
	Bachelor	–	–	2.89	3.78	–	–
	Master/Phd	1.90	2.40	3.72	4.64	–	–
PC skills	None						
	Low	1.60	2.20	–	–	2.58	3.18
	Medium	1.91	3.05	1.87	2.75	2.67	3.29
	High	1.98	3.12	1.90	2.80	3.39	4.08
Internet skills	Low						
	Medium	–	–	–	–	–	–
	High	1.53	2.19	–	–	1.87	2.29
	Very high	2.55	4.53	2.59	4.30	2.84	3.71
Internet trust	Low						
	Medium	1.20	2.06	–	–	–	–
	High	1.65	3.61	–	–	1.73	3.52
Online opinion seeker	Hardly ever						
	Sometimes	1.65	3.75	1.90	4.58	1.41	1.98
	Always	1.97	5.78	2.12	6.15	2.10	4.81
Income	< 900						
	900–1599	–	–	–	–	1.46	2.14
	1600–2499	–	–	–	–	–	–
	2500–2999	–	–	–	–	–	–
	> 3000	–	–	–	–	–	–
Nationality	Spanish						
	Foreigner	1.86	3.35	1.61	2.72	–	–
Constant		0.14	−5.58	0.06	−7.63	0.03	−8.56
N. observations		5576		5576		5587	
Wald χ^2		318.86 DF: 20		336.52 DF: 13		190.27 DF: 15	
Pseudo R^2		0.0745		0.0817		0.0632	
Correctly classified		63.77%		63.18%		69.09%	

Notes: Weighted logistic regression. Robust estimates. Reference category: female, 16–24 years, no studies or primary studies, no PC skills, low internet skills, low internet trust, hardly ever Online Opinion Seeker and net income levels below 900€ per month. Estimations refer to those who have purchased online during the last year. The pseudo-R^2 is a measure of the in-sample goodness of fit. However the relevant statistics for testing the significance of the estimated coefficients is the χ^2 test of joint significance of all slope coefficients, which is very high and has very low p-values: below 0.001 in all cases, and also the percentages of correct classifications, which are above 63%.

types). The larger the use of this type of information, the larger the odds of making purchases abroad (either in the EU or from the rest of the world).

INCOME: It is essentially insignificant across models and income segments. This suggests that once you are an e-commerce user other factors rather than income are driving your purchase behavior.

NATIONALITY: This variable is significant in CBeC and CBeC_EU models. This suggests that being a foreigner increases the odds of becoming a cross border eBuyer.

The numbers of observations vary between 5587 and 5,576, which constitute reasonably large samples, which are representative of all Spanish-resident households, including the regional dimension.

The Wald χ^2 is a test of joint significance of all the parameters in each equation. Under the null of insignificance of all the parameters the statistic behaves as a χ^2 with a number of degrees of freedom equal to the number of estimated coefficients in each model. The computed values are highly significant in all the models considered.

The Pseudo R^2 is a measure of the goodness of fit. Higher values denote better fit. The values in these models are significant enough to be able to estimate with sufficient precision the statistics of interest and to be able to make inference and policy recommendations, since most of the parameters are individually and jointly significant. The correctly classified measure is another goodness of fit statistic which measures the percentage of cases correctly predicted by the model. The estimated percentages are

Table 3
Polychoric correlations among selected independent variables.

	Age	Income	PC skills	Internet skills	Internet trust
Age	1.000				
Income	0.045	1.000			
PC skills	−0.387	0.344	1.000		
Internet skills	−0.391	0.312	0.729	1.000	
Internet trust	−0.103	0.157	0.246	0.261	1.000

reasonably high in the models[2] of Table 2.

The decision to purchase online is also influenced by the characteristics of the good/service being purchased, as well as a variety of unobserved individual characteristics and perceptions of each individual. Therefore, supply side considerations would help to improve de the model. Recognizing unobserved individual heterogeneity is also relevant in this context.

However, the availability of relevant demand side data is limited to the variables that we have discussed so far in this paper, while supply side characteristics are not included in our sample.

The approach here is that in the data set, the large quantity of data makes up for the relatively low quality of the data on some variables. In this fashion it is possible to estimate meaningfully the sign, size and significance of each one of the effects of the variables included in the models.

Due to the possible presence of collinearity in the explanatory variables of the model, polychoric correlations among the independent variables have been computed, as shown in Table 3 below.

In the above table, most of the computed polychoric correlations (Drasgow, 1988; Stata Corporation, 2017) are moderate. However, the estimated standard errors and associated LR statistics show that they are mostly significantly different from zero. Thus, it is likely that collinearity is partly responsible for the insignificance of AGE and INCOME.

It can be mentioned that preliminary results using pooled data 2014–2017 indicate that all independent variables, including age and income are significant in the CBeC model.

It should be pointed out that the models presented in this paper are conditional on performing ecommerce. In the ecommerce model of Garín Muñoz et al. (2018) the variables AGE and INCOME are both significant. This may suggest that they are relevant for adopting e-commerce, while they appear to be insignificant in the cross-border equations (their effect cannot be measured accurately with this sample, model and estimation technique).

6. Conclusions

This paper deals with the drivers and barriers for the individual adoption of cross-border e-commerce using data **from the 2016 Survey on ICT usage in households** INE (2016).

The paper estimates three models of cross-border e-commerce, conditional on the individual being a user of e-commerce. The three models are: CBeC, CBeC_EU and CBeC_RW. A summary of the main findings contained in Table 2 goes as follows:

Being a Male is positively related to using cross-border e-commerce. **Age** is mostly significant with a negative effect on CBeC for those aged above 65. **Education** is positively related to CBeC_EU while it seems mostly insignificant in the other cases.

PC skills is significant and positive in all the models, especially in the CBeC model. However, **Internet skills** are mostly significant especially in the high and very high levels.

Trust on the Internet seems to be relevant and positive for becoming a cross-border eBuyer especially in the case of higher levels of trust.

When a potential customer is an **Online Opinions Seeker** he or she is more likely to do cross-border e-commerce. On the other hand, income seems to be mostly irrelevant. **Foreign** nationality increases the likelihood of using cross-border e-commerce in general and decreases the likelihood of a CBeC_RW.

The European Commission and the national authorities decided to promote cross-border e-commerce for a variety of reasons discussed in previous sections. For doing so, policy instruments are needed. Several variables of the models can hardly be manipulated to be used as policy instruments, like gender, age, education, income and nationality. However, there are some variables on which one could act in an attempt to boost cross-border e-commerce such as PC skills, Internet skills, Internet trust and online opinions seeker. And, even if it has not been considered as variable, knowledge of foreign languages plays a decisive role in buying online abroad. Creative measures designed to improve them could be implemented. They should be targeted at population groups with less cross-border e-commerce penetration. One such example could be to use specific education measures targeted in older people and housekeepers, who have lower penetration and more time to learn. These measures are in line with the European Commission, 2017a,b,c report that points to deficiencies in the demand side in Spain, mainly centered in human capital, while focusing on ensuring equal conditions for online buyers and sellers across Europe through homogenization of regulation.

[2] The pseudo-R^2 is a measure of the in-sample goodness of fit and it seems somewhat low in these models. However in this case the relevant statistics for testing the joint significance of the estimated coefficients are the χ^2 tests of joint significance of all slope coefficients, which are highly significant in all cases: 318.86, 336.52 and 190.27 with very low p-values, which are below 0.001 in all cases. The percentages of correct classifications are also high with values of 63.77%, 63.18% and 63.09% respectively.

The conclusions of this study require some caveats. The first is that several questions in the survey are not designed specifically for the topics discussed in this paper. Second, cross-border e-commerce may not be well approximated via surveys since many consumers may not know exactly where the website or the center for dispatching the merchandise is located. Another qualification is that static models are being used in situations in which the dynamics seem to be relevant. A further limitation is that only the demand side is analyzed. However, in the context of survey data of only one year, the supply is given, and it is treated as such throughout this paper.

The research agenda contains several issues to be analyzed next. The first one is to use the pool of all the available years to estimate richer sub-models that allow for heterogeneity within the sample. Furthermore, a full panel data set will be available shortly for 2008–2016. Allowing the use of dynamic panel data models to further characterize questions analyzed in the present paper, as well as additional ones like simultaneity and dynamic relationships. Next, it would be important to focus on other relevant issues that can be analyzed using the panel data of this survey, like the demand for IT equipment by households, demand for bundled services, and the demands for a variety of other services, both allowing for geographical and economic dimensions.

Funding

This research is funded by the Autonomous Community of Madrid – Spain. Project: Finance, Innovation and Strategies: Economic Analysis of Business Productivity and its Determinants (PRODECON-CM HM S2015/HUM-3491), 2016–2018.

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