

Garín-Muñoz, Teresa; López, Rafael; Pérez-Amaral, Teodosio; Herguera García, Iñigo; Valarezo, Angel

Conference Paper

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28th European Regional Conference of the International Telecommunications Society (ITS): "Competition and Regulation in the Information Age", Passau, Germany, 30th July - 2nd August, 2017

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Garín-Muñoz, Teresa; López, Rafael; Pérez-Amaral, Teodosio; Herguera García, Iñigo; Valarezo, Angel (2017) : Models for individual adoption of eCommerce, eBanking and eGovernment in Spain, 28th European Regional Conference of the International Telecommunications Society (ITS): "Competition and Regulation in the Information Age", Passau, Germany, 30th July - 2nd August, 2017, International Telecommunications Society (ITS), Calgary

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Models for individual adoption of eCommerce, eBanking and eGovernment in Spain

15/07/2017

Teresa Garín-Muñoz
Universidad Nacional de Educación a Distancia, UNED

Rafael López
Universidad Complutense de Madrid (UCM)

Teodosio Pérez-Amaral
Instituto Complutense de Análisis Económico (ICAE), UCM

Iñigo Herguera García
ICAE, UCM

Angel Valarezo
ICAE, UCM

ABSTRACT

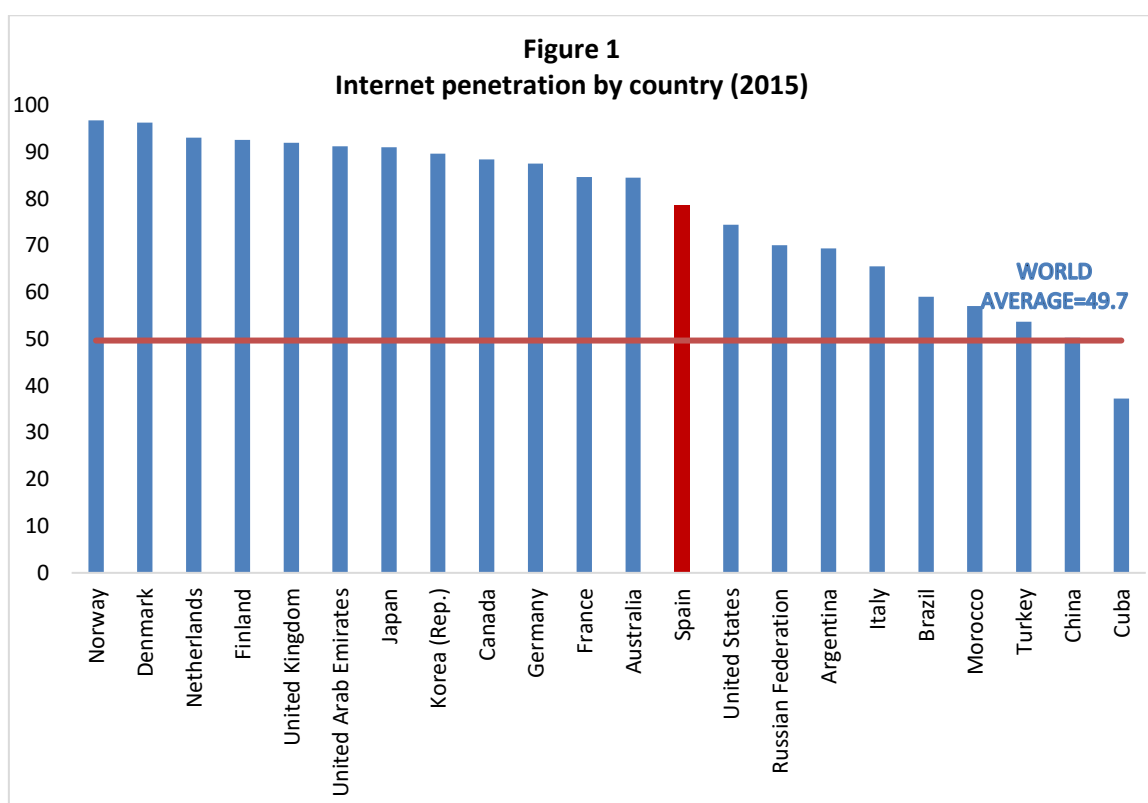
This paper analyzes the adoption patterns of selected internet services such as eCommerce, eBanking and eGovernment in Spain. High quality official data from the Survey on Equipment and Use of Information and Communication Technologies in Households (ICT-H) of the National Institute of Statistics are used. The dataset is a cross section of 16,209 individuals for 2016. Theoretical demand models, grounded in a standard neoclassical utility maximization framework, are adapted to these services. Logistic regression techniques allow quantifying the impact of the socioeconomic characteristics of the individual on the adoption of each service. The resulting models are statistically significant and with a high predictive power. Age, education and levels of internet and computer skills are all significant in explaining the adoption of any of the three services; as are gender and income, but just for eCommerce and eBanking. Interestingly, the level of trust in internet is only significant to explain participation in eCommerce. Finally, policy recommendations are suggested, highlighting the desirability of using specific measures for the different socio-demographic groups and income strata.

Keywords: ECommerce; eBanking; eGovernment; logistic model; digital divide

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.

1. INTRODUCTION

The Internet is one of the most powerful agents of change in recent history. Since its inception in 1991¹, its diffusion has been so rapid (not only along the geography but also by the possibilities and new services that it covers) that it has given rise to major changes in everyday life. In fact, according to the latest data provided by the International Telecommunications Union (ITU, 2016) almost half of the world's population is using the Internet; however there are strong differences either by regions or by groups of individuals. Figure 1 shows the differences between a group of selected countries and with respect to the world average.



Source: Own elaboration based on data extracted from ICT Facts and Figures, ITU (2016)

In addition to these differences by geographical area, there are also differences according to the sociodemographic characteristics of the individuals (gender, income, age group, habitat of residence, nationality, etc.). As an example of the above, the digital gender gap can be mentioned. Internet penetration rates are higher for men than for women in all regions of the world. And the expectations are not very encouraging if we consider that the global Internet user gender gap grew from 11% in 2013 to 12% in 2016 according to ITU, 2016.

¹ There is a broad consensus in situating the birth of the internet in 1991 when Tim Berners Lee created the World Wide Web using three new resources: HTML, TTP and a program called Web Browser.

The empirical evidence corroborates the existence of a “digital divide”² that is measurable and multidimensional. This digital divide is a great challenge as its existence tends to favour deeper divergences in terms of economic and social development and justifies the public policy goal of universal service.

Until recently, the main policy goal was to generalize Internet access and to do so at an affordable price. This is the necessary condition to generalize its use, but it is not a sufficient condition. Evidence of this is that in the case of Spain and with data from 2016 (INE, 2016), there are about 24% of individuals who, having access to the Internet at home, have never used it (neither in that year nor in the previous ones).

However, in the current stage of Internet penetration, it is not only important to improve and extend access to the internet, but to also promote its different usages. If the intention of policy-makers enhancing citizens' internet access and usage is to increase social capital and equal opportunities, not all services are equally valuable from the standpoint of public policy. Based on this, in the present study we place high priority on examining determinants of the three following services: online shopping (eCommerce), electronic banking (eBanking) and electronic administration (eGovernment).

We have focused in these three services because they are high value-added services at both the individual and social levels, and because there are strong synergies and complementarities among them. In addition, their penetration rates in Spain are relatively low when compared to those of other EU countries.

In particular, the emergence of eCommerce has had important economic and social implications. Consumers are changing their consumption habits and businesses have had to adapt to the new situation modifying their business strategies and marketing. This situation is evolving so rapidly that it could be considered a kind of social revolution. Nowadays, some authors even wonder whether conventional shopping centers will survive or are doomed to disappear. In the early days of eCommerce, although many consumers searched for information and compared products on the Internet, they ultimately went to the physical store to shop. Now, in many cases, the situation is the opposite: some individuals use the physical store as a living catalog where to see and try the products that will later be bought online.

² As used in (OECD, 2001), the term “digital divide” refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities.

Electronic banking (eBanking) is also a service of great value that allows the individual to carry out operations with their bank from anywhere at any time of the day. In addition, it is a facilitator of eCommerce and eGovernment. Without the existence of eBanking it is difficult to think about how to make payments derived from online commerce. In the same fashion, eBanking allows one to make payments to the administration as a result of online transactions.

Electronic government (eGovernment) is the use of electronic communications devices, computers and the Internet to provide public services to citizens and other persons in a country or region. The diffusion of eGovernment has many advantages for both the citizen and the administration. Citizens can make their arrangements at any time of the day without having to travel (efficient and time-saving process). For its part, governments also save resources and improve their efficiency. Although both reasons would be sufficient to promote eGovernment, they must be added the capacity to act as enabler and facilitator of eCommerce. According to Blakeley and Matsuura (2001), as eGovernment evolves from being simply an information service to a more transactional environment, governments function as both consumers and suppliers of eCommerce and related services.

Whether or not promoting eCommerce, eBanking or eGovernment is a policy goal, it seems necessary to acquire thorough knowledge of the factors that determine their adoption and to quantify the impact of each one of them. And this is the main objective of the present work.

We will do so for the case of Spain, using microdata from the “Survey on Equipment and Use of ICT in Households” (INE, 2016) which is a survey comparable to those carried out in all EU countries and, therefore, allows interesting comparisons across the 28 countries that compose it.

The rest of the paper is organized as follows: **Section 2** presents an overview of the current situation of eCommerce, eBanking and eGovernment in Spain as well as their recent evolution. In **Section 3** the data to be used is presented, highlighting its advantages over data used in other studies. It also shows the penetration of each of the services by groups of individuals according to their sociodemographic characteristics. **Section 4** presents the logistic models showing the variables that influence the probability that an individual will decide to become an online consumer or to perform eBanking or eGovernment. Finally, the main conclusions and their corresponding policy recommendations are presented in **section 5**.

2. AN OVERVIEW OF THE SITUATION IN SPAIN

This section illustrates the penetration rates of major Internet services such as eCommerce, eBanking and eGovernment as well as their recent evolution and in comparison with other European countries. The recent Europe's Digital Progress Report (EDPR) by the European Commission is used in this section, as well as ICT-H surveys and Eurostat (2017). According to European Commission (2017):

“Spain ranks 14th out of the 28 EU Member States in the European Commission Digital Economy and Society Index (DESI) 2017. Overall Spain has improved its score on all of the dimensions measured with the exception of Human Capital, where it scored lower than last year, in spite of its solid growth in STEM³. Its performance is especially remarkable in Digital Public Services, although Spain made most progress in the Integration of Digital Technology dimension. Spanish public and private sectors are quickly progressing in the integration of digital technologies, in general, some indicators tend to point to a weak demand on the user side, with lower levels of growth on digital skills that hamper development in the Human Capital dimension. Spain belongs to the medium performance cluster of countries⁴.”

Once the latest comparison with other EU countries has been sketched, the evolution of the selected services is analyzed in the next subsection.

2.1. Rates of penetration and their evolution

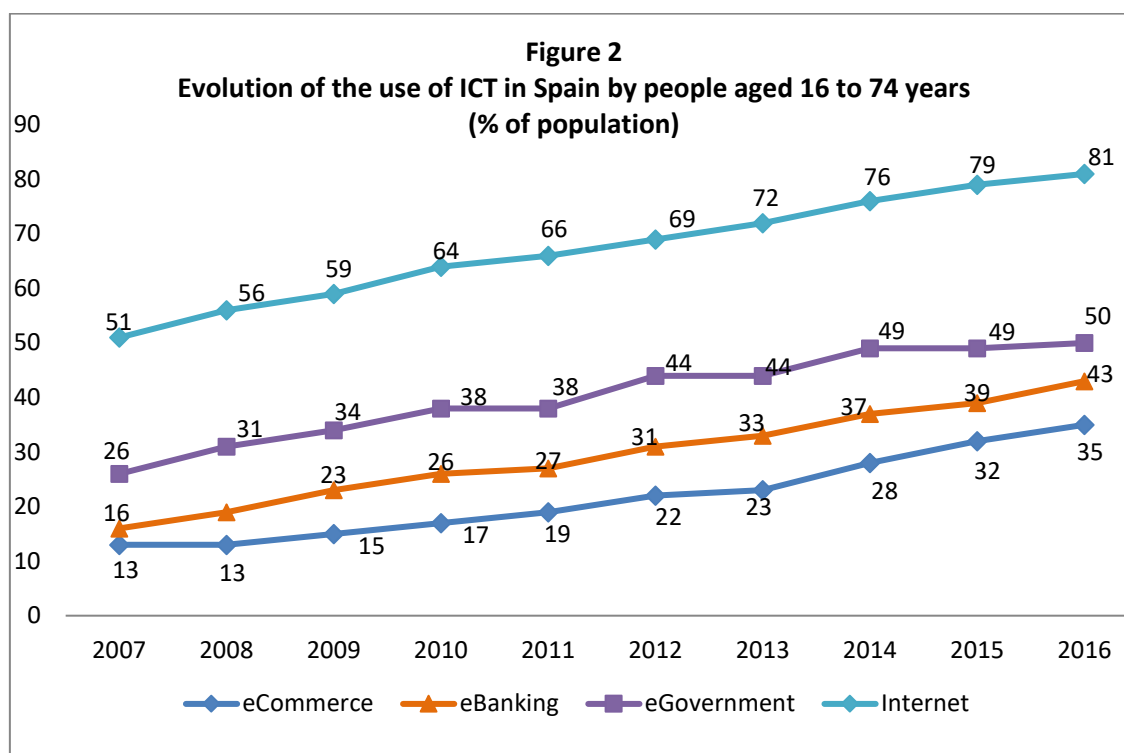
Figure 2 shows a steady increase in the rates of penetration of all services in the last decade. Starting from 51 percent in 2007, currently 81 percent of the population between the ages of 16 and 74 are Internet users (have used the Internet for private purposes within the last 3 months). Possible reasons for this increase are more affordable services as well as the popularization of mobiles devices as a main Internet access channel. Participation in eCommerce (Individuals having ordered/bought goods or services for private use over the Internet in the last 3 months) has also experienced a remarkable advance, going from 13 to 35 percent of the population between 2007 and 2016. The increase in the number of Internet users, the improvement of online trust and greater supply availability, may have encouraged the participation of individuals in eCommerce.

The growth path of eBanking (Individuals using the Internet for banking within the previous 3 months) during this period is parallel to that of eCommerce (from 16 percent of population in 2007 to 43

³ STEM: graduates in science, technology, engineering, and mathematics.

⁴ Medium performing countries are Latvia, Czech Republic, Slovenia, France, Portugal, Spain, Lithuania, Malta, Germany and Austria.

percent in 2016). This can account for the synergies between both services. EBanking can be considered as a facilitator of the payments generated by eCommerce and, therefore, the latter can only be developed with the help of the first.



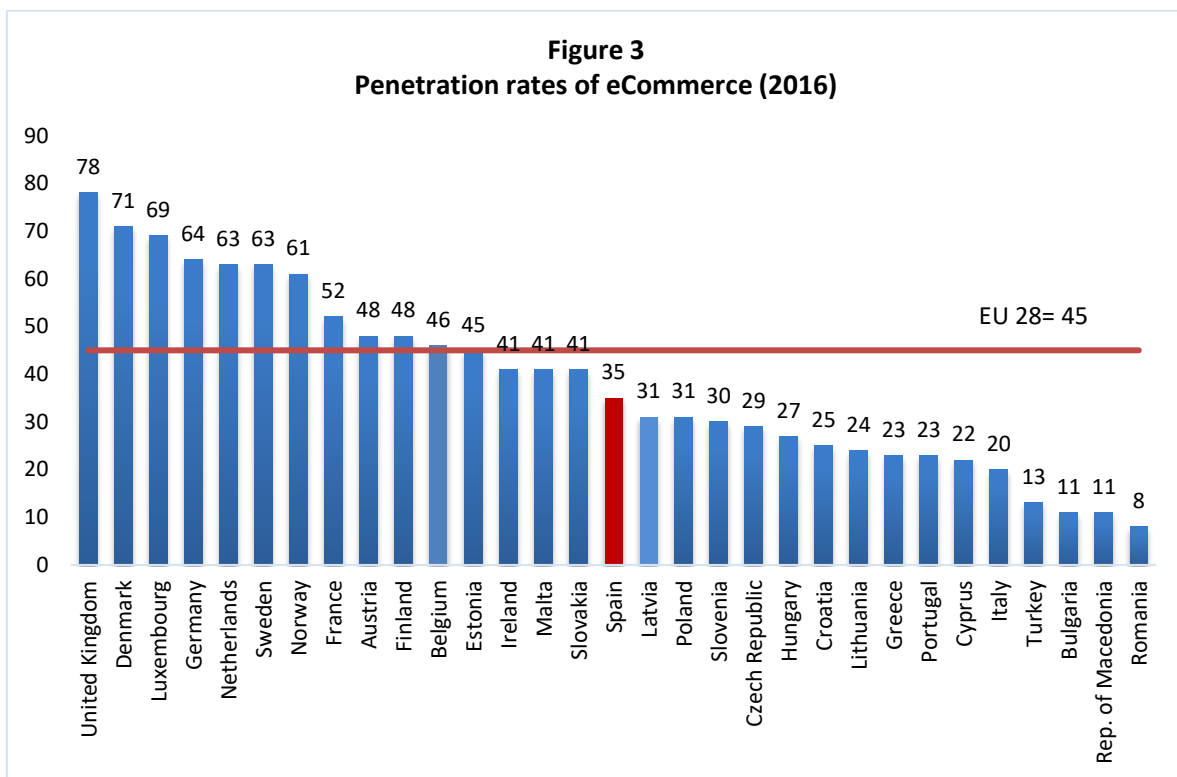
Source: Own elaboration based on Eurostat's survey on ICT usage in households (Eurostat, 2017). The penetration rates of eCommerce and eBanking refer to the individuals using these services within the last 3 months. Penetration of eGovernment is percentage of individuals using the Internet for interaction with public authorities within the previous 12 months.

EGovernment (Individuals using the Internet for interaction with public authorities for private purposes within the previous 12 months) is consistently above the other services and the penetration rate currently reaches 50 percent of the population. This may be because in Spain, as in other countries, eGovernment has been used as a means of promoting the use of new technologies and thereby exploiting its potential as a factor of economic growth. For this, great investments have been made and more and more institutions are engaged in these kinds of citizen services. EGovernment in Spain began to take hold in the first decade of the XXI century, motivated in part by the evolution of technology and a legal framework that allows the legal guarantees that exist in the real world to also extend to the virtual world. The year 2006 is an important milestone in the diffusion of eGovernment in Spain since this was when an electronic ID card was introduced. This document incorporates an electronic signature that allows individuals to transact with the administration. As was the case in Spain and in other countries, the Tax Agency was a pioneer in the implementation of an electronic administration. Presently, 90% of personal income tax declarations are done online.

2.2 International comparison

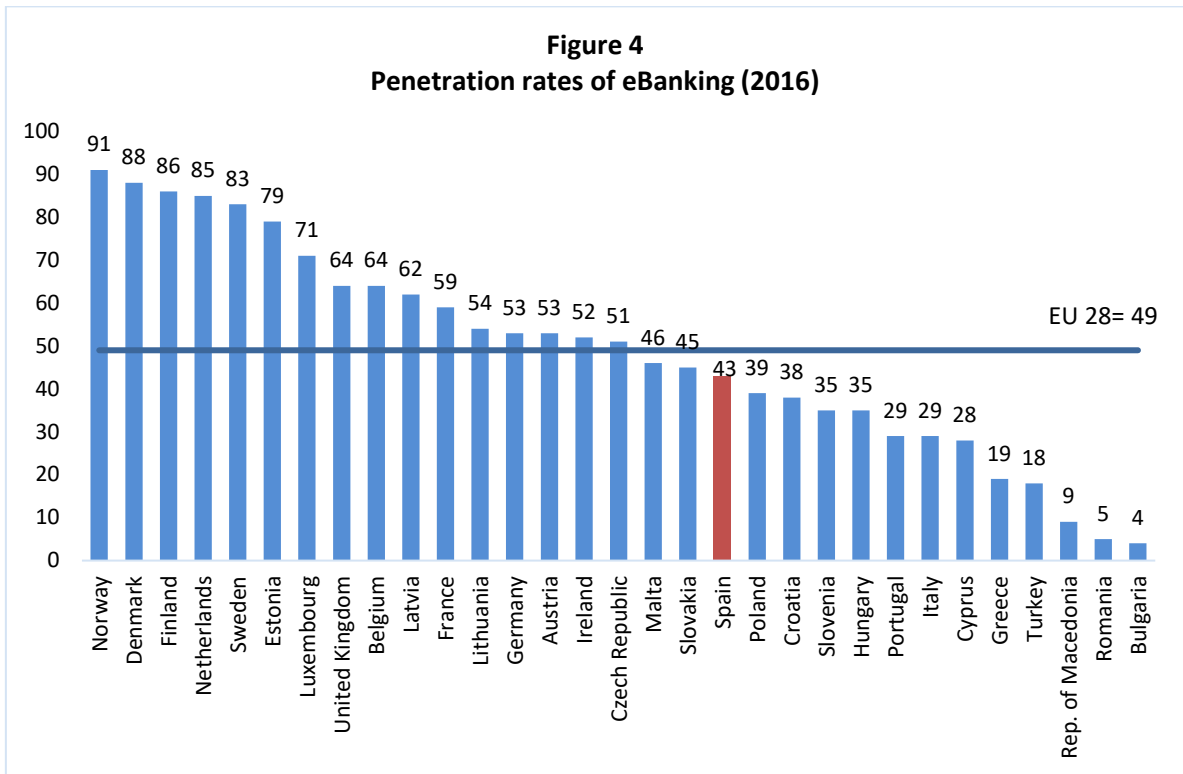
While the Spanish services considered have evolved favorably in recent years, they are still far from reaching their desired levels. This is illustrated by the relative situation with its EU partners. For comparisons, the data provided by the Eurostat ICT-H surveys for the year 2016 (Eurostat, 2017) are used.

Figure 3 shows the ranking of the 28 EU countries in descending order by its eCommerce penetration rate. Defining the participation rate in eCommerce as the percentage of people who have purchased online in the past three months, Spain, with 35 percent, is 10 points below the average of EU 28 which is 45. Interestingly, the penetration in Spain is less than half of that in the UK.



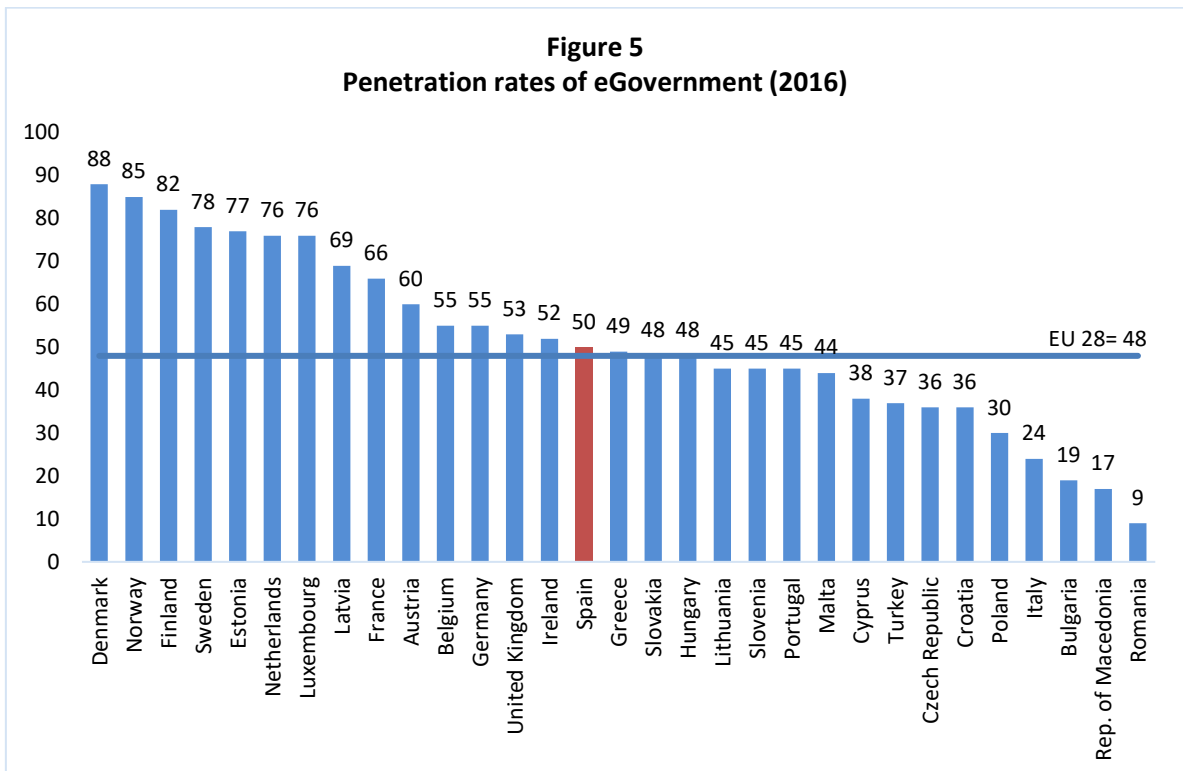
Source: Own elaboration based on Eurostat's survey on ICT usage in households (Eurostat, 2017).

The penetration rates for eBanking are presented in Figure 4. With 43% of the population between 16 and 74 years of age performing electronic banking operations, Spain is 6 points below the average of the 28 EU countries. It is interesting to note that the Nordic countries are in the top positions of the ranking.



Source: Own elaboration based on Eurostat's survey on ICT usage in households (Eurostat, 2017).

In Figure 5 the 28 EU countries are ranked according to penetration rates in eGovernment. The penetration rate for the case of Spain is 50, slightly above the EU 28 average of 48, but well below the major European countries.



Source: Own elaboration based on Eurostat's survey on ICT usage in households (Eurostat, 2017).

Studying the analysis above, there seems to be a problem with the adoption of Internet related services in Spain. In short, it could be insufficient supply, insufficient demand or both. The present paper focuses attention on the demand side and tries to explain the factors acting as drivers and impediments for the individual's adoption of specific Internet services. This is the goal of the models discussed in section 4.

3. DATA

Most studies to date are based on data obtained through surveys conducted either by telephone or via the Internet. These surveys have the advantage of using questionnaires designed specifically for the subject under study. Therefore, they incorporate all the variables that the researcher in each case considers relevant to explain individual behavior. However, these databases also present some problems. In many cases, the sample is small or extracted from a specific group and probably lacks the representativeness that can be expected when using a representative sample with high statistical standards.

In this paper we use data from the Survey on Equipment and Use of Information and Communication Technologies in Households (ICT-H Survey) in 2016 of the Spanish National Statistical Institute (INE, 2016). The Survey follows the methodological guidelines of the Statistical Office of the European Union (Eurostat). It is the only source of its kind that has data comparable not only between the member states, but also in other international spheres.

The 2016 ICT-H Survey is a panel-based study, aimed at people aged 10 and over residing in dwellings, that collects information on home equipment in information and communication technologies (television, telephone, radio, computer equipment) and on the use of computer, Internet and eCommerce. Through 16.209 personal interviews, the database provides information on a wide range of social variables, including media use, demographics and socioeconomics at individual and household level. This data set is appropriate for the objectives and the hypotheses of the present study, as it provides information on the usage of the three considered services together with many other related variables.

The data used in the present study have been weighted for analytical purposes. The ICT-H survey (INE, 2016) provides the relative weight for each respondent, which allows obtaining representative estimates at the population level. We use the sampling weight as the number of subjects in the population that each observation represents when computing estimates such as descriptive statistics and econometric estimates. This is something that is often missing in past literature where only the raw sample data is used. Applying the weights allows for correcting and obtaining estimates that are

not affected by a possible sample selection bias. The design weights are computed as the inverse of the inclusion probabilities and then scaled so that their sum equals the net sample size.

Before proceeding with the study, it is useful to describe the general penetration of the three services (eCommerce, eBanking and eGovernment) as well as the penetration rates by socio-demographic characteristics. For this purpose, Table 1 is presented where the penetration rates are calculated using the weighted data⁵.

The information contained in the table suggests that there are important differences between different groups of individuals. This would confirm that, still in 2016 there was a multidimensional digital divide. The different dimensions of this digital divide are discussed below.

In terms of gender, a digital divide is consistently observed for all services and always in favor of men. The largest differences are recorded for Internet use, where men have a participation rate 6.7 points higher than women.

The digital divide by age group is even more important and affects all services. Individuals aged 65 and over turn out to be the group with the lowest participation rates (except for the case of eBanking where the lowest rates correspond to the group of 16 -24 years).

Also the level of studies of individuals generates notable differences in the use of ICTs (higher education levels correspond to higher participation rates). This divide according to individuals' years of study is observed in the four columns of Table 1.

There are also different participation rates when considering the number of inhabitants of the place of residence. Individuals living in populations with more than 500,000 inhabitants have higher penetration rates in all services. By nationality, Spanish nationals have higher participation rates (calculated as percentage of Internet users) in eCommerce, eBanking and eGovernment than foreigners. However, foreigners have a higher Internet penetration rate than Spanish nationals.

As expected, the individual's economic level also determines their use of ICTs. The higher the net monthly income, the higher the penetration rate. This applies to all services considered.

The results from this table may be useful for locating the groups towards which policies aimed at bridging the digital divide should be directed.

⁵ Although the focus of this study is on services eCommerce, eBanking and eGovernment, it seemed appropriate to include in the table a column that reflects Internet penetration (% of Individuals who used the internet within the last 3 months).

TABLE 1				
Penetration rates: INTERNET, ECOMMERCE, EBANKING, EGOVERNMENT (Spain, 2016)				
	INTERNET USE	ECOMMERCE	EBANKING	EGOVERNMENT
GENDER				
MALE	76.4	45.5	56.5	63.2
FEMALE	69.7	40.2	50.1	60.2
AGE				
16-24	98.4	45.1	33.9	60.1
25-34	96.0	51.9	61.0	65.0
35-44	93.3	49.7	61.3	65.4
45-54	84.9	40.1	55.2	64.8
55-64	64.8	30.4	50.1	56.6
> 65	22.3	19.9	42.2	41.7
EDUCATION				
No studies/Primary	24.0	9.2	18.2	22.3
Secondary studies	85.1	35.0	44.1	55.6
Bachelor's degree	94.7	56.1	68.8	76.6
Master or PhD	97.6	66.8	79.2	80.8
HABITAT				
> 500,000	77.0	48.2	59.3	67.3
100,000-500,000	73.0	42.0	54.6	59.5
20,000-500,000	74.2	41.6	52.6	60.9
<20,000	67.8	38.3	46.8	56.8
HOUSEHOLD MEMBERS				
One	49.6	38.2	56.9	60.1
Two	57.7	43.3	57.7	59.0
Three	80.5	41.9	53.2	61.0
Four	88.8	47.0	53.6	65.5
Five or more	79.9	35.4	42.1	59.5
NATIONALITY				
Spanish	71.9	44.3	54.8	63.7
Foreigner	82.6	31.4	41.3	45.8
INCOME				
<900	47.6	23.0	30.1	46.0
900-1599	68.8	33.9	47.5	54.9
1600-2499	85.1	49.6	63.4	68.3
2500-2999	92.4	62.0	75.9	77.1
>3000	94.8	68.8	76.6	82.4
TOTAL	73.0	42.9	53.4	61.7
NOTES. Weighted data: the sampling weight is the number of subjects in the population represented by each observation. Penetration rates of eCommerce, eBanking and eGovernment as a percentage of Internet users. An individual is considered as eCommerce or an eBanking adopter if he has carried out an online purchase or electronic banking operation within the last 3 months. To be considered as an eGovernment adopter, the individual must have established some online relationship with the administration within the last 12 months.				

4. THEORETICAL AND EMPIRICAL MODELS

Most of the research that tries to explain consumer online behavior uses the so-called Models of Adoption of new technologies. The pioneering models within this category are the theory of reasoned action-TRA (Ajzen and Fishbein, 1980), the theory of planned behavior (Ajzen, 1991; Davis, 1993; Davis, et al., 1989) and the technology-acceptance model-TAM (Davis, 1993; Davis et al., 1989). The technology acceptance model, which has been used to explain the adoption of information technologies in a variety of contexts, is especially attractive for its simplicity and its high predictive power.

The technology acceptance model (TAM) has been widely used in eCommerce research. Ahn et al. (2004) and O'Cass and Fenech (2003) applied this theory directly to investigate consumer behavior in its eCommerce side. On the other hand, most of the studies carried out an adaptation (simplified or extended) of the conceptual framework elaborated from the TAM. The original version of the TAM proposes perceived utility (PU) and perceived ease of use (PEOU) as the main determinants of the adoption of information technologies. The PU of an individual refers to the subjective evaluation of the benefits induced by the use of information technologies. The PEOU indicates the degree to which the prospective user expects the achievement of their goal to be simple and effortless (Davis et al., 1989). Both PU and PEOU have a direct and positive impact on the use.

A previous study for Spain (Garín-Muñoz and Pérez-Amaral, 2011) used this framework and, in particular, the results support the hypothesis that: 1) being a male (all other things being equal) increases the probability of being an online shopper; 2) the higher the level of studies, the greater the likelihood of being an online shopper; and 3) the level of digitalization of the individual (measured by computer literacy, Internet literacy, Internet exposure and Internet trust) have a significant and positive impact on the probability of being an online buyer.

However, in the present study, we generalize this framework following the standard neoclassical utility maximization approach (Varian, 2012) where the demand for access is determined by the size of consumer surplus associated with Internet usage and the cost of access. In this context, an individual derives utility (U) from adopting a particular Internet service (Y), if the benefits from using that service $B(Y)$ exceed its costs $C(Y)$. Empirical works based on this approach are Demoussis and Giannakopoulos, 2006; Fairlie, 2004; Vicente and López, 2008; Lera-López et al., 2011 (the last two referred to the case of Spain).

Assuming that the utility from the usage of the service is a function of a vector of attributes (x) of the decision maker, and given accessibility to Internet services, the probability that an individual will use a given Internet service Y is:

$$P(U|x) = P[B(Y) - C(Y) > 0|x] \quad (1)$$

In this case the three uses of Internet that we want to study are: online commerce, electronic banking and electronic administration. Therefore, we will alternatively use the following binary dependent variables that are defined below.

ECOMMERCE: 1 if the individual uses the Internet for buying or ordering goods or services for private use within the last 3 months; 0 otherwise.

EBANKING: 1 if the individual uses the Internet for banking⁶ within the last 3 months; 0 otherwise.

EGOVERNMENT: 1 if the individual uses the Internet for interaction with public authorities⁷ for private purposes within the last 12 months; 0 otherwise.

The underlying idea in this model (equation 1) is that both the benefits perceived by the potential user of a given service and the expected costs of using the service depend on the individual characteristics (socioeconomic and demographic) of the user. For example, one would expect individuals with a higher level of education to assign a greater value to the benefits of using a service, and for that reason (all other things being equal), the probability of using that service is greater. With regard to costs (monetary and non-monetary), we may think that individuals with more computer skills or more familiarity with the Internet would tend to assign a lower value to the costs since the usage costs for them are lower.

According to the above, and based on previous empirical studies, the explanatory variables are as follows:

GENDER: 1 if male; 0 if female

AGE: Six (6) age groups are considered: 16-24; 25-34; 35-44; 45-54; 55-64; 65 or more.

EDUCATION: Four (4) age groups measured by years of study of the respondent.

PC_SKILLS: Four (4) levels of computer skills. Self-elaborated index by using a self-assessment approach, where the respondent indicates whether he/she has carried out specific tasks related to computer use, without these skills being assessed, tested or actually observed. The different tasks are weighted according to their degree of

⁶ Internet banking includes electronic transactions with a bank for payment, transfer funds, request check books, etc. or for looking up account information.

⁷ E-GOVERNMENT=1 means that individuals used at least one of the following services: for obtaining information from public authorities websites, for downloading official forms, for submitting completed forms.

difficulty. Then, the respondents are grouped into 4 levels: Low, Medium, High and Very high.

INTERNET_SKILLS: Four (4) levels of an individual's internet skills. Self-elaborated index by using a self-assessment approach, where the respondent indicates whether he/she has carried out specific tasks related to internet use, without these skills being assessed, tested or actually observed. Twenty seven internet-related items were used to group the respondents into 4 levels of internet skills: Low, Medium, High and Very high.

INTERNET_TRUST: Three (3) levels of trust on the Internet as reported by respondents: Low, Medium and High.

INCOME: Five (5) groups measured by monthly net income of households (in euros): less than 900; 900-1599; 1600-2499; 2500-2999; 3000 or more.

The probability for the occurrence of an event is modelled using the logistic function. The logistic regression allows predicting the probability of the adoption of a service (eCommerce, eBanking, eGovernment) with the help of a number of predictor variables: the socio-economic characteristics of the individual. These models also show the extent to which changes in the values of the attributes may increase or decrease the predicted probability of event outcome. Models of this type for adoption of ICTs are Askar et al., 2006; Carter et al. 2008 (for eGovernment) and Serener, 2016 (for eBanking).

In these kind of models, the dependent variables are dichotomous whereas the independent variables can be either continuous or categorical. For the purpose of the present analysis, the characteristics of the respondents were converted into binary values, indicating the membership of an individual to one of the categorical values. This was done for the purpose of calculating odds ratio estimates that indicate the odds of an event compared to the odds of a reference group. Categories with estimated values greater than 1 indicate higher odds (and hence higher probability of occurrence) than the reference group. On the other hand, categories with estimated values below 1 indicate lower odds (and hence lower probability of occurrence) than the reference group.

Table 2 shows the binomial regression results on factors predicting online shopping (MODEL 1), Internet banking adoption (MODEL 2) and electronic administration adoption (MODEL 3) for the case of Spain and referring to 2016 data. All three models were statistically significant and able to distinguish between respondents who used each one of the services and respondents who did not. MODEL 1 correctly classified 77.87 percent of cases, and the corresponding percentages for MODELS 2 and 3 are 77.90 and 76.31, respectively.

TABLE 2									
Odds Ratios estimates of logistic regressions for adoption of each service (Spain, 2016)									
	MODEL 1. ECOMMERCE			MODEL 2. EBANKING			MODEL 3. EGOVERNMENT		
	Odds ratios	z	p value	Odds ratios	z	p value	Odds ratios	z	p value
GENDER			0.016		3.73	0.0000	---	---	---
Female	1.00			1.33					
Male	1.20	2.41							
AGE			0.000			0.000			0.000
16-24	1.00	---		5.11	8.62		1.60	3.63	
25-34	1.45	2.45		6.56	10.62		2.24	6.93	
35-44	1.79	4.25		6.51	10.17		3.21	9.50	
45-54	1.64	3.48		7.40	10.12		3.07	8.48	
55-64	1.18	0.97		7.07	8.96		2.11	4.98	
>65	1.02	0.10							
EDUCATION			0.000			0.000			0.000
Primary studies or less	1.00	---							
Secondary studies	2.09	3.20		1.42	2.19		2.37	6.18	
Bachelor's degree	3.05	4.72		2.13	4.38		3.87	8.85	
Master or PhD	3.24	4.76		2.21	4.10		3.52	7.51	
PC_SKILLS			0.000			0.000			0.000
Low	1.00	---		1.00	---		1.00	---	
Medium	1.54	2.76		1.68	4.33		2.09	7.41	
High	2.66	6.10		2.51	6.81		4.53	13.46	
Very high	3.61	7.36		3.31	7.66		6.27	13.65	
INTERNET_SKILLS			0.000			0.000			0.000
Low	1.00	---		1.00	---		1.00	---	
Medium	2.62	6.43		3.52	11.05		2.26	8.77	
High	6.86	12.65		8.65	17.18		3.74	12.60	
Very high	19.31	16.26		26.52	17.88		8.13	13.97	
INTERNET_TRUST			0.000						
Low	1.00	---							
Medium	1.43	4.21		---	---	---	---	---	---
High	1.88	4.09							
INCOME			0.000			0.000			
<900	1.00	---		1.00	---		---	---	---
900/1599	1.26	1.79		1.66	4.23				
1600/2499	1.75	4.21		2.16	6.07				
2500/2999	2.17	5.16		2.96	7.03				
3000 or more	2.59	6.06		2.53	5.64				
CONSTANT	0.0097	-14.66		0.0069	-20.34		0.0376	-17.95	
N. observations	8,031			8,031			10,544		
Wald χ^2	1133.50 Df: 21			1208.46 Df: 19			1154.89 Df: 14		
Pseudo R ²	0.3041			0.2998			0.2356		
Correctly classified	77.52%			77.61%			76.30%		

Notes: Weighted logistic regression. Robust estimates. Reference category: female, 16-24 years, no studies or primary studies, low PC skills, low Internet skills, low Internet trust and net income levels below 900 € per month. The z statistic measures the individual significance of each parameter. It behaves as approximately normal (0, 1) under the null of equality to zero.

The odds ratios results for the three models are presented in Table 2. The odds ratio⁸ reflects the examined category's relation to the reference category, which here is the variable's first category. The models are discussed variable by variable (instead of model by model) to facilitate the comparison.

The estimated odds ratios of the models can be interpreted as follows:

GENDER: Gender plays an important role in explaining the adoption of eCommerce and eBanking (being a male increases the odds of adopting both services). However, gender does not affect the odds of using eGovernment. These results are in line with previous literature that finds that gender plays an important role in making the decision to use or a particular service or not. (Richard et al, 2010; San Martin and Jimenez, 2011).

AGE: The overall age effect is significant across all the three considered services (p value= 0.000). Using as a reference group the individuals with ages between 16 and 24:

- Individuals belonging to the group 35-44 have the largest probability of adopting eCommerce. In fact, their odds of being an online buyer is 1.79 times greater than for the reference group. However, individuals over 55 do not behave in a significantly different manner than the younger group (16-24).
- Individuals belonging to the group 55-64 have the largest probability of adopting eBanking. In fact, their odds of using online banking are 7.40 times greater than for the reference group.
- Individuals belonging to the group 45-54 have the largest odds of adopting eGovernment. For people in this range of age the odds of practicing eGovernment are 3.21 times greater than for the reference group. Also in this case, the lowest odds correspond to the reference group (16-24).

EDUCATION: Education measured by years of study of the individual is a significant variable for explaining eCommerce, eBanking and eGovernment.

- The odds of being an online buyer increase with education. People with a master's or PhD (17-20 years of study) have the largest probability of adopting eCommerce. In fact, their odds of being online buyer are 3.24 times greater than for the reference group (people without studies or primary studies).

⁸ The odds of an event happening is the probability that the event will happen divided by the probability that the event will not happen. An odds ratio is used to compare the odds for two groups and is calculated by dividing the odds of a particular group by the odds of the reference group. While the probability is bounded between 0 and 1, the odds and the odds ratio can take any positive value. However, higher odds correspond to higher probabilities and vice versa.

- The odds of practicing eBanking also increase with education. People with a masters or PhD (17-20 years of study) have the largest probability of practicing online banking. In fact, their odds of adopting online banking is 2.21 times greater than for the reference group (people without studies or with primary studies).
- Compared with the reference group, the odds of practicing eGovernment is significantly different and larger for all the other groups. For people with a bachelor's degree the odds of using eGovernment are 3.87 times higher than those without or with primary studies.

PC_SKILLS: The overall effect of computer skills is significant across all the three considered services (p value= 0.000). In all cases it is observed that the higher the qualification and proficiency of the user, the greater the odds of adopting any of the 3 services considered. As an example, for eGovernment, highly qualified individuals' odds are 6.27 times higher than for the reference group (low skills).

INTERNET_SKILLS: Internet skills are a valuable predictor in explaining the adoption of any of the 3 considered services. Higher level Internet skills are associated with increased odds of adopting eCommerce, eBanking and eGovernment.

- Respondents with very high-level skills had odds of adopting eCommerce 19.31 times greater than people belonging to the reference group (low skills).
- Respondents with very high level skills had odds of adopting eBanking 26.52 times greater than people belonging to the reference group (low skills).
- Respondents with very high level skills had odds of adopting eGovernment 8.13 times greater than people belonging to the reference group (low skills).

INTERNET_TRUST: The overall effect of Internet confidence is significant for explaining the adoption of eCommerce, however it does not affect the odds of practicing eBanking or eGovernment which makes sense, given current safe navigation practices, more secure platforms, multi-step confirmation of operations, requirement for use of digital certificates and the trust associated with institutions with whom the relationship is longer and permanent. Considering 3 levels of Internet trust, the odds of adopting eCommerce for respondents with the highest levels of trust were 1.88 times greater than people belonging to the reference group (low Internet trust).

INCOME: Income is a good predictor to explain the adoption of eCommerce and eBanking, however it does not affect the odds of adopting eGovernment.

- The odds of adopting eCommerce is 2.59 times greater for respondents with a monthly net income above 3000 euros than for the people belonging to the reference group (monthly net income levels below 900 €).

- The odds of adopting eBanking is 2.53 times greater for respondents with a monthly net income above 3000 euros than for the people belonging to the reference group (monthly net income levels below 900 €).

Other variables that we have included in the models, but turned out insignificant are: frequency of Internet use, population of the place of residence, number of members of the household, and nationality of the individual.

The results summarized in Table 2 add significant value to the descriptive statistics in Table 1. Table 2 quantifies the possible effects suggested in Table 1 using a multivariate framework in which the partial effects of each variable are covered and its importance estimated. Variables that may look important in Table 1 may turn out irrelevant in the proper multivariate framework of Table 2 and vice versa.

Discussion of results

The results of the estimation are generally good; with the expected relations between odds ratios, which are mostly individually and jointly significant. This goes along with a high quality sample and adequate models and estimation techniques.

The variables that approximate ease of use (in the TAM terminology), education, pc_skills, and Internet skills are significant, with the right effects. The variable that approximates risk is significant in the eCommerce case, but not in the other two cases. The variable that approximates perceived usefulness is income. And income is statistically significant for eCommerce and eBanking, but it is not for explaining the participation of an individual in eGovernment. Socioeconomic variables that shift the demand up or down are gender and age, both significant and with the expected effects.

It can be pointed out that Internet trust is only significant in the eCommerce model. The non-significance of this factor in the case of eBanking and eGovernment can be interpreted as a proof of the importance attached by the consumer to the service provider. It seems that if the service is provided by a trusted private or public agent, confidence is no longer an issue (this is the case with banks or government). So, it is the offer that creates confidence (or has it ex ante). Although this study does not analyse supply factors, this is indirect evidence of its importance.

With respect to eGovernment, it should be pointed out that three variables are insignificant, suggesting that this activity is more related to the needs of the citizens⁹ than to their economic capacity, their gender or their confidence in Internet.

⁹ The fact that, more and more, the Administration practically forces citizens to do many things over the internet, makes users (irrespective of their level of income) have to participate in eGovernment.

5. CONCLUSIONS

The main goal of this article was to identify the factors that shape the decisions of individuals for adopting eCommerce, eBanking and eGovernment services for the case of Spain during the year 2016. Logistic regression models were used and the obtained empirical results show that the odds ratios of adopting these services are influenced (although with different intensities) by gender, age, education, level of trust in Internet, household income, and the individual's levels of Internet and computer skills. The results of the estimation are generally very good, with the expected relations between odds ratios and mostly individually and jointly significant.

One of the main conclusions from a policy perspective is that a uniform policy across all individuals will not be the most effective in promoting the use of each of the three services. Because of the observed digital divide, policy makers should better focus on socio-demographic and income strata specific measures. Such an orientation by policy makers could be helpful given the structural character of the observed digital divide. It is also clear that measures to improve computer and Internet skills of individuals can improve the penetration of the use of these (and other) Internet services. In this sense, it may be more reasonable to train specific strata of the population rather than laying out fiber in rural areas at a high cost.

If the aim is to promote the use of electronic commerce, it seems clear that providers must take steps to create more confidence and policy makers could promote and enforce consumer protection laws to this form of commerce. In addition, any specific innovation that facilitates the use of ICT services will increase and promote their usage and diffusion.

This paper has used cross section data for analysing a phenomenon that may have an important time dimension. This may be a limitation of the analysis and conclusions. Moreover the analysis is centered on the demand side. A complementary analysis of the supply side may be useful to put the conclusions in context. The possibility of simultaneity between the adoption of each service and some of its determinants may be further explored.

The limitations outlined above suggest that dynamic models might be used. This is the next step of the research agenda, using the panel data structure of this survey. This will also allow the introduction of price indexes of the different services, which will allow characterizing the equations as proper demand equations, with income, price and other socio-demographics as explanatory variables. This approach may also help to alleviate the possible simultaneity that might occur in the models.

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