

# Adoption and expenditure on e-commerce: Evidence from pool and panel data in Spain.

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# OUTLINE

1. INTRODUCTION
2. **OVERVIEW**
  - 2.1. **Penetration rates** and their evolution
  - 2.2. International **comparison**
3. **MICRO DATA**
4. THEORETICAL AND EMPIRICAL MODELS.
5. **EMPIRICAL RESULTS**
6. **CONCLUSIONS**
7. REFERENCES

# 1. INTRODUCTION

**Why e-commerce:** crucial social impact (disabled, rural, poor health, time constrain, ...)

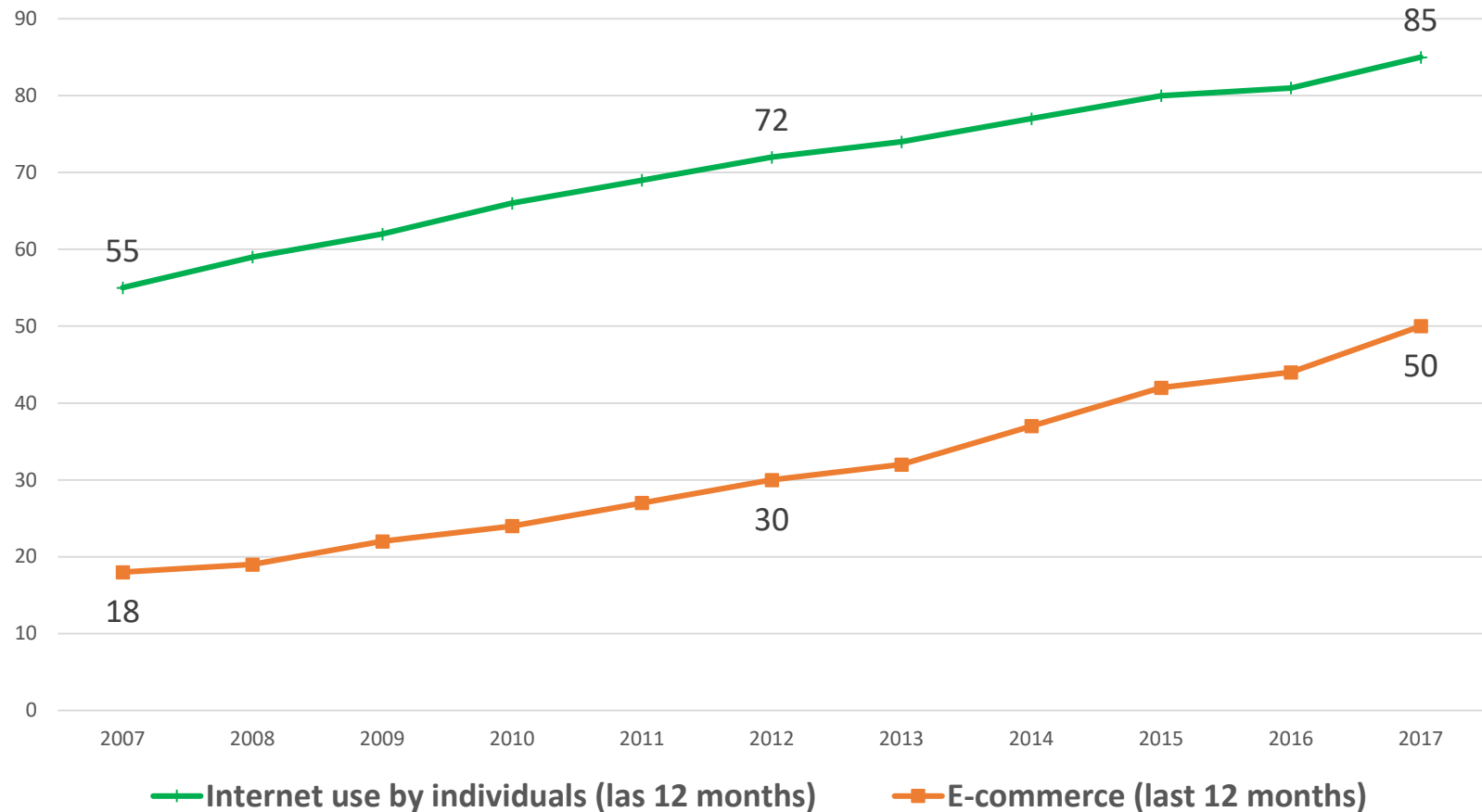
**Main goals:** understanding and **promoting** usage of **e-commerce**. EU priority: social benefits, Digital Single Market, avoid exclusion.

Focus on e-commerce due to **low penetration rates in Spain vs EU** countries.

**Models of Adoption and expenditure of e-commerce** in Spain are estimated using pool and panel data (first time) and logistic and ordered logit models.

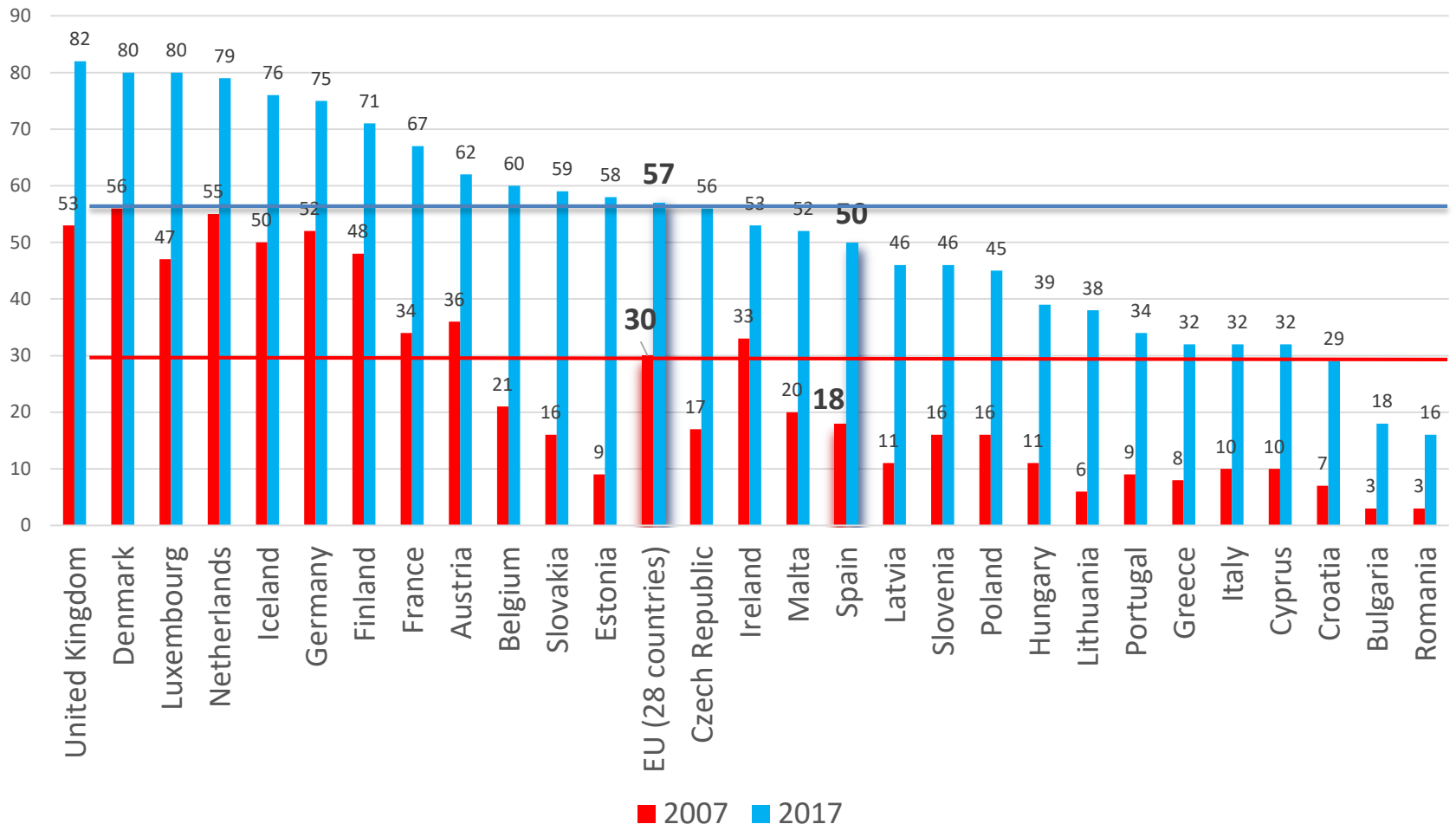
## 2. THE SITUATION IN SPAIN

**Figure 1. Households with broadband access, penetration rates of internet use and e-commerce as percentage of people aged 16 to 74 (2007–2017)**



Source: Eurostat 2018

**Figure 2. Penetration rates of e-commerce in the EU-28 countries as percentage of people aged 16 to 74 (2007–2017)**



Source: Eurostat 2018



### 3. MICRO DATA

- Survey on Equipment and Use of Information and Communication Technologies in Households (**ICT-H Survey**) from **2008 to 2017**. **Spanish National Statistical Institute (INE, 2017)**.
- Methodology of **Eurostat**.
- Includes **elevation factor**.

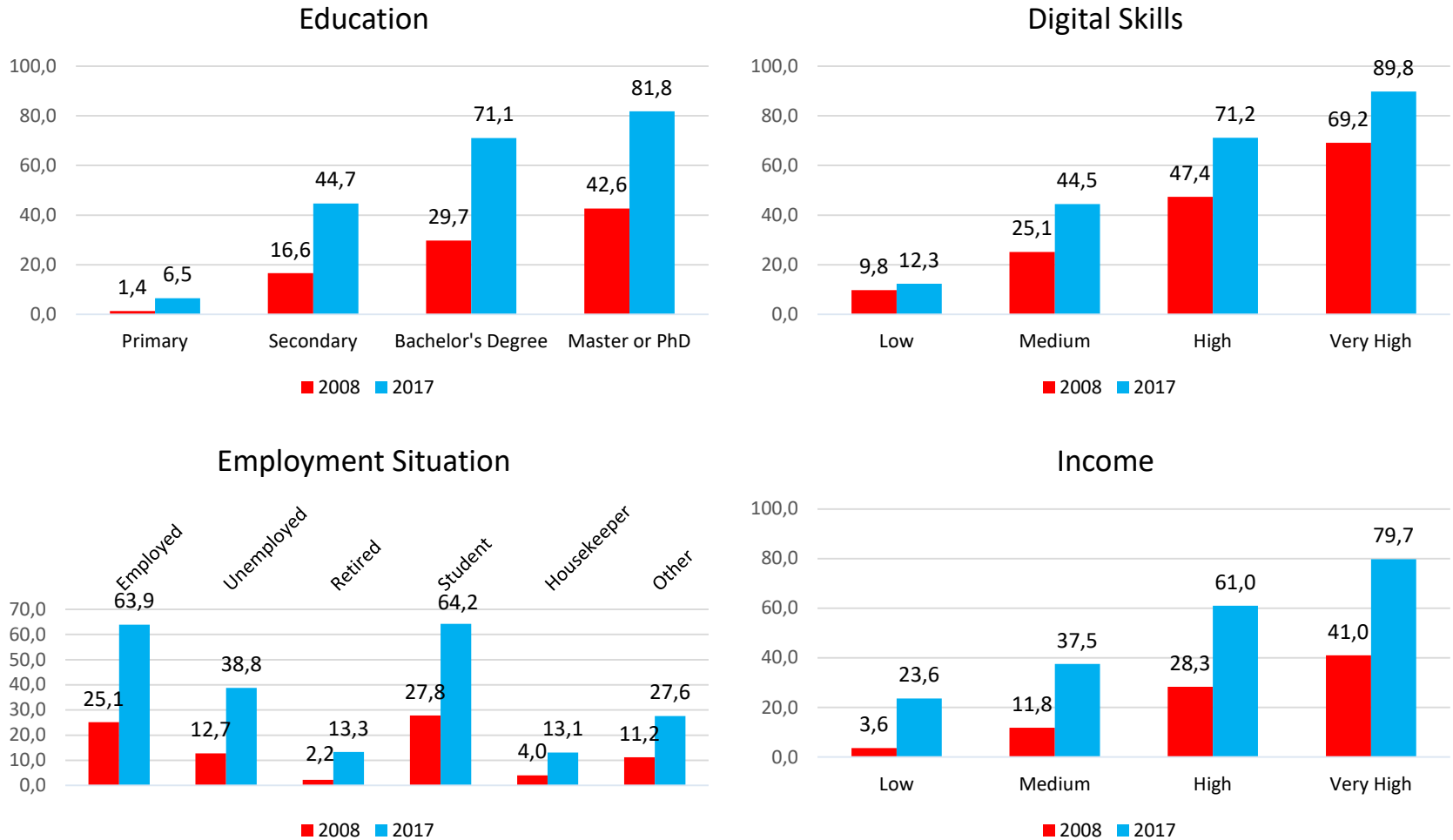
Table 1. Individual penetration rates of e-commerce in Spain (2008 and 2017)

Characteristics	Category	2008	2017
<b>Gender</b>	Female	14.2	41.4
	Male	20.5	48.5
<b>Age</b>	<25	25.1	64.5
	[25,35)	31.4	68.1
	[35,45)	21.3	62.3
	[45,55)	16.2	51.0
	[55,65)	7.2	31.8
	65+	1.0	9.3
<b>Education</b>	Primary	<b>1.4</b>	<b>6.5</b>
	Secondary	16.6	44.7
	Bachelor's Degree	29.7	71.1
	Master or PhD	<b>42.6</b>	<b>81.8</b>
<b>Digital Skills</b>	Low	<b>9.8</b>	<b>12.3</b>
	Medium	25.1	44.5
	High	47.4	71.2
	Very High	<b>69.2</b>	<b>89.8</b>
<b>Habitat</b>	>500,000	22.2	51.2
	100,000-500,000	18.2	42.2
	20,000-500,000	16.3	45.4
	<20,000	13.0	38.7
<b>Household Members</b>	1	12.4	31.1
	2	14.6	32.5
	3	18.1	51.2
	4	21.5	58.7
	5+	14.9	43.0
<b>Employment Situation</b>	Employed	25.1	63.9
	Unemployed	12.7	38.8
	Retired	2.2	13.3
	Student	27.8	64.2
	Housekeeper	4.0	13.1
	Other	11.2	27.6

Characteristics	Category	2008	2017
<b>Nationality</b>	Foreigner	14.5	41.0
	Spanish	17.7	45.3
<b>Income</b>	Low	<b>3.6</b>	<b>23.6</b>
	Medium	11.8	37.5
	High	28.3	61.0
	Very High	<b>41.0</b>	<b>79.7</b>
<b>Autonomous Community</b>	Andalucía	13.1	41.0
	Aragón	18.7	49.1
	Asturias	16.1	44.3
	Baleares	24.3	52.9
	Canarias	12.2	37.6
	Cantabria	18.6	49.8
	Castilla y León	14.6	39.4
	Castilla La Mancha	12.6	41.7
	Cataluña	21.2	49.1
	Valencia	15.3	43.7
	Extremadura	14.4	37.1
	Galicia	13.9	36.0
	Madrid	23.8	53.9
	Murcia	14.2	39.2
	Navarra	20.1	53.2
	País Vasco	21.1	46.7
La Rioja	18.3	44.0	
Ceuta	12.6	48.6	
Melilla	17.9	47.8	
<b>TOTAL</b>		<b>17.3</b>	<b>44.9</b>



Figure 3. Individual penetration rates of e-commerce for categories of Education, Digital Skills, Employment Situation and Income in Spain (2008 and 2017)





## 4. THEORETICAL AND EMPIRICAL MODELS

### Previous Models of Adoption of new technologies.

- The theory of reasoned action-**TRA** (Ajzen and Fishbein, 1980),
- The theory of planned behavior **TPB** (Ajzen, 1991; Davis, 1993; Davis, et al., 1989),
- Technology-acceptance model-**TAM** (Davis, 1993; Davis et al., 1989).

- **Discrete choice models** analyze choices made among a finite set of alternatives.
- The discussion below follows Nobel Laureate in Economics 2000 **Daniel McFadden (2001)**.
- Can be derived from **utility theory** and are useful because they give a precise meaning to the probabilities  $P_i$ .

# E-commerce adoption

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

**Model based on utility maximization.**

$$U_i = f(\beta z_i) + \varepsilon_i$$

- $\beta$  vector of **coefficients** of the **observed variables**
- $\varepsilon_i$  captures the **impact of all unobserved factors**
- $x_i$  **attributes of the alternatives.**
- $s_i$  **attributes of the person**
- $z_i$  **observed variables relating to person  $i$**  (depends on attributes of the alternative,  $x_i$ ),
- interacted perhaps with **attributes of the person,  $s_i$** , such that

$$z_i = z(x_i, s_i)$$

Dependent variable: discrete,

**E-COMMERCE**

= **1**, the individual bought online for private use in the last 12 months.

= **0**, otherwise.

Model conditional on being Internet user.

# Independent variables:

<b>Gender:</b>	2 groups: 1 if male, 0 if female
<b>Age:</b>	6 groups
<b>Education:</b>	4 levels of study
<b>Digital Skills:</b>	4 levels
<b>Habitat:</b>	4 groups
<b>Household Members:</b>	5 groups
<b>Nationality:</b>	2 groups: Spanish, Foreign
<b>Employment Situation:</b>	6 groups
<b>Income:</b>	4 groups, monthly net income
<b>Yearly Dummies:</b>	1 for each year
<b>Regional Dummies:</b>	17 Autonomous Communities

## Table 2 E-commerce models. Pool and panel data (2008–2017)

		(1)		(2)	
		E-commerce adoption. Pool data		E-commerce adoption. Panel data	
		Odds ratios	z	Odds ratios	z
Gender	Female				
	Male	1.29	10.40	1.45	11.90
Age	16-24				
	25-34	0.82	-0.98	0.85	-0.81
	35-44	0.52	-3.49	0.56	-3.12
	45-54	0.46	-4.13	0.38	-5.03
	55-64	0.31	-6.00	0.23	-7.19
	> 65	0.24	-6.38	0.14	-8.37
Education	Primary or less				
	Secondary	1.45	6.36	1.58	7.12
	Bachelor	1.90	10.25	2.34	11.95
	Master/Phd	2.34	13.45	3.36	16.86
Digital Skills	Low				
	Medium	2.48	4.78	2.56	4.90
	High	4.88	8.71	7.95	11.22
	Very high	12.52	13.84	25.32	17.36
Habitat	<20000				
	20000-100000	0.95	-1.57	0.94	-1.49
	100000-500000	0.78	-5.24	0.78	-3.82
	>500000	1.02	0.73	1.00	-0.05
Household Members	One				
	Two	0.93	-1.85	0.87	-2.69
	Three	0.78	-6.36	0.73	-6.02
	Four	0.76	-6.71	0.71	-6.42
	Five or more	0.62	-8.34	0.60	-7.15
Nationality	Foreigner				
	Spanish	1.16	2.82	1.26	3.67
Employment Situation	Employed				
	Unemployed	0.74	-7.80	0.73	-6.94
	Retired	0.82	-2.72	0.84	-2.16
	Student	0.73	-5.00	0.70	-4.78
	Housekeeper	0.84	-2.65	0.81	-2.79
	Other	0.90	-1.36	0.83	-1.89
Income	Low				
	Medium	1.32	6.97	1.60	10.43
	Medium-high	1.91	15.14	2.58	19.04
	High	2.71	19.45	4.00	23.43
Digital Skills × Age	High × 55-64	2.40	4.15	2.44	4.02
	High × 65 or more	2.40	3.61	2.33	3.24
	Very high × 55-64	2.04	3.30	1.80	2.53
	Very high × 65 or more	3.07	4.27	3.09	3.90

		(1)		(2)	
		E-commerce adoption. Pool data		E-commerce adoption. Panel data	
		Odds ratios	z	Odds ratios	z
Year	2007				
	2008				
	2009	0.87	-2.41	0.84	-3.28
	2010	1.14	2.32	1.17	2.88
	2011	1.05	0.78	1.05	0.76
	2012	1.06	1.01	1.13	2.03
	2013	1.23	3.72	1.23	3.57
	2014	1.61	8.43	2.09	12.57
	2015	2.89	18.68	4.21	24.33
	2016	2.83	18.56	4.09	23.94
	2017	4.17	25.81		
Autonomous Community	Andalucía				
	Aragón	1.10	1.56	1.16	1.81
	Asturias	1.22	3.65	1.26	3.01
	Baleares	1.68	7.49	2.35	9.39
	Canarias	0.75	-4.31	0.82	-2.24
	Cantabria	1.40	5.42	1.60	5.36
	Castilla la Mancha	1.11	1.68	1.26	2.71
	Castilla León	1.01	0.19	1.04	0.45
	Cataluña	1.32	5.68	1.55	6.58
	Extremadura	1.06	0.98	1.12	1.29
	Galicia	1.00	0.09	1.04	0.46
	La Rioja	1.21	2.72	1.27	2.58
	Madrid	1.17	3.20	1.42	5.16
	Navarra	1.35	5.47	1.66	6.92
País Vasco	1.39	5.86	1.79	7.27	
Murcia	0.87	-2.33	0.94	-0.75	
Valencia	0.91	-1.81	0.91	-1.34	
Ceuta	0.78	-1.64	0.72	-1.72	
Melilla	0.88	-0.73	0.98	-0.11	
Constant		0.05	-15.36	0.02	-
					20.27
N. observations		75,960		66,169	
Wald $\chi^2$		10581.81 DF: 70		7982.03 DF: 69	
Pseudo R <sup>2</sup>		0.2759			
Correctly classified		75.95%			
Notes: Odd ratios and z statistics significant at the 5% are represented in bold. Weighted logistic regression (Equation 1) and random-effects logit models (Equation 2). Robust estimates.. Estimations refer to those internet users that have purchased (or not) online during the last year					

# Post-estimation statistics

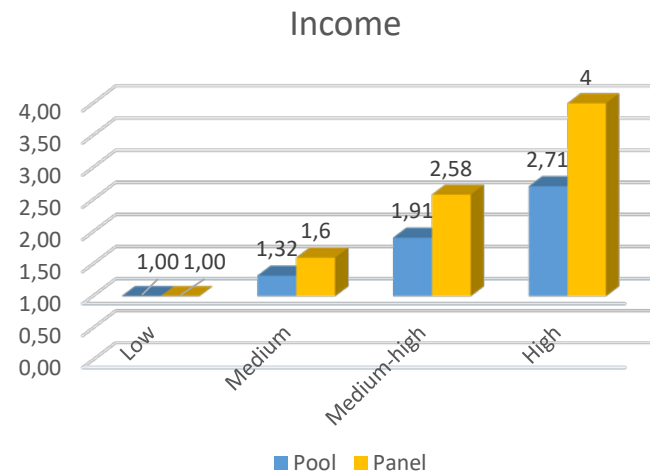
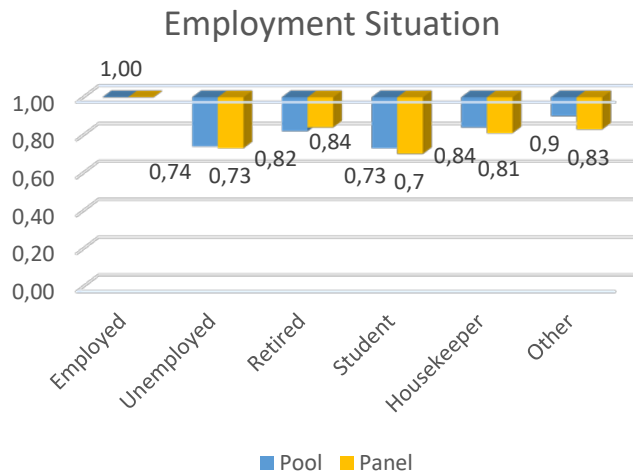
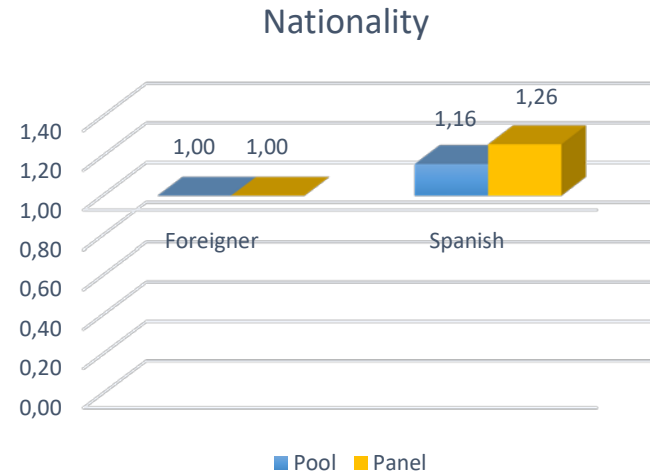
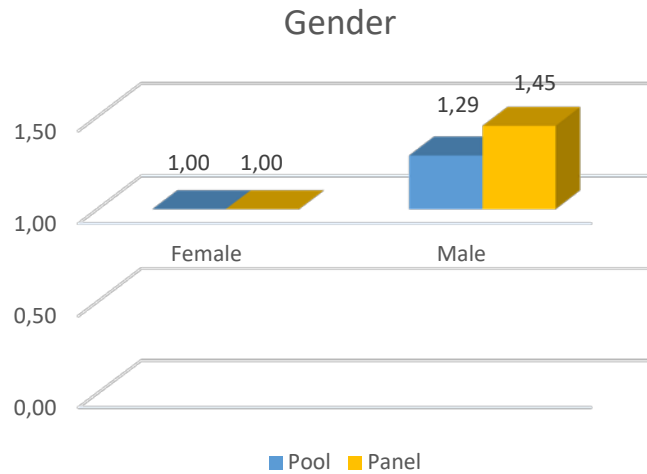
- **Pool** (2008-2017)
  - N. obs. = 75,960
  - **Wald = 10581.81** DF: 70
  - Pseudo  $R^2 = 0.28$
  - Correctly classified = 75.95%
  
- **Panel** (2008-2016)
  - N. obs. = 66,169
  - **Wald = 7982.03** DF: 69



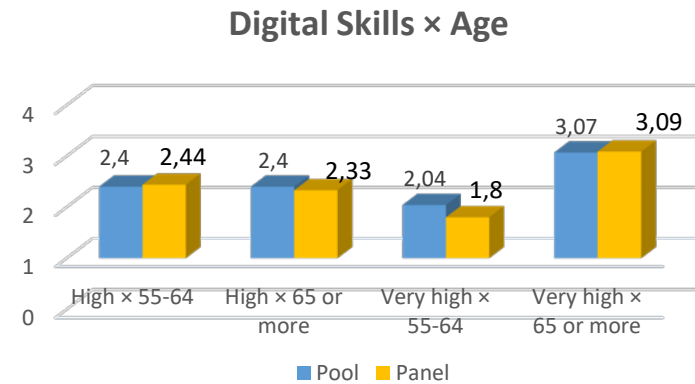
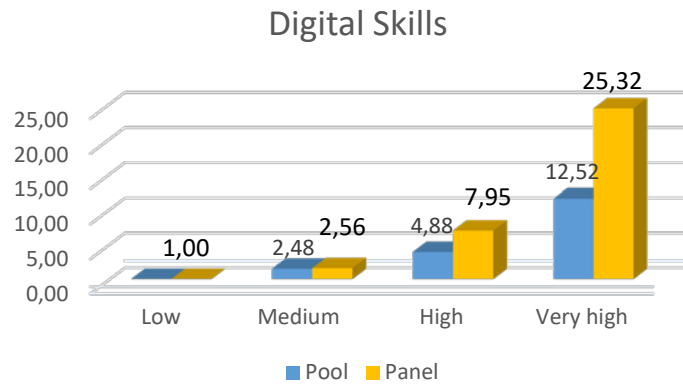
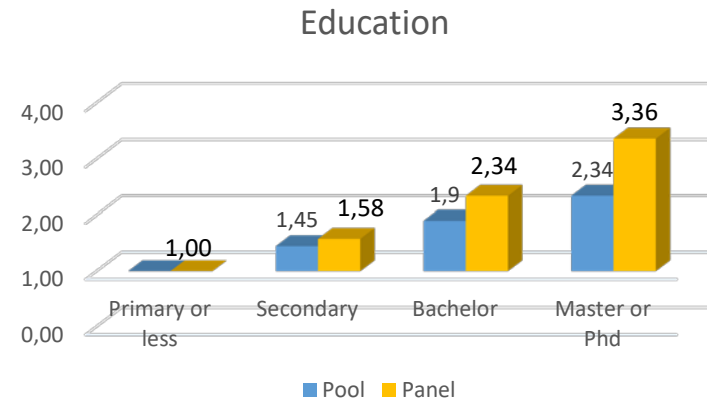
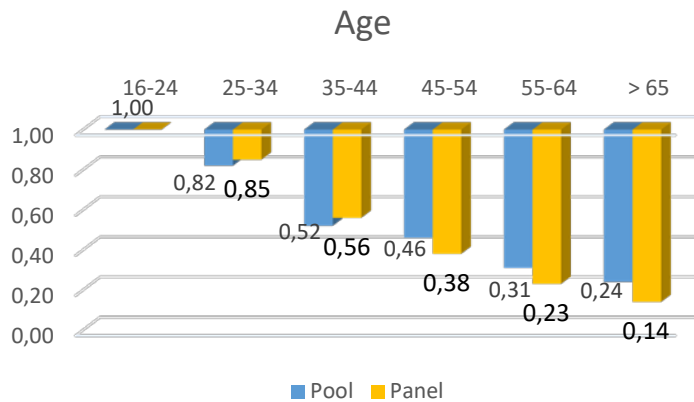
# Adoption of e-commerce

- **Panel data** control unobserved **heterogeneity**. Consistent, efficient and robust estimates.
- **Adoption**, jointly significant model.
  - **positive**: male, education, digital skills, Spanish, employed, income, digital skills x age, year.
  - **negative**: age, household members,
  - **insignificant**: habitat.
- **Regional dummies**, stand out: Baleares, Cantabria, Cataluña, Madrid, Navarra and País Vasco. Explanation: income, wealth.

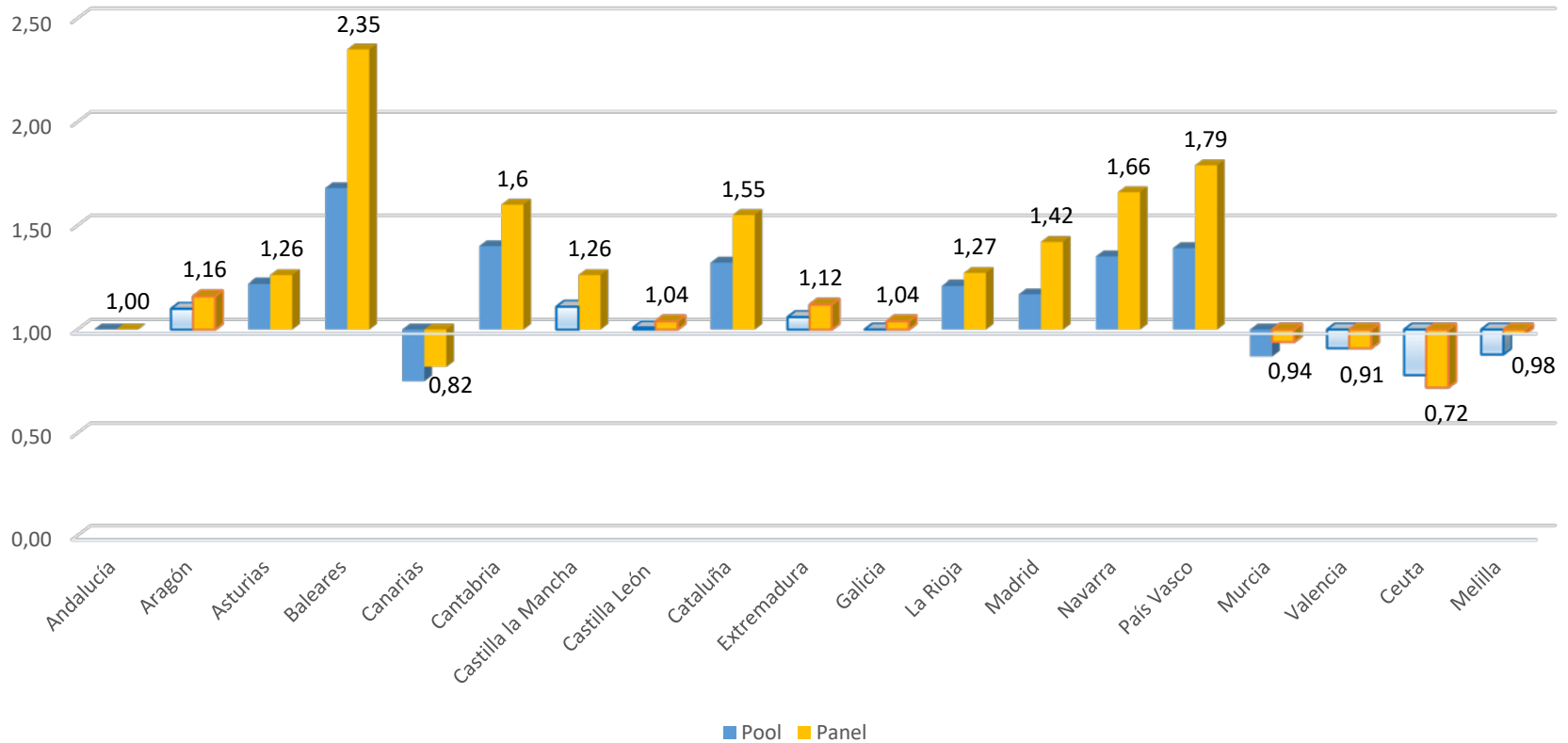
**Figure 4. Odds ratios of e-commerce. Pool (2008-2017) and panel (2008–2016)**



**Figure 5. Odds of e-commerce. Pool (2008-2017) and panel (2008–2016)**

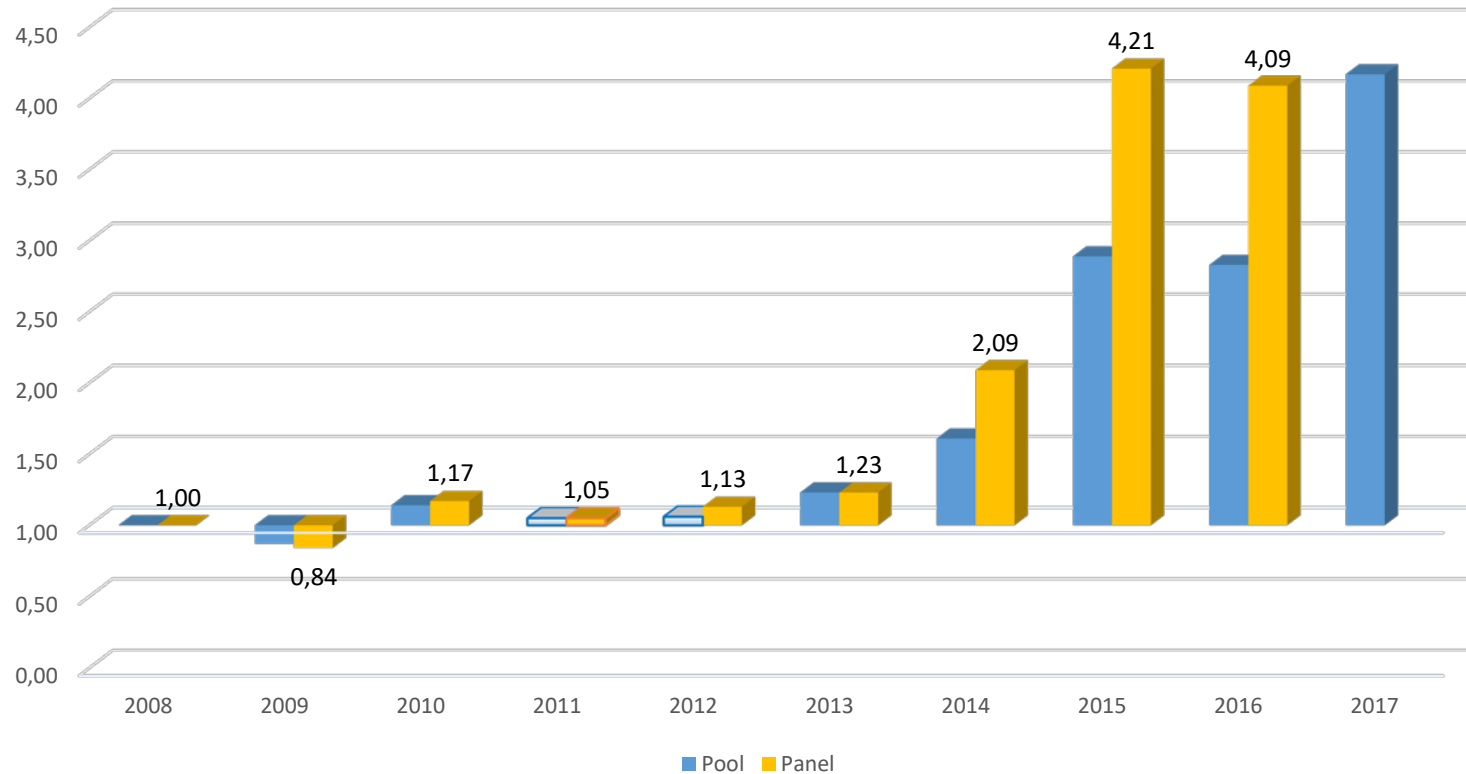


**Figure 6. Odds ratios of e-commerce by regions. Pool (2008-2017) and panel (2008-2016)**



Note: The horizontal line at 1 represents the case of no difference with the base category Andalucía. Positive numbers represent higher odds ratios of adopting e-commerce.

**Figure 7. Odds ratios of yearly dummies. Pool (2008-2017 and panel (2008-2016).**



Note: The horizontal line at 1 represents no difference with the base categories. Positive numbers represent higher odds ratios of adopting e-commerce.

## 5.1 FURTHER RESULTS: EXPENDITURE

### Expenditure (5 Levels) : ordered logistic model

$$y_i = \begin{cases} 1 & \text{very low} \\ 2 & \text{low} \\ 3 & \text{medium} \\ 4 & \text{high} \\ 5 & \text{very high} \end{cases}$$

## Expenditure in e-commerce: pool and panel

- **Only three** years of pool and **two** years of panel.
- **Highly significant.** 10,852 obs. (pool)
- **Positive effect:** male, age (mostly), education, digital skills, employed, income (especially high income).
- **Negative effect:** household members, Spanish
- **Mostly insignificant:** habitat.
- Differences in **odds ratios**, less intense than in adoption model for digital skills.
- Stand out: Baleares, Cantabria, Castilla-León, Galicia, Navarra, País Vasco.

## 6. CONCLUSIONS

- First time to use this type (**quantity and quality**) of data.
- First time to use **panel data** techniques.
- Consistent, efficient and robust estimates.
- **Lower odds**: Female, unemployed, retired, house keepers, rural area, over 55 years.
- **Using panel data** and controlling for individual (random) effects, the **effects** of determinants for adoption are **larger and more significant** than in the pool case, in particular: gender, income, age, digital skills and education.
- High **digital skills** have a positive influence, partly **counteracting the negative effect** of some **age** groups.



# Policy recommendations

- **To promote e-commerce.**

**Demand side** → Bridge divides.

- Focus **specifically**: females, over 55 years, low digital skills, rural, housekeepers.
- **Technical support** online, by phone, and in person.
- **Training** on specific **Digital Skills**, focusing the effort on going from low to medium level.

# Supply side measures

## Government

- Promote complementary services: e-government, e-health.
- Identify and re-edit successful supply side programs.
- Reduce transaction costs, red tape, trade barriers and geographic barriers.
- Incentives for efficient e-commerce platforms.

## Private sector

- Easy-to-use platforms.
- Ask for customer reviews.
- Promotions targeted on groups with low penetration.
- Streamline payment and transaction process.

# Thank you

# APPENDIX

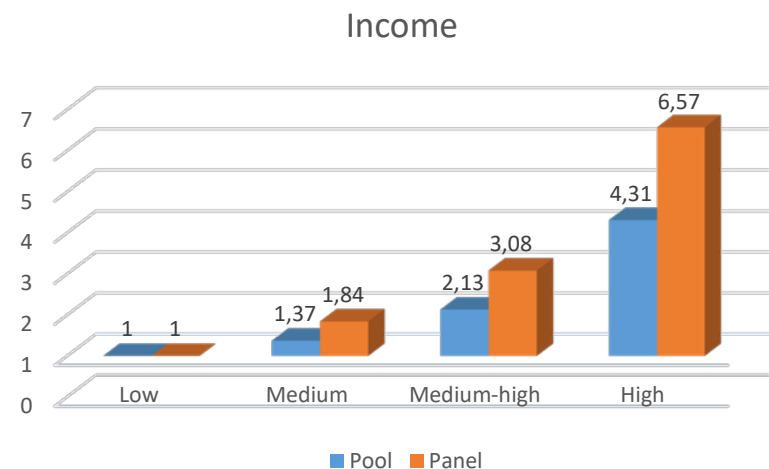
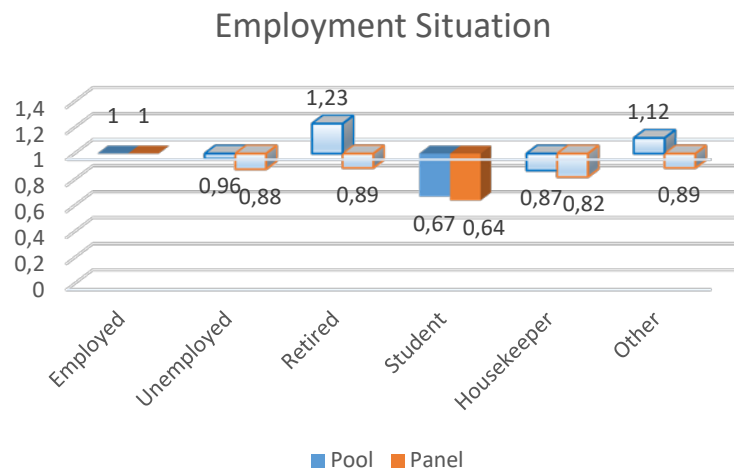
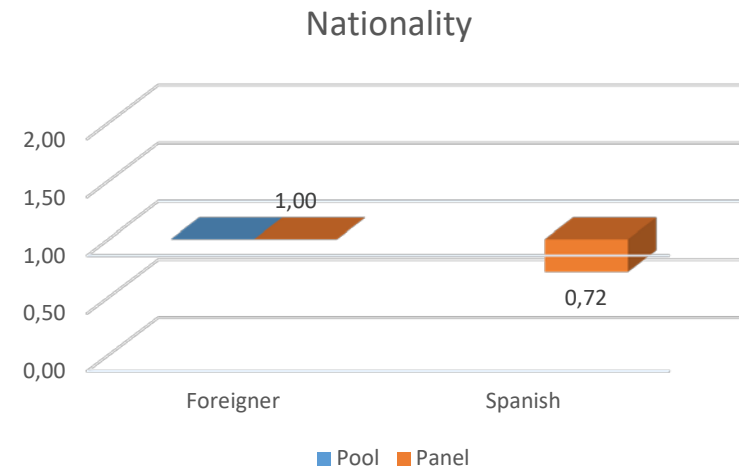
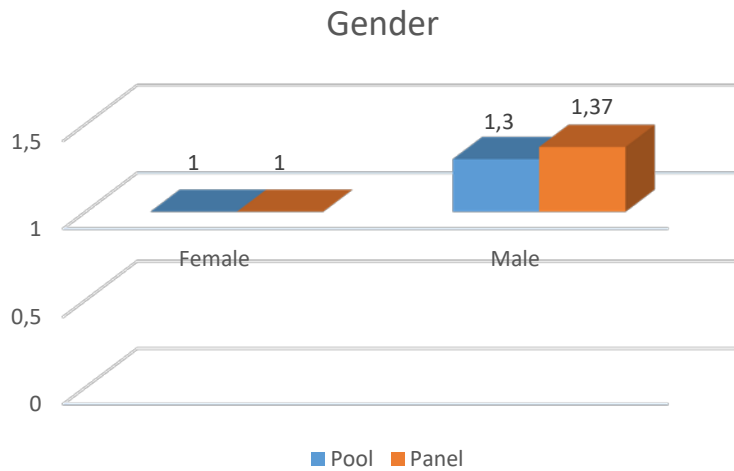
LIMITATIONS	FURTHER RESEARCH
<ul style="list-style-type: none"> <li>• The analysis does not include yet dynamics.</li> <li>• The models don't include price indexes.</li> <li>• Possible multicollinearity.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce <b>dynamics</b> in the models using the panel data structure of this survey.</li> <li>• Introduction of <b>price indexes</b> of the different services, which will allow characterizing the equations as proper demand equations, with income, price and other socio-demographics as explanatory variables.</li> <li>• Polychoric correlation.</li> <li>• Comparison with cross section analysis of 2016.</li> </ul>
<ul style="list-style-type: none"> <li>• The analysis is centered on the <b>demand side only</b>.</li> </ul>	<ul style="list-style-type: none"> <li>• An analysis of the <b>supply side</b> may be useful to put the conclusions in context.</li> </ul>
<ul style="list-style-type: none"> <li>• The possibility of <b>simultaneity</b> between the adoption of e-commerce and some of its determinants may be further explored.</li> </ul>	<ul style="list-style-type: none"> <li>• The panel data approach may also help to alleviate the possible <b>simultaneity</b> that might occur in the models.</li> </ul>

**Table A1. Spending on e-commerce by individual internet users. Weighted ordered logit. Pool (2008-2017) and panel data (2008–2016)**

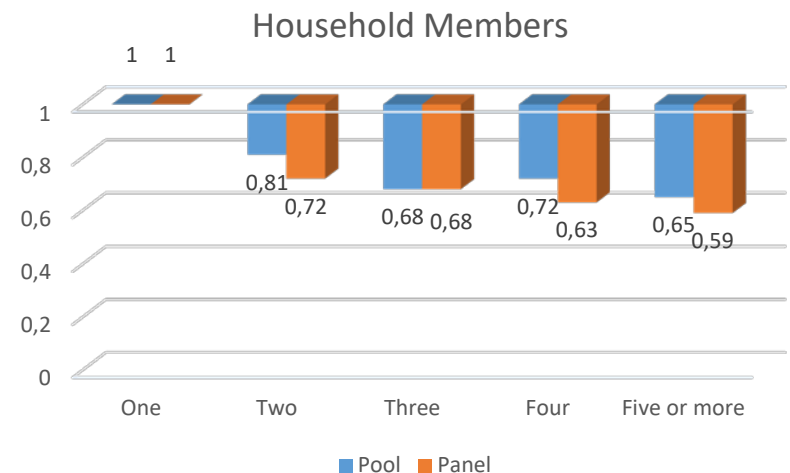
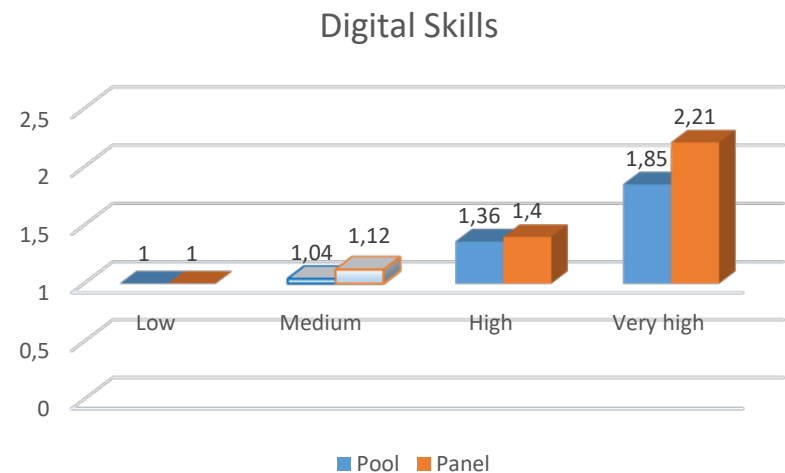
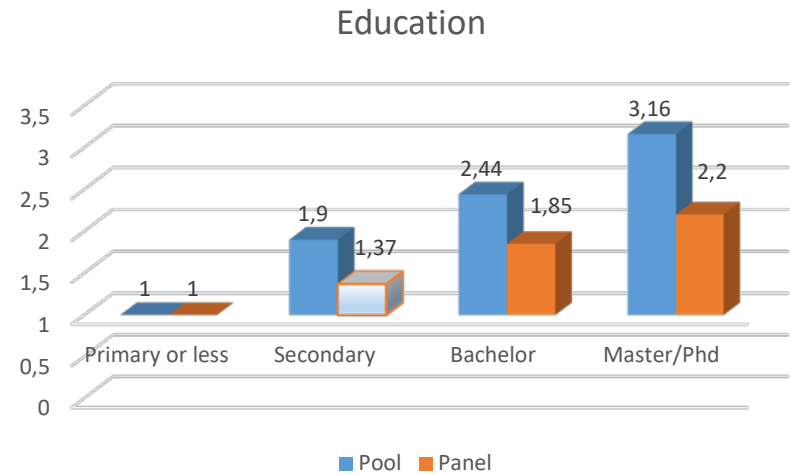
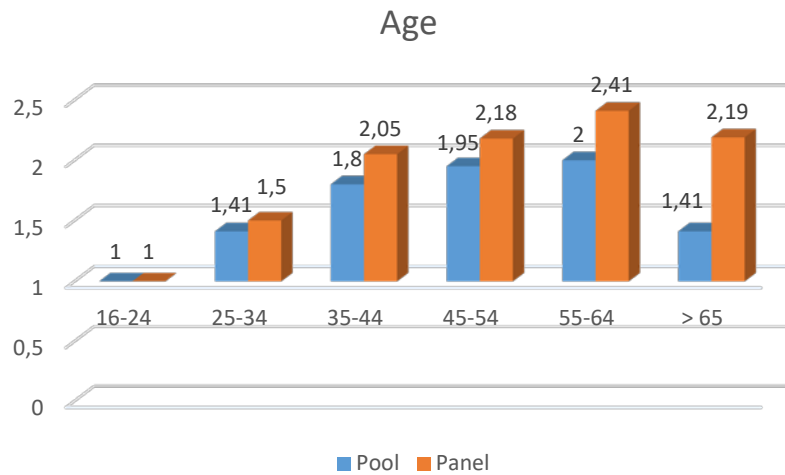
		(3)		(4)	
		Spending on e-commerce. Pool data		Spending on e-commerce. Panel data	
		Odds ratios	z	Odds ratios	z
<b>Gender</b>	Female				
	Male	1.30	5.54	1.37	5.08
<b>Age</b>	16-24				
	25-34	1.41	3.03	1.50	2.37
	35-44	1.80	5.22	2.05	4.18
	45-54	1.95	5.69	2.18	4.40
	55-64	2.00	5.03	2.41	4.44
	> 65	1.41	1.54	2.19	2.63
<b>Education</b>	Primary or less				
	Secondary	1.90	3.56	1.37	1.46
	Bachelor	2.44	4.87	1.85	2.77
	Master/Phd	3.16	6.18	2.20	3.49
<b>Digital Skills</b>	Low				
	Medium	1.04	0.30	1.12	0.68
	High	1.36	2.24	1.40	2.11
	Very high	1.85	4.47	2.21	5.00
<b>Habitat</b>	<20000				
	20000-100000	1.05	0.80		
	100000-500000	0.80	-2.39		
	>500000	0.92	-1.38		
<b>Household Members</b>	One				
	Two	0.81	-2.64	0.72	-3.21
	Three	0.68	-4.81	0.68	-3.61
	Four	0.72	-4.09	0.63	-4.43
	Five or more	0.65	-3.49	0.59	-3.33
<b>Nationality</b>	Foreigner				
	Spanish			0.72	-2.12
<b>Employment Situation</b>	Employed				
	Unemployed	0.96	-0.55	0.88	-1.29
	Retired	1.23	1.13	0.89	-0.51
	Student	0.67	-3.38	0.64	-2.55
	Housekeeper	0.87	-0.90	0.82	-1.08
<b>Income</b>	Other	1.12	0.78	0.89	-0.54
	Low				
	Medium	1.37	3.29	1.84	5.31
	Medium-high	2.13	7.77	3.08	9.32
<b>Year</b>	High	4.31	12.83	6.57	12.99
	2015				
	2016	0.99	-0.13	1.00	0.08
	2017	0.82	-3.45		

		(3)		(4)	
		Spending on e-commerce. Pool data		Spending on e-commerce. Panel data	
		Odds ratios	z	Odds ratios	z
<b>Autonomous Community</b>	Andalucía				
	Aragón	0.88	-1.01	0.99	-0.07
	Asturias	1.11	0.93	1.20	1.11
	Baleares	1.59	3.91	2.31	5.04
	Canarias	0.95	-0.35	1.29	1.19
	Cantabria	1.20	1.62	1.45	2.30
	Castilla la Mancha	1.06	0.53	1.28	1.52
	Castilla León	1.26	1.88	1.71	3.10
	Cataluña	1.21	1.93	1.43	2.53
	Extremadura	0.98	-0.17	1.12	0.66
	Galicia	1.28	2.27	1.87	3.94
	La Rioja	1.20	1.37	1.17	0.80
	Madrid	1.21	2.03	1.31	1.97
	Navarra	1.11	0.89	1.49	2.52
	País Vasco	1.15	1.30	1.51	2.66
	Murcia	1.00	-0.02	1.22	1.18
	Valencia	0.98	-0.21	1.12	0.75
Ceuta	0.87	-0.44	1.16	0.38	
Melilla	0.81	-0.63	0.73	-0.92	
<b>Cut Points</b>	Cut 1	0.61		0.24	
	Cut 2	2.08		2.09	
	Cut 3	4.27		4.82	
	Cut 4	5.34		6.14	
<b>N. observations</b>		10,852		6,525	
<b>N. of groups</b>				5,313	
<b>Wald <math>\chi^2</math></b>		1015.16 DF: 47		617.57 DF: 44	
<b>Pseudo R<sup>2</sup></b>		0.0621			
Notes: Odd ratios and z statistics significant at the 5% are represented in bold. Weighted ordered logistic regression (Equation 3) and random-effects ordered logistic models (Equation 4). Robust estimates. Reference category: female, 16-24 years, no studies or primary studies, low digital skills, habitat of < 20000, one household member, Spanish, employed, low income, year 2015 and Autonomous Community of Andalucía. Estimations refer to those internet users that have purchased (or not) online during the last year. The pseudo R <sup>2</sup> is a measure of the in-sample goodness of fit. A relevant statistics for testing the significance of the estimated coefficients is the $\chi^2$ test of joint significance of all slope coefficients, which is high and has very low p-values: below 0.001 in all cases.					

**Figure A1. Odds ratios of Gender, Nationality, Employment Situation and Income on the expenditure in e-commerce. Pool (2008-2017) and panel data (2008–2016)**



**Figure A2. Odds ratios of Age, Education on the expenditure in e-commerce. Pool (2007-2017) and panel data (2007–2016)**





**Table A2 Adoption of e-commerce by individual internet users in Spain, Madrid and rest of Spain. Pool data (2007 - 2017)**

		(1) E-commerce adoption. Pool data. Spain		(5) E-commerce adoption. Pool data. Madrid		(6) E-commerce adoption. Pool data. Spain without Madrid	
		Odds ratios	z	Odds ratios	z	Odds ratios	z
Gender	Male	1.29	10.40	1.32	3.72	1.29	9.65
Age	16-24						
	25-34	0.82	-0.98	0.46	-1.19	0.89	-0.55
	35-44	0.52	-3.49	0.23	-2.40	0.58	-2.75
	45-54	0.46	-4.13	0.17	-2.74	0.52	-3.28
	55-64	0.31	-6.00	0.20	-2.67	0.33	-5.29
	> 65	0.24	-6.38	0.13	-3.16	0.27	-5.51
Education	Primary or less						
	Secondary	1.45	6.36	1.79	2.55	1.44	6.05
	Bachelor	1.90	10.25	2.24	3.38	1.89	9.85
	Master/Phd	2.34	13.45	3.40	5.14	2.24	12.29
Digital Skills	Low						
	Medium	2.48	4.78	2.78	1.74	2.42	4.39
	High	4.88	8.71	3.02	1.94	5.21	8.57
	Very high	12.52	13.84	8.77	3.79	13.21	13.35
Habitat	<20000						
	20000-100000	0.95	-1.57	1.16	0.99	0.93	-1.92
	100000-500000	0.78	-5.24	0.95	-0.38	0.78	-4.60
	>500000	1.02	0.73	1.57	3.30	0.97	0.97
Household Members	One	0.93	-1.85	1.02	0.22	0.91	-2.16
	Two	0.78	-6.36	0.91	-0.82	0.76	-6.37
	Three	0.76	-6.71	0.77	-2.15	0.76	-6.25
	Four	0.62	-8.34	0.58	-3.40	0.64	-7.51
	Five or more						
Nationality	Foreigner						
	Spanish	1.16	2.82	1.47	3.01		
Employment Situation	Employed						
	Unemployed	0.74	-7.80	0.55	-4.82	0.78	-6.35
	Retired	0.82	-2.72	0.67	-2.13	0.85	-2.10
	Student	0.73	-5.00	0.55	-3.07	0.76	-4.00
	Housekeeper	0.84	-2.65	0.83	-1.00	0.83	-2.68
	Other	0.90	-1.36	0.82	-0.74	0.91	-1.06
Income	Low						
	Medium	1.32	6.97	1.02	0.15	1.40	7.92
	Medium-high	1.91	15.14	1.71	4.08	2.00	15.36
	High	2.71	19.45	2.39	5.87	2.82	18.95
Digital Skills × Age	High × 55-64	2.40	4.15	3.28	1.85	2.31	3.76
	High × 65 or more	2.40	3.61	3.74	1.90	2.30	3.21
	Very high × 55-64	2.04	3.30	1.75	0.86	2.19	3.41
	Very high × 65 or more	3.07	4.27	4.86	2.18	2.83	3.66

**Table A3 Adoption of e-commerce by income levels. Pool data (2007–2017)**

		(7) E-commerce adoption. Pool data. Low Income		(8) E-commerce adoption. Pool data. High Income	
		Odds ratios	z	Odds ratios	z
Gender	Female				
	Male	1.27	6.76	1.33	8.45
Age	16-24				
	25-34	0.78	-1.03	0.90	-0.29
	35-44	0.48	-3.25	0.62	-1.44
	45-54	0.41	-3.72	0.57	-1.72
	55-64	0.32	-4.67	0.34	-3.17
	> 65	0.23	-5.26	0.28	-3.33
Education	Primary or less				
	Secondary	1.51	5.86	1.51	3.95
	Bachelor	2.17	9.92	1.87	5.86
	Master/Phd	2.51	11.04	2.55	8.83
Digital Skills	Low				
	Medium	2.93	4.68	2.00	2.08
	High	5.19	7.41	4.92	4.96
	Very high	13.55	11.77	12.39	7.78
Habitat	<20000				
	20000-100000	0.93	-1.54	0.98	-0.45
	100000-500000	0.65	-6.33	0.95	-0.80
	>500000	0.94	-1.51	1.14	3.16
Household Members	One				
	Two	0.98	-0.44	0.95	-0.87
	Three	0.83	-3.72	0.80	-3.45
	Four	0.82	-3.81	0.81	-3.25
	Five or more	0.63	-5.63	0.73	-3.93
Nationality	Foreigner				
	Spanish	1.20	3.12		
Employment situation	Employed				
	Unemployed	0.69	-8.65	0.72	-4.30
	Retired	0.92	-0.71	0.73	-3.42
	Student	0.67	-4.94	0.79	-2.31
	Housekeeper	0.81	-2.36	0.83	-1.80
	Other	0.73	-2.84	1.13	1.01
Digital Skills × Age	High × 55-64	2.44	3.24	2.47	2.57
	High × 65 or more	2.90	3.35	2.21	1.99
	Very high × 55-64	1.62	1.62	2.40	2.45
	Very high × 65 or more	2.70	2.85	3.37	2.88
Year	2007				
	2008				
	2009	0.97	-0.36	0.80	-3.09
	2010	1.18	1.78	1.10	1.35
	2011	1.26	2.53	0.86	-2.00
	2012	1.09	0.94	1.00	-0.06
	2013	1.24	2.43	1.14	1.82
	2014	1.63	5.54	1.48	5.14
	2015	2.96	12.23	2.62	12.68
	2016	2.89	12.04	2.60	12.75
	2017	4.58	17.71	3.49	17.06

**Table A4**  
**Models of spending on e-commerce by individual internet users,**  
**Spain and Madrid. Pool data (2015–2017)**

		( 3 ) Spending on e-commerce. Pool data. Spain		( 9 ) Spending on e-commerce. Pool data. Madrid		( 10 ) Spending on e-commerce. Pool data. Spain without Madrid	
		Odds ratios	z	Odds ratios	z	Odds ratios	z
<b>Gender</b>	Female						
	Male	1.30	5.54	1.93	5.26	1.22	3.85
<b>Age</b>	16-24						
	25-34	1.41	3.03	1.72	1.96	1.38	2.68
	35-44	1.80	5.22	2.11	2.81	1.79	4.85
	45-54	1.95	5.69	2.07	2.65	1.94	5.23
	55-64	2.00	5.03	2.37	2.75	1.97	4.60
	> 65	1.41	1.54	2.34	1.96	1.46	1.56
<b>Education</b>	Primary or less						
	Secondary	1.90	3.56	4.06	2.71	1.79	3.12
	Bachelor	2.44	4.87	5.71	3.30	2.30	4.38
	Master/Phd	3.16	6.18	8.08	3.99	2.93	5.53
<b>Digital Skills</b>	Low						
	Medium	1.04	0.30			1.06	0.42
	High	1.36	2.24			1.34	2.11
	Very high	1.85	4.47			1.85	4.50
<b>Habitat</b>	<20000						
	20000-100000	1.05	0.80				
	100000-500000	0.80	-2.39				
	>500000	0.92	-1.38				
<b>Household Members</b>	One						
	Two	0.81	-2.64			0.83	-2.08
	Three	0.68	-4.81			0.68	-4.49
	Four	0.72	-4.09			0.69	-4.23
	Five or more	0.65	-3.49			0.64	-3.42
<b>Nationality</b>	Foreigner						
	Spanish						
<b>Employment Situation</b>	Employed						
	Unemployed	0.96	-0.55			0.96	-0.46
	Retired	1.23	1.13			1.09	0.44
	Student	0.67	-3.38			0.66	-3.31
	Housekeeper	0.87	-0.90			0.83	-1.22
	Other	1.12	0.78			1.19	1.13
<b>Income</b>	Low						
	Medium	1.37	3.29	1.03	0.09	1.47	3.81
	Medium-high	2.13	7.77	1.73	1.92	2.26	7.95
	High	4.31	12.83	4.24	4.55	4.31	12.28
<b>Year</b>	2015						
	2016	0.99	-0.13	1.13	0.75	0.97	-0.39
	2017	0.82	-3.45	0.98	-0.17	0.80	-3.58

# Previous research

Garín and Pérez-Amaral (2011)

Garín *et al.* (2018)

Valarezo *et al.* (2018)

Correa *et al.* (2015)

# References

- Correa, M. García J. R. and A. Tabanera (2018) Comercio electrónico y hábitos de consumo en España: la importancia de la banca *on-line*. *Observatorio Economía Digital, BBVA Research*.
- Garín Muñoz, R. López, T. Perez Amaral, I. Herguera García, A. Valarezo Unda **Models for individual adoption of eCommerce, eBanking and eGovernment in Spain**. Telecommunications Policy
- Garín Muñoz, T. and T. Pérez-Amaral **Factores Determinantes del Comercio Electrónico en España** Boletín Económico Del ICE, 3016 (2011), pp. 51-65
- [Ángel Valarezo, Teodosio Pérez-Amaral<sup>b</sup> Teresa Garín-Muñoz<sup>c</sup> Iñigo Herguera García<sup>b</sup> and Rafael López<sup>b</sup>](#) Drivers and barriers to cross-border e-commerce: Evidence from Spanish individual behavior, Telecommunications Policy,