EKONOMIA I PRAWO. ECONOMICS AND LAW
Volume 21, Issue 4, December 2022
p-ISSN 1898-2255, e-ISSN 2392-1625
www.economicsandlaw.pl

ORIGINAL ARTICLE
received 20.10.2022; revised 15.12.2022; accepted 31.12.2022
Citation: Huterska, A., & Huterski, R. (2022). Determinants of using online shopping in European Union countries. *Ekonomia i Prawo. Economics and Law*, 21(4), 675–691.
https://doi.org/10.12775/EiP.2022.036.

Determinants of using online shopping in European Union countries

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Abstract

Motivation: Online shopping has gained increased economic importance as a result of restrictions on brick-and-mortar purchases due to the COVID-19 pandemic. Notwithstanding the natural partial return of consumers to direct purchases with the lifting of restrictions by the authorities, interest in online shopping does not return to pre-pandemic levels.

Aim: The aim of the article is to verify the influence of various factors on the propensity to use online shopping in the European Union countries in the period 2010–2021. Due to the temporal and geographical scope of data, the panel method was used in the research.

Results: The research on the determinants of online shopping, carried out by the authors, showed the statistical significance of all eight dependent variables affecting the share of people who shop online in the societies of the European Union countries. The increase in the use of online shopping is influenced by both the quality of Internet connections, the general frequency of Internet use, readiness to search the Internet for information about goods and services and the use of Internet banking. This regularity also occurs in the case of the share of older people in society, the share of people with at least

the second level of education, the share of people employed in science and technology, and the level of GDP per capita.

Keywords: e-commerce; online shopping; digitalisation; EU countries; panel model
JEL: L81; O33; O44; O52

1. Introduction

Online shopping has gained increased economic importance as a result of restrictions placed on brick-and-mortar purchases due to the COVID-19 pandemic. Notwithstanding the natural partial return of consumers to direct purchases with the lifting of restrictions by the authorities, interest in online shopping is not returning to pre-pandemic levels.

The aim of the article is to verify the influence of various factors on the propensity to buy online in the European Union countries. While the authors of many works, cited in the literature review, research this issue on the basis of primary data from one period, mostly collected through proprietary surveys, we tried to get a picture of the impact of the studied factors on the tendency to buy online in a longer period in 2010–2021, which is 12 years. The intention of the authors was to check more permanent trends in online shopping and to go beyond the period of the COVID-19 pandemic, which created a special motivation to use online shopping.

The research was based on data from 27 European Union countries according to its composition from October 2022, i.e. without the United Kingdom, for which there is no longer any continuity of data on the issues under study.

Based on the available data, the following research questions were formulated:

1. Does the availability of broadband Internet influence the popularity of online shopping?
2. Does the way of using the Internet influence the popularity of online shopping?
3. Do the demographic characteristics of societies influence the popularity of online shopping?
4. Does the level of economic development measured by GDP per capita affect the popularity of online shopping?

The availability of broadband Internet in individual countries is to reflect the general quality of Internet connections and, at the same time, the comfort of using the Internet. The way the Internet is used in a given country relates to the share of people using the Internet at least once a week, the share of people who find information about goods and services online, and the share of people using online banking. The demographic features included in the research are the share of older people in the society of a given country (65+), the share of people with at least upper secondary educational attainment, and the share of people working for science and technology as the basis of the modern economy. GDP per capita is used in this study as a synthetic measure of a country's economic situation and prosperity.

Due to the time and geographical scope of data, the panel method was used in the research.

2. Literature review

The issue of determinants of using online shopping is very often raised in the literature on e-commerce. Determinants of both demographic (age, sex, income, education, place of residence), technical (type of device or software) and behavioral (emotions, motivations) character are examined. Some determinants are of a complex nature, such as the issue of online shopping safety, which can be considered both from a technical and psychological point of view.

Differences in relation to online shopping between men and women are often discussed issues, such as in the works of Akhlaq & Ahmed (2016), Arora & Aggarwal (2018), Atchariyachanvanich et al. (2007), Girard et al. (2003) and Nguyen (2020). The issue of gender is often associated with the influence of the age of respondents on online shopping decisions, as reported by Hou & Elliott (2021), Kuoppamäki et al. (2017), Liebermann & Stashevsky (2009), Richa & Vadera (2019) and Zhang et al. (2012). A specific reference to the problem of age appears in works devoted to the specificity of generations, especially the young (millennials, generations Y and Z). These issues are addressed by Aw et al. (2021), Dabija & Lung (2018), Makhitha (2014), Melović et al. (2021), Svatosova (2022) and Zamzuri et al. (2018). College and university students attract particular attention from researchers as a sub-generation group, as in Al Asheq et al. (2022), Hossain et al. (2020), Mehrotra et al. (2020), Ofori & Appia-Nimo (2019) and Seock & Bailey (2008). This is justified by the studies as a period of shaping purchasing preferences in connection with the future purchasing potential of this group. The relationship between attitudes to online shopping and educational attainment is the subject of more extensive research in the work of of Akhter (2015), Gong et al. (2013), Li (2011), Lightner (2003) and Yin & Wu (2008).

Among the demographic characteristics, the researchers also mention the marital status (Gong et al., 2013), the number of children in the family (Kuoppamäki et al., 2017; Xiong et al., 2021; Young Kim & Kim, 2004), race (Saphores & Xu, 2021), urban (Arora & Aggarwal, 2018; Farag et al., 2003) or rural (Lennon et al., 2007; Zheng & Ma, 2021) character of the place of residence. The income obtained by people surveyed in terms of using online shopping is an economic aspect complementing personal demographic characteristics, which was used in the works of Çera et al. (2020), Ghita et al. (2022), Mehrotra et al. (2020), Punj (2011) and Xiong et al. (2021).

The search for determinants of online shopping is also described from the point of view of selected product and service categories. These are, for example, beauty and cosmetics (Nguyen, 2020), personal hygiene products (Cheng & Chung, 2010), clothing and jewelry (Young Kim & Kim, 2004), digital products (Fang, 2011) or grocery products (Bauerova & Klepek, 2018; Saphores

& Xu, 2021). A study by Xiong et al. (2021), which compares housing, food, and beverage vs wearing, recreation, and education expenses in the context of COVID-19 and its impact on the growth of online shopping, is very specific. Examples of research on online buying of services include publications referring to banking (Akhter, 2015), insurance (Al Salamat & Elian, 2021) and travel (Eboli & Mazzulla, 2013; Farag et al., 2003). Hossain et al. (2020) combine research on online shopping and payments by students using social media on mobile devices. Yeh et al. (2011) researched online purchases of various goods using the form of auctions.

Numerous studies have been devoted to the use of mobile devices for online shopping, such as Hossain et al. (2020), Hou & Elliott (2021), Natarajan et al. (2018), Ofori & Appiah-Nimo (2019) and Ono el al. (2012). Online shopping using only smartphones and laptops was also investigated, not including tablets and desktop computers (Pšurný et al., 2022). The technical aspects of online shopping have also been reflected in research on experience in technology (Eboli & Mazzulla, 2013), especially internet use capability (Mehrotra et al., 2020) and variously defined personal innovativeness (Atchariyachanvanich et al., 2007; Cheng & Chung, 2010). Guo et al. (2012), Hossain et al. (2020), Li (2011) and Yeh et al. (2011) devoted their work to the safety of online shopping, both from the technical and psychological point of view. It is interesting to link the perception by customers of online shopping as unsafe with their avoidance of online purchases of higher-value goods (Melović et al., 2021). The security aspect also applies to the online payment process itself (Yeh et al., 2011).

The impact of the COVID-19 pandemic on customer use of online shopping has been reflected in many e-commerce articles published since 2020, such as Al-Hattami (2021), Alvarez-Risco et al. (2022), Kieu (2022), Moon et al. (2021), Prasetyo & Fuente (2020) and Svatosova (2022).

Part of the research on online shopping focuses on specific topics. Repurchase intention together with brand awareness was studied by Ilyas et al. (2020). Kukar-Kinney & Close (2010) focused on the issue of online cart abandonment. A research model focusing on trust in conjunction with website complexity was built by Cheng & Fu (2018). Online shopping literature review is the work of Panda & Swar (2016).

The vast majority of articles focusing on online shopping determinants use primary data collected through proprietary consumer questionnaires, such as Bosnjak et al. (2007), Fang et al. (2011), Gera et al. (2021), Hsu et al. (2013) and Maditinos & Theodoridis (2010) or from national surveys as in Saphores & Xu (2021). As a minority of examples of a different approach, one can cite the publication Al Salamat & Elian (2021), which is based on data from an expert survey addressed to insurance companies. The article by Svatosova (2020) combines secondary data with survey data obtained from employees of enterprises.

Among the models explaining the behavior of Internet users in the context of their online shopping habits, the technology acceptance model (TAM) is often used, as in Bauerova & Klepek (2018), Chiu et al. (2009), Hai & Kazmi

(2015), Natarajan et al. (2018) and Ofori & Appiah-Nimo (2019). Other models are e.g. Theory of Planned Behavior (TPB) used by Yin & Wu (2008), Expectation-Confirmation Model (ECM) in Wu et al. (2020), and combined with Task Technology Fit (TTF) in Al-Hattami (2021) or Innovation Diffusion Theory, as in Lennon et al. (2007) and Natarajan et al. (2018).

In the reviewed literature, secondary macroeconomic data are very rarely used to explain the determinants of using online shopping, as in Ghita et al. (2022) household income data from the Eurostat (2021) database were used. The vast majority of research on online shopping focuses on Internet users from one country, which is related to the use of the survey method of obtaining data. Examples of going beyond such a limitation include Fang (2011) (USA and Taiwan), Mehrotra et al. (2020) (Gulf Cooperation Council countries), or Ghita et al. (2022) (as many as 29 European countries).

3. Methods

In order to identify factors influencing the scale of using online shopping in the European Union countries, an econometric model for panel data was constructed.

The dependent variable was the share of people who shopped online in the last three months in individual EU countries in 2010–2021. A year 2010 was chosen to avoid possible distortion of the picture of the situation in e-commerce by the crisis of 2007/2008. The set of independent variables included variables related to the level of digital inclusion, such as: the percentage of adults who shopped online in the last three months, the percentage of people using digital banking, the percentage of people who searched the Internet for information about goods and services, and the percentage of people using the Internet at least once a week. Additionally, the share in the population aged 65+ and higher, the share in the 25–64 age group of people with at least secondary education, the share of people with higher education (ISCED) and/or employed in science and technology, and GDP per capita in PPS were taken into account. The model is therefore as follows:

$$E\_commerce_{jt} = \alpha_0 + \alpha_1 Int\_access_{jt} + \alpha_2 Int\_use_{jt} + \alpha_3 Int\_goods_{jt} + \\ + \alpha_4 Int\_bank_{jt} + \alpha_5 Age65_{jt} + \alpha_6 Edu\_25\_64_{jt} + \alpha_7 HR\_sci\_tech_{jt} + \\ + \alpha_8 GDP\_PPP_{jt} + v_{jt}, \tag{1}$$

$$v_{jt} = e_t + u_j + \varepsilon_{jt}. \tag{2}$$

The source of the data was the Eurostat (2021) database. Table 1 presents the description of variables, while Table 2 includes the statistical description of the variables. The correlations between the variables are presented in Table 3.

4. Results

In this study, a panel model determined by the formula (1) was used to describe the relationship between the scale of using remote purchases and dependent variables in the European Union countries. Data was collected for 27 EU countries. They concern a 12-year period (annual data for 2010–2021).

The panel data model (1) was estimated using the GRETL software (GNU Regression Econometrics Time-Series Library). The choice of the estimation method was made on the basis of the decision-making procedure proposed in the literature on econometrics (Baltagi, 2001). First, a simple panel model (without individual effects) was estimated using the classical method of least squares, and the model's diagnostic tests were performed. The following test statistic values were obtained: Wald test ($F(26, 291)=25.1717$; p-value$\approx$0.0000), Breusch–Pagan test ($LM=441.46$; p-value$\approx$0.0000) and Hausman test ($H=50.0071$; p-value$\approx$0.0000).

Analyzing the results of Wald's test, it can be concluded that the correct model describing the level of internet shopping use in EU countries and the explanatory variables is the model with fixed individual effects (FEM — fixed effects model). The results of the Breusch–Pagan test indicate the model with random individual effects (REM — random effects model) as better. Finally, the results of the Hausman test allow us to state with the error risk of 0.05 (α=0.05) that the model with fixed individual effects (FEM) is appropriate for the description of the studied dependence. However, further analysis of the model properties confirmed the heteroscedasticity of the random component. In order to eliminate this drawback, the weighted least squares method (WLS) was used to estimate the model parameters.

Table 4 presents the results of estimation of the above model. The estimated model is statistically correct. From among eight potential independent variables, as many as seven have turned out to be statistically significant. All the obtained signs of structural parameters' evaluations next to the independent variables are in line with the theoretical assumptions.

The obtained results allow to conclude that all independent variables has a positive influence on the dependent variable (i.e. the scale of use of internet purchasing) The variables are percentage of household with boardband internet access, percentage of individuals regulary using the internet, percentage of individuals finding informations about goods and services, percentage of individuals using internet banking, proportion of population 65+ and over, human resources in science and technology and GDP per capita in PPP (variables: Int_access_{jt}, Int_use_{jt}, Int_goods_{jt}, Int_bank_{jt}, $Age65+_{jt}$, $HR\_sci\_ch_{jt}$, GDP_PPS_{jt}) . Interpretation of parameter evaluation in the case of a particular variable is relatively simple. For instance, the parameter evaluation of the Int_access_{jt} variable (0.266173) should be interpreted as follows: if the percentage of household with boardband internet access grow by 1 percentage point, then the scale of use

of remote purchasing will consequently grow by, on average, about 0.266173 percentage points, if one assumes constant values of the remaining variables.

5. Conclusion

The research on the determinants of online shopping, carried out by the authors, showed the statistical significance of all eight dependent variables affecting the share of people who shop online in the societies of the European Union countries.

Most popular online purchases of goods in EU in 2021 (percentage of people who bought or order goods or services over the internet for private use in the previous 3 months), as follows (Eurostat, 2021):

- clothes (including sport clothing), shoes or accessories: 68%;
- deliveries from restaurants, fast-food chains, catering services: 21%;
- furniture, home accessories or gardening products: 29%;
- cosmetics, beauty or wellness products: 27%;
- printed books, magazines or newspapers: 25%;
- sports goods (excluding sport clothing): 24%;
- computers, tablets, mobile phones or accessories: 23%;
- children toys or childcare items: 20%.

Factors for the development of online shopping are both technological (broadband access) and social (internet use preferences, ageing) as well as economic and social at the same time (GDP per capita, human resources in science and technology). Together, these factors influence the actual decisions of online shoppers.

The increase in the use of online shopping is influenced by both the quality of Internet connections, the general frequency of Internet use, readiness to search the Internet for information about goods and services and the use of Internet banking. This regularity also occurs in the case of the share of older people in society, the share of people with at least the second level of education, the share of people employed in science and technology, and the level of GDP per capita.

While most of the results of these studies appear to be acceptable, there is also a thread that requires additional research.

A broadband connection increases the comfort of using the Internet and encourages its more intensive use. More frequent and varied use of the Internet increases the likelihood of making online purchases. The ability to use online banking facilitates cashless payments for online purchases. A better educated society and more involved in working with new technologies should have fewer barriers to using remote shopping. Increasing affluence of societies means a greater purchasing fund, allowing both to increase the frequency and value of purchases, and to build a better Internet infrastructure and to acquire the appropriate equipment to use this infrastructure intensively.

However, there is a problem with the interpretation of the positive relationship between the share of people shopping online and the share of people aged 65+ in the societies of the studied countries. One possible explanation is that more affluent and, consequently, more technologically advanced societies are aging faster than those less prosperous. However, the raw data collected do not directly support this attempt at explanation. This is undoubtedly a limitation of the conducted research, but also a motivation for further in-depth research on this topic.

The examined factors turn out to operate with different power in individual soci-eties of the EU countries, since the share and growth scale of e-commerce users in 2010-2021 differ significantly between the analyzed countries (Table 5). This issue is worth conducting separate research.

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Acknowledgements

Author contributions: authors have given an approval to the final version of the article. Authors contributed to this work as follows: A.H. developed the concept and designed the study, R.H. collected the data, A.H. analysed and interpreted the data, A.H. and R.H. prepared the draft of the article, A.H. and R.H. revised the article critically for important intellectual content.

Funding: this research was undertaken as part of the *The impact of the development of FinTech and legal regulations on innovations in the payment services market of the European Union: strategies of the financial sector and consumer needs* project and was fully funded by a grant from the National Science Centre, Poland (2017/26/E/HS4/00858).

Supplementary information: authors acknowledge following people and institution for help with the preparation of the article: staff of the Faculty of Economics and Administration at the Masaryk University (in particular Štěpán Mikula for consultations during the author's internship at MUNI, made possible thanks to the support of the Nicolaus Copernicus University *Excellence Initiative: Research University* programme for years 2020–2026).

Appendix

Table 1.
Variables used in empirical investigation

Variables	Variables description
Independent variable	
$E\_commerce_{jt}$	percentage of all adults who did their shopping online in the last three months, in % (ISOC_EC_IBUY_custom_3420517), (ISOC_EC_IB20_custom_3420723)
Explanatory variables	
Int_access_{jt}	percentage of households with broadband internet access (TIN00073)
Int_use_{jt}	percentage of all adults who regularly using the internet once a week (including every day) (TIN00091)
Int_goods_{jt}	percentage of all adults who regularly using the internet to finding information about goods and services (ISOC_CI_AC_I_custom_3423061)
Int_bank_{jt}	percentage of all adults who use online banking (ISOC_I_AC_I_custom_3423061)
$Age65+_{jt}$	proportion of population aged 65 and over, in % (TPS00028)
$Edu\_25\_64_{jt}$	at least upper secondary educational attainment, age group 25–64, in % (TPS00065)
$HR\_sci\_ch_{jt}$	human resources in science and technology (HRST) — persons from 25 to 65 years with tertiary education (ISCED) and/or employed in science and technology, percentage of population in the labour force, (TSC00025)
GDP_PPS_{jt}	GDP per capita in PPS (TEC00114)
v_{jt}	the random error in the object j, in the time period t, which consists of the following components:

Source: Own preparation.

Table 2.
Statistical description of variables (n=324)

Variables	Min	Max	Mean	Sd	25%	Me	75%	D
E_commerce	2.0	83.0	38.030	19.374	22.000	37.00	54.00	23.0
Int_acccess	23.0	99.0	77.500	13.297	69.250	79.50	88.00	78.0
Int_use	34.0	98.0	76.450	13.250	68.000	78.00	87.00	91.0
Int_goods	26.0	91.0	64.200	14.962	55.000	65.50	76.00	62.0
Int_bank	2.0	95.0	49.440	23.709	32.000	50.00	68.00	47.0
Age65+	11.2	23.5	18.206	2.452	16.825	18.50	19.90	18.8
Edu_25_65+	31.7	95.4	78.985	13.015	75.325	82.20	87.90	86.6
HR_sci_ch	23.9	68.1	45.126	9.204	37.525	45.85	52.10	49.3
GDP_PPS	45.0	283.0	100.750	44.256	71.000	90.00	121.0	84.0

Source: Own preparation.

Table 3.
Correlation table (Pearson correlation coefficients)

Variables	*E_commerce*	*Int_acccess*	*Int_use*	*Int_goods*	*Int_bank*	*Age65+*	*Edu_25_65+*	*HR_sci_ch*	*GDP_PPS*
E_commerce	–								
Int_acccess	.827**	–							
	<0.001								
Int_use	.901**	.909**	–						
	<0.001	<0.001							
Int_goods	.851**	.779**	.892**	–					
	<0.001	<0.001	<0.001						
Int_bank	.845**	.749**	.887**	.872**	–				
	<0.001	<0.001	<0.001	<0.001					
Age65+	.119*	.259**	.125*	0.095	0.106	–			
	0.032	0.000	0.025	0.088	0.057				
Edu_25_65+	.188**	.205**	.303**	.277**	.288**	−0.090	–		
	<0.001	<0.001	<0.001	<0.001	<0.001	0.104			
HR_sci_ch	.803**	.678**	.816**	.786**	.826**	−0.066	.283**	–	
	<0.001	<0.001	<0.001	<0.001	<0.001	0.235	<0.001		
GDP_PPS	.610**	.415**	.554**	.486**	.487**	−.328**	−0.020	.689**	–
	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.715	<0.001	

Source: Own preparation.

Table 4.
Results of model estimation by means of WLS

	Dependent variable $E\_commerce_{jt}$				
Independent variables	Coefficient	Std. Error	t-ratio	p-value	Signifcance
Constant	−52.2484	4.4976	−11.6200	<0.0001	***
Int_access_{jt}	0.2662	0.0703	3.7880	0.0002	***
Int_use_{jt}	0.3563	0.1094	3.2560	0.0013	***
Int_goods_{jt}	0.1421	0.0495	2.8720	0.0044	***
Int_bank_{jt}	0.2095	0.0398	5.2660	<0.0001	***
Age65+jt	0.3489	0.1733	2.0130	0.0450	**
$HR\_sci\_ch_{jt}$	0.2188	0.0875	2.5000	0.0129	**
GDP_PPS_{jt}	0.0661	0.0115	5.7330	<0.0001	***
observations			324		
standard error of residuals			0.986733		
R^2			0.908841		
adjusted R^2			0.906821		
F(7, 316)=450.0653			p-value for test F< 0.00001		

Notes:

*** Means the statistically significant variable at the level of 1% ; ** at the level of 5%.

Source: Own preparation.

Table 5.
Rankings of EU countries in terms of share and 2010–2021 growth of share of e-commerce users (in pp. and %)

Share of e-commerce users				2010–2021 growth of share of e-commerce users					
No.	Country	2010	2021	No.	Country	pp.	No.	Country	%
1.	Netherlands	52	83	1.	Ireland	51	1.	Romania	1050
2.	Denmark	54	82	2.	Slovakia	50	2.	Lithuania	629
3.	Ireland	28	79	3.	Estonia	49	3.	Bulgaria	567
4.	Sweden	50	78	4.	Czechia	48	4.	Latvia	538
5.	Luxembourg	47	70	5.	Hungary	48	5.	Hungary	480
6.	Germany	48	69	6.	Lithuania	44	6.	Greece	422
7.	Slovakia	19	69	7.	Latvia	43	7.	Croatia	411
8.	Belgium	27	66	8.	Slovenia	42	8.	Estonia	377
9.	France	40	66	9.	Belgium	39	9.	Italy	344
10.	Czechia	15	63	10.	Greece	38	10.	Czechia	320
11.	Estonia	13	62	11.	Spain	38	11.	Portugal	300
12.	Finland	41	62	12.	Croatia	37	12.	Slovakia	263
13.	Slovenia	17	59	13.	Italy	31	13.	Slovenia	247
14.	Hungary	10	58	14.	Netherlands	31	14.	Spain	224
15.	Malta	32	57	15.	Cyprus	30	15.	Cyprus	214
16.	Spain	17	55	16.	Portugal	30	16.	Ireland	182
17.	Austria	32	54	17.	Denmark	28	17.	Belgium	144
18.	Latvia	8	51	18.	Poland	28	18.	Poland	140
19.	Lithuania	7	51	19.	Sweden	28	19.	Malta	78
20.	Poland	20	48	20.	France	26	20.	Austria	69
21.	Greece	9	47	21.	Malta	25	21.	France	65
22.	Croatia	9	46	22.	Luxembourg	23	22.	Netherlands	60
23.	Cyprus	14	44	23.	Austria	22	23.	Sweden	56
24.	Italy	9	40	24.	Finland	21	24.	Denmark	52
25.	Portugal	10	40	25.	Germany	21	25.	Finland	51
26.	Romania	2	23	26.	Romania	21	26.	Luxembourg	49
27.	Bulgaria	3	20	27.	Bulgaria	17	27.	Germany	44

Source: Eurostat (2021).