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ONLINE SHOPPING PROFILES WITHIN EUROPEAN COUNTRIES DURING THE COVID-19 PANDEMIC

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ABSTRACT. ***The paper aims to highlight online shopping profiles within different European countries, most members of the European Union, before and during the COVID-19 pandemic, considering both demographic and economic characteristics. The analysis carried out on six relevant variables (Age-group, Gender, Occupation status, Formal education level, Income, Residence area) allowed the determination of five clusters, each with its particular online shopping profiles. The results outline that the share of individuals using the Internet in the purchase of goods and services experienced an increase in 2020 compared to 2019, both across the analysed countries and at the level of each cluster. Aiming at highlighting the modelling of online shopping profiles in 2020, compared to 2019, the study reveals the same number of clusters, but with slightly different compositions and profiles.***

KEYWORDS: e-commerce, online shopping, online shopping profile, behavioural patterns, COVID-19 pandemic.

JEL classification: C38, J10, L81, M21.

Introduction

The current health crisis has strongly changed both commercial activity and consumers' shopping behaviour, especially as the economic and social instability and uncertainty triggered by the COVID-19 pandemic exert a lot of pressure on the way people react in times of crisis (Pătărlăgeanu *et al.*, 2020; Matharu *et al*., 2021; Dementiev, 2021; Okunola *et al*., 2021). Even though online purchases have increased since the beginning of the pandemic, uncertainty persists when tackling the drivers of online buying behaviour in this context (Kersan-Skabic, 2021; Boustani *et al*., 2021; Javaria *et al*., 2021).

Our study highlights profiles of online shopping during the COVID-19 pandemic within different European countries, considering both demographic and economic characteristics, focusing on five representative factors: Age-group, Gender, Occupation status, Formal education level, Income, Residence area. The results are aimed at modelling online shopping behaviour in 2020, compared to 2019, as a result of the emergence and development of the COVID-19 pandemic.

The analysis is carried out in relation to three major objectives considered of high relevance for the topics addressed in the context of the COVID-19 pandemic, as follows:

- The first one envisages the study and analysis of the categories of persons who have purchased products and services in the online environment,

taking into account demographic and economic characteristics, in the period before and during the pandemic (more precisely, in the first year of its emergence).

- At the same time, the second objective is to identify clusters, in the form of online shopping patterns within European countries in order to carry out an analysis of their specificity according to the categories of persons that shopped online.
- The third objective is closely related to the development of a comparative analysis of these behaviour patterns in the period before and during the pandemic. This is how the changes occurred between the two periods and the impact of the pandemic on e-commerce activity are aimed to be outlined.

Although there is vast literature on different patterns of consumers of e-commerce services, the novelty of the article consists, first of all, of studying the online shopping profiles in relationship with the COVID-19 pandemic, a topic poorly explored in the scientific literature (Hartono *et al.*, 2021). Moreover, the comparison of the profiles before and after the emergence of the COVID-19 pandemic adds value to the paper. In addition, a novel aspect of the paper consists of the five variables selected for analysis and the countries in which the analysis was performed. Different from other studies that focus on providing online shopping profiles considering industry-related aspects, or psychological factors, as well (Blake, *et al.*, 2007; Mee, Huei, 2015; Khare, 2016), the study presented in this paper takes into account only demographic and economic characteristics. However, studies analysing demographic characteristics in relation to their influence on consumers' inclination and propensity to shop online exist in the scientific literature (Hashim *et al.*, 2009), but focus on other variables or on other countries. In the same context, the originality of the paper is reflected by the clustering method applied to the variables on the sub-categories of the five categories, respectively Agglomerative hierarchical clustering. Furthermore, the paper adds value to both theory and practice by outlining highly relevant information about the modelling of online shopping profiles within the analysed European countries, especially during the pandemic.

In such a context, the present article is structured into three main sections, besides the introduction and conclusions. The next section, dedicated to the literature review, briefly outlines previous works, focusing on the relationship with the variables included in the present analysis. Section 2 highlight the main methodological aspects, presenting the used dataset and detailing the clustering method employed in the processing of variables. Section 3 contains the actual processing and presentation of the results, including three sub-sections: in the first one, a pre- and post-pandemic comparative descriptive analysis of e-commerce activity in the European countries is carried out, while the next two sub-sections outline the main results of the analysis for 2019, respectively 2020. The last section of the article highlights the main conclusions of the analysis and future research trajectories.

1. Literature Review

According to Taylor (2019), e-commerce continues to increase from one year to another in all developed countries and is expected to grow by up to 25% by 2026. While e-commerce plays an increasingly important role in crisis situations, few studies are looking at how the consumer's online buying behaviour evolves in times of crisis. For example, recent studies (Hamilton *et al.*, 2019) developed a labour-based framework in conditions of resource scarcity and economic uncertainty to describe the effects of financial constraints on consumer

behaviour. They demonstrate that, over time, consumer behaviour adapts to operate under restrictive conditions (Jayaraman *et al*., 2020; Metzker *et al*., 2021).

Kim (2020) is using the theory of diffusion of innovation to demonstrate that the pandemic has caused late consumers to start their online purchases. Thus, those who have learned during the pandemic to shop online, may appreciate the convenience and safety of online purchases, and be motivated to continue their online purchases after the pandemic, as well. According to Escursell *et al.* (2021), these late users are, in fact, older consumers. This aspect comes to confirm the theory of Hernández *et al.* (2011), which outlines the following: not gender, age and income are the significant variables in the modelling of online behaviour, but the positive acquisition experience in the online environment.

However, some studies advocate that the gender of the online shopper can lead to differences in the purchase of goods and services online. Thus, Baubonienė and Gulevičiūtė (2015) outline that women are interested in finding products at low prices, while men are motivated by the speed and convenience of online shopping. Regardless of the reasons that lead them to purchase online, the buyer experience must be a positive one in order to increase their confidence in e-commerce.

Over the years, the profile of the online consumer, according to its socio-demographic characteristics, has changed. As illustrated by Agudo-Peregrina *et al.* (2016), a long time ago, the profile of the online consumer was well defined (middle-aged man, from urban areas, with above-average income and high educational attainment), at the moment, it is difficult to establish such a profile. Furthermore, as the current economic environment is characterised by a high degree of complexity and increased dynamism, various unpredictable changes occur in consumers' purchasing behaviour (Tohănean *et al.*, 2020).

2. Methodology

Agglomerative hierarchical clustering is a technique used to group several similar units in terms of the values of the variables that characterise these units, highlighting their common part. The similarity is established by a size called distance, which can be calculated by several mathematical functions.

At the same time, each constituted group of units differs significantly from the other groups. In the present analysis, this method was used for the multicriterial classification of the European countries analysed, according to a series of criteria that characterise the phenomenon of online shopping as intensity, but also as categories of the population who resorted with greater frequency to this method of commerce.

The dataset used in the analysis refers to the indicator entitled *Internet purchases by individuals (Last online purchase: in the last 12 months, % of individuals)*, for 2019 and 2020, for 29 European countries (European Union and non-European Union members). Its values provided by Eurostat are structured/detailed on the criteria presented in the following table (*Table 1*).

The above-mentioned indicator (RA) is determined by Eurostat based on a survey on the use of ICT by firms and individuals, being a way of quantifying the e-commerce activity for individuals, from the perspective of the share of the population who have made online purchases.

Based on the above criteria, an agglomerative hierarchical clustering of the European countries was achieved through a bottom-up algorithm.

Table 1. Variables included in the cluster analysis

Categories		Subcategories	
Name	**Symbol**	**Name**	**Symbol**
Age-group	AG	Individuals, 16 to 24 years old	AG_ 16-24years
		Individuals, 25 to 34 years old	AG_ 25-34years
		Individuals, 35 to 44 years old	AG_ 35-44years
		Individuals, 45 to 54 years old	AG_ 45-54years
		Individuals, 55 to 74 years old	AG_ 55-74years
Gender	G	Males, 16 to 74 years old	M
		Females, 16 to 74 years old	F
Occupation status	OS	Individuals aged 25 to 64 who are employees self-employed or family workers	OS_E
		Individuals aged 25 to 64 who are retired or other inactive	OS_R/I
Formal education level	ED	Individuals with no or low formal education	ED_L
		Individuals with medium formal education	ED_M
		Individuals with high formal education	ED_H
Income	INC	Individual living in a household with income in first quartile	IC_1st Q
		Individual living in a household with income in second quartile	IC_2st Q
		Individual living in a household with income in third quartile	IC_3st Q
		Individual living in a household with income in fourth quartile	IC_4st Q
Residence area	RA	Individuals living in cities	RA_L
		Individuals living in towns and suburbs	RA_T/S
		Individuals living in rural areas	RA_R

Source: authors' selection, based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

The application of this method is initially based on a matrix that can be written in the form of:

$$X = \left\| x_{ij} \right\|_{i=\overline{1,n},j=\overline{1,m}} \tag{1}$$

In this matrix, the two elements targeted in the analysis are identified: the volume of the sample (the European states), denoted by n, and the number of variables involved in clustering, denoted by m.

The process of standardising the elements of the X matrix involves the application of a transformation that is highlighted by the relationship:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{\sigma_j} \tag{2}$$

The two indicators included in the relationship are determined as follows:

- Mean: $$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{ij}}{n} \tag{3}$$
- Standard deviation: $$\sigma_j = \sqrt{\frac{\sum_{i=1}^{n} \left(x_{ij} - \bar{x}_j \right)^2}{n-1}} \tag{4}$$

Next, the Proximity Matrix is obtained by taking into account the presented relations along with the Euclidian distance (Rotaru *et al.*, 2006). Thus, the relationship for the Proximity Matrix is as follows:

$$Y = \left\| y_{ij} \right\|_{i=\overline{1,n}, j=\overline{1,m}}, \text{ where } \quad y_{ij} = \sqrt{\sum_{i=1}^{n} \left(z_{ik} - z_{ij} \right)^2}, \; j = \overline{1,m}, \; k = \overline{1,m} \; j \neq i, \; k \neq i, \; w_{ii} = 0 \tag{5}$$

The combination of clusters was achieved using Ward's method, employed in the case of non-alternative quantitative variables, which is based on the clusters' variance and aims to minimise the variation within the clusters (to ensure their homonymity) and to maximise variation, differences between clusters.

Theoretically, the distance between two groups (group A and group B) and an individual element or a group x_i (Marinoiu, 2016) is defined as follows:

$$\Delta(A,B) = \sum_{i \in A \cup B} \left\| x_i - m_{A \cup B} \right\|^2 - \sum_{i \in A} \left\| x_i - m_A \right\|^2 - \sum_{i \in B} \left\| x_i - m_{\mathbf{B}} \right\|^2 - \frac{n_{A \cap B}}{n_{A \cup B}} \left\| m_A - m_B \right\|^2 \tag{6}$$

where, m_i is considered the middle, and n_i represents the number of formed clusters (i).

The process of validation of the cluster structure required the determination of the best solution. Going through this stage involved determining the Total Sum of Squared Error (TSSE) values. This aspect has been specified for each possible solution (n> 2 clusters). Thus, from a theoretical point of view, as *n* increases, TSSE decreases. This decrease is the result of a reduction in the number of components of each cluster. In this direction, Peeples (2011), state that: "an appropriate cluster solution could be defined as the solution at which the reduction in SSE slows dramatically".

The testing of the significance of a variable's belonging to clusters requires the application of the Hierarchical Clustering method. This consists of testing the homoscedasticity of the data series variances, by applying the Levene test, taking into account the following statistical hypotheses:

H0-1: The variances do not differ significantly (they are homoscedastic)

$$\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \ldots = \sigma_r^2 \tag{7}$$

H1-1: Variances differ significantly (they are heteroscedastic).

$$\exists \, \sigma_i^2 \neq \sigma_j^2 \tag{8}$$

The continuation of testing the statistical significance for the average values, at the level of each cluster, envisages either the acceptance of the null hypothesis (H0-1) with the application of the ANOVA methodology (the F test) or the acceptance of the alternative hypothesis $H_{1\text{-}1}$ which requires the application of the Welch test (Robust Test of Equality of Means)

In view of the statistics of the Fisher test, it is outlined the following:

$$F_{stat} = \frac{\sum_{i=1}^{r} (\bar{x}_i - \bar{x}_0)^2 n_i \Big/ df_1}{\sum_{i=1}^{r} \sum_{j=1}^{ni} (x_{ij} - \bar{x}_i)^2 \Big/ df_2} \tag{9}$$

The tested hypotheses are:

H0-2: the belonging of the analysed variable to the clusters is not statistically significant (there is no significant difference between the averages of the analysed variables)

$$F_{stat} < F_{\alpha, r-1, n-r} \quad equivalent\ to \quad Sig.F > \alpha \tag{10}$$

H1-2: the belonging of the analysed variable to the clusters is statistically significant because there is a significant difference between the averages of the analysed variables

$$F_{stat} > F_{\alpha, r-1, n-r} \quad equivalent\ to \quad Sig.F < \alpha \tag{11}$$

The means of the variables at the level of each cluster are significantly different given that the Sig < 0.05.

The testing of the statistical hypotheses was based on a significance threshold α=0.05 (Confidence level 95%), and the processing of the data series was accomplished by using the software programs SPSS and Excel.

The results of applying the presented methodology are the 5 clusters of European countries. The conjuncture allowed the definition of one behaviour profile/pattern for each cluster, characterised from the point of view of the population categories that showed a higher predilection for online shopping. The method was applied twice: for 2019 – the year before the COVID-19 pandemic emerged, and for 2020 – the first year of its evolution. Furthermore, the behaviour patterns of the European countries were compared, and, at the same time, a series of changes that occurred in the online shopping profile, especially as a result of the health crisis, were identified.

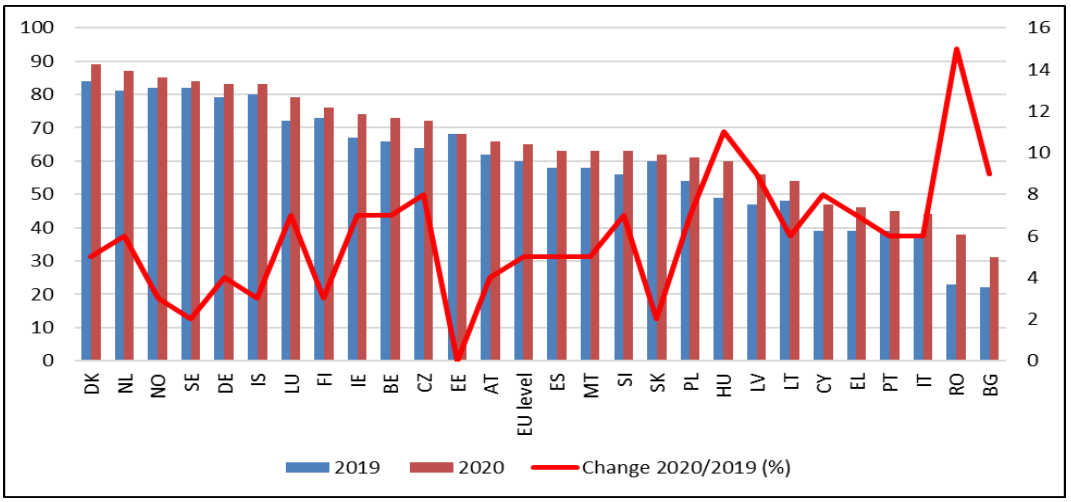
3. Results

The COVID-19 pandemic has produced a turning point in the use of the virtual environment for carrying out daily activities. Among the activities that during the lockdown periods have moved to the online environment is also the activity of purchasing goods and services; the share of e-commerce in global retail trade increased from 14% in 2019 to 17% in 2020 (UNCTAD, 2021). This activity has been a real incentive for businesses in trade, helping them to survive during the restrictions imposed by the pandemic.

3.1 Pre- and Post-pandemic Comparative Descriptive Analysis of E-commerce Activity in European Countries

In 2020, the year that marked the onset of the pandemic, at the level of the analysed European countries, the share of people aged 16–74 who purchased goods and services through the Internet was 65%, higher by 5% compared to 2019. The analysis of the indicator level in 2020 in territorial profile shows that the developed Northern European countries had the highest values of the indicator – at least 85% (Denmark 89%, Netherlands 87%, Norway 85%), while the South-Eastern European countries, with a lower level of development, recorded values below 40% (Bulgaria 31%, Romania 38%). In Italy, Portugal, Greece, and Cyprus, less than 50% of the population aged 16–74 used the Internet for e-commerce activities (*Figure 1*).

Regarding the increases registered in 2020 compared to 2019, the most spectacular occurred even in the countries that recorded the most modest levels of the indicator, respectively in Romania (+15%). On the other hand, the countries with high values of the indicator were characterised by smaller increases (between 2%–6%).



Source: created by the authors based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

Figure 1. **Internet purchases by individuals in European countries (2019 and 2020) and relative change 2020/2019 (%)**

Regarding the profile of the consumer of online goods, at the level of the analysed European countries, 83% of young people aged 25–34, 66% of men, 85% of those with higher education, 82% of people with high incomes (4th quartile), and 69% of the inhabitants of large cities, shopped online in 2020.

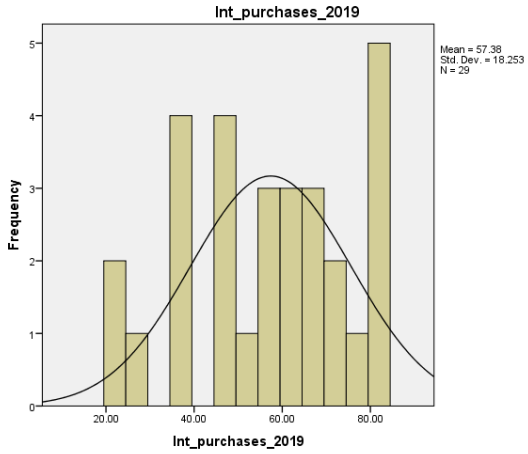
From the descriptive analysis of the variable *Internet purchases by individuals* in 2019 and 2020, for the 29 countries included in the study, an increase in the average percentage from 57.38% (2019) to 63.48% (2020) can be observed, mostly due to the restrictions imposed by the pandemic which limited the population's movements in order to purchase the necessary goods for a living and imposed the translation of this activity in the virtual environment. The variation of the variable's values decreased in 2020 compared to 2019, with the degree of homogeneity of the countries in terms of this indicator being higher in 2020 (*Table 2*).

Table 2. Descriptive analysis results

Statistics			
		Int_purchases_2019	Int_purchases_2020
N	**Valid**	29	29
	Missing	0	0
Mean		57.3793	63.4828
Median		58.0000	63.0000
Mode		39.00	63.00
Std. Deviation		18.25301	16.53918
Variance		333.172	273.544
Skewness		-.281	-.258
Std. Error of Skewness		.434	.434
Kurtosis		-.836	-.833
Std. Error of Kurtosis		.845	.845
Range		62.00	58.00
Minimum		22.00	31.00
Maximum		84.00	89.00

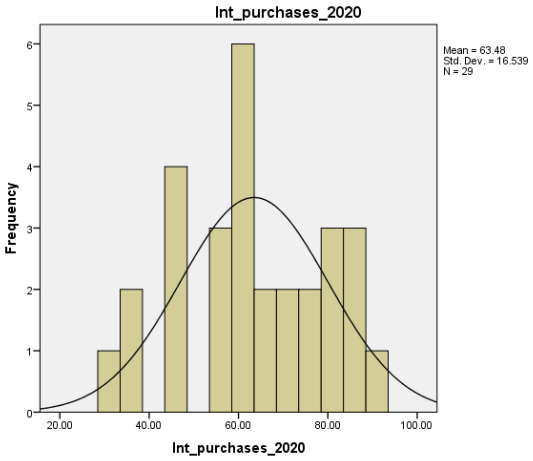
Source: created by the authors based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

The distribution of the analysed European countries by the degree of using the Internet for online shopping is a normal one, with greater proximity to normality in 2020, and a slight negative skewness that reflects a predominance of high values (above average) of the variable. (*Figure 2a* and *Figure 2b*, *Table 3*)



Source: created by the authors based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

Figure 2a. **Histogram - 2019**



Source: created by the authors based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

Figure 2b. **Histogram - 2020**

Table 3 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Int_purchases_2019	.089	29	.200*	.954	29	.236
Int_purchases_2020	.088	29	.200*	.962	29	.361

Notes: *. This is a lower bound of the true significance; a. Lilliefors Significance Correction.

Source: created by the authors based on Eurostat data (Eurostat, 2019; Eurostat, 2020).

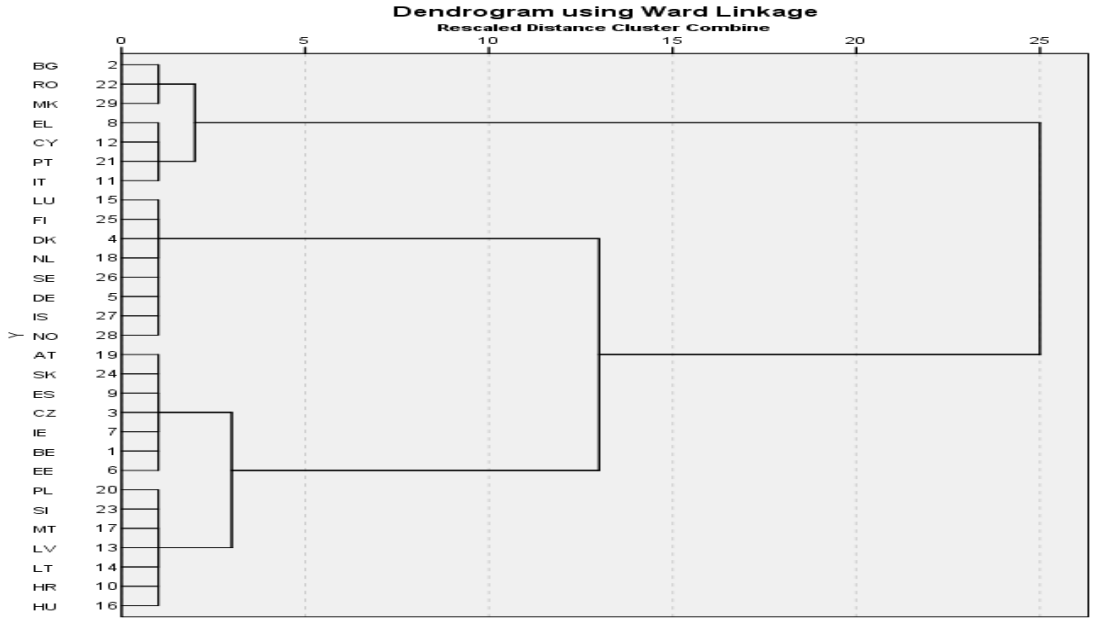
In 2021, the Internet continued to be used to a greater extent in the acquisitions of goods and services but the increases have been less spectacular than in the previous year. If most countries have registered increases in the level of the indicator, in a few countries, decreases were registered (for example, Germany – 7%, Austria – 3%). Despite this, experts believe that the upward trend of e-commerce will continue in the post-pandemic period, at a faster pace than in the pre-pandemic period.

3.2 Clusters Structure – 2019

The hierarchical analysis of the clusters, by applying the Ward cluster method, was based on minimising the variance within each cluster (the similarity of the response variables was measured by the Squared Euclidean Distance), using as clustering criteria the aforementioned variables (19 subcategories), for the years 2019 and 2020.

The purpose of the analysis is to group the selected European countries according to the similarities of the studied variables, in order to identify patterns of behaviour from the point of view of the profile of internet users for the purchase of products and services, in the first year of the pandemic and in the previous one. The analysis allows the notification of

changes in the profile of Internet users who shop online that have occurred as a result of the emergence and development of the COVID-19 pandemic. There is no need to standardise the variables, as all the bundling criteria are expressed in the same unit of measurement.



Source: created by the authors based on Eurostat data (Eurostat, 2019).

Figure 3. **Dendrogram Using Ward Linkage for the Year 2019**

Following the analysis, in 2019, 5 clusters of European countries were identified, depending on the profile of people who shopped online via the Internet. This is outlined in the dendrogram (*Figure 3*) and *Table 4*.

Table 4. Cluster structure - 2019

Cluster	**European Countries - 2019**
Cluster_1	Bulgaria, Romania, North Macedonia
Cluster_2	Greece, Cyprus, Portugal, Italy
Cluster_3	Luxembourg, Finland, Denmark, Netherlands, Sweden, Germany, Iceland, Norway
Cluster_4	Austria, Slovakia, Spain, the Czech Republic, Ireland, Belgium, Estonia
Cluster_5	Poland, Slovenia, Malta, Latvia, Lithuania, Croatia, Hungary

Source: created by the authors based on Eurostat data (Eurostat, 2019).

The determination of the composition of the clusters is followed by the testing of the hypothesis regarding the non-existence of significant differences between the values of the dispersions of the data series obtained through the grouping into the five clusters (H_{0_1}). This testing is based on the application of Levene's Test (*Table 5*).

Considering that, after testing, all Sig. F values are higher than the significance level of 0.05 (probability of guaranteeing the results is 95%), the null hypothesis H0_1 (of homoscedasticity) is accepted.

Next, the belonging to a cluster of the variables utilised as being statistically significant as in between their means there is a significant difference, is tested (Robustness Test).

Table 5. Test of Homogeneity of Variances – 2019

Variables	df1	df2	Levene Statistic	Sig F
AG_ 16-24	4	24	1.358	.278
AG_ 25-34	4	24	1.616	.203
AG_ 35-44	4	24	.443	.776
AG_ 45-54	4	24	1.234	.323
AG_ 55-74	4	24	1.373	.273
M	4	24	2.301	.088
F	4	24	1.114	.373
OS_E	4	24	1.468	.243
OS_R/I	4	24	1.774	.167
ED_L	4	24	1.344	.283
ED_M	4	24	.998	.428
ED_H	4	24	8.477	.000
IC_1st Q	4	24	.224	.922
IC_2st Q	4	24	1.661	.192
IC_3st Q	4	24	1.746	.173
IC_4st Q	4	24	1.263	.312
RA_L	4	24	2.115	.110
RA_T/S	4	24	.777	.551
RA_R	4	24	.402	.806

Source: created by the authors based on Eurostat data (Eurostat, 2019).

The results of applying the robustness test to the variable data of 2019 (*Table 6*) reveal that the averages of the variables at the level of each cluster differ significantly as all the Sig. values are lower than the level of significance of 0.05. This result very clearly highlights the belonging of each variable to the determined clusters.

Table 6. Robust Tests of Equality of Means – 2019

Variables	Welch				Brown-Forsythe			
	Statistic[a]	df1	df2	Sig.	Statistic[a]	df1	df2	Sig.
AG_ 16-24	41.427	4	8.844	.000	39.061	4	18.392	.000
AG_ 25-34	80.704	4	8.024	.000	71.948	4	9.354	.000
AG_ 35-44	167.950	4	10.016	.000	106.470	4	21.354	.000
AG_ 45-54	215.871	4	9.776	.000	172.396	4	20.835	.000
AG_ 55-74	104.304	4	10.723	.000	128.111	4	18.592	.000
M	187.560	4	9.008	.000	165.257	4	11.806	.000
F	136.750	4	9.193	.000	113.069	4	20.684	.000
OS_E	101.571	4	8.279	.000	99.667	4	7.413	.000
OS_R/I	62.939	4	9.503	.000	89.551	4	21.636	.000
ED_L	74.559	4	11.266	.000	61.981	4	19.633	.000
ED_M	48.691	4	8.070	.000	32.595	4	12.627	.000
ED_H	73.375	4	8.419	.000	45.535	4	10.783	.000
IC_1st Q	47.752	4	9.107	.000	58.005	4	20.935	.000
IC_2st Q	221.480	4	10.082	.000	55.308	4	12.175	.000
IC_3st Q	45.154	4	7.935	.000	35.515	4	11.897	.000
IC_4st Q	23.896	4	8.052	.000	29.936	4	9.042	.000
RA_L	259.444	4	10.683	.000	182.041	4	21.930	.000
RA_T/S	70.679	4	9.019	.000	77.092	4	16.312	.000
RA_R	92.851	4	8.978	.000	97.482	4	16.597	.000

Source: created by the authors based on Eurostat data (Eurostat, 2019).

Further on, a detailed analysis of these belongings is accomplished through the average values of the variables per country, at the level of 2019.

Tables 7 and *8* outline a detailed characterisation of the obtained clusters, which present as many models of consumer behaviour in the e-commerce activity for 2019,

reflecting the usual situation, when the economy and society were in a state of normality before the pandemic took over.

Table 7. Age-groups, Gender, Occupation status (%, 2019)

	AG (years)					OS		G	
Cluster	**16 - 24**	**25 - 34**	**35 - 44**	**45 - 54**	**55 - 74**	**OS_E**	**OS_R/I**	**M**	**F**
Cluster_1	**38.67**	**42.00**	**30.33**	**21.33**	**7.33**	**33.00**	**11.00**	**25.00**	**25.00**
Cluster_2	57.00	60.25	52.25	36.00	15.25	48.00	18.50	40.75	36.75
Cluster_3	**85.38**	**91.25**	**89.50**	**83.88**	**61.00**	**87.50**	**68.38**	**80.00**	**78.63**
Cluster_4	80.86	83.43	77.43	65.14	35.43	73.43	47.00	63.57	63.57
Cluster_5	73.57	76.57	65.71	48.43	21.43	61.71	29.71	51.43	50.57
OVERALL_ MEAN	**67.09**	**70.70**	**63.05**	**50.96**	**28.09**	**60.73**	**34.92**	**52.15**	**50.90**

Source: created by the authors based on Eurostat data (Eurostat, 2019).

Table 8. Education, Income, Residence Area (%, 2019)

	ED.			IC.				RA		
Cluster	**ED_L**	**ED_M**	**ED_H**	**1st Q**	**2nd Q**	**3rd Q**	**4th Q**	**RA_C**	**RA_T/S**	**RA_R**
Cluster_1	**9.00**	**24.67**	**46.67**	**11.67**	**14.67**	**27.00**	**38.00**	**28.67**	**25.67**	**19.67**
Cluster_2	14.50	43.25	65.50	17.75	25.50	37.00	48.00	43.00	37.50	31.75
Cluster_3	**67.25**	**79.50**	**89.63**	**68.38**	**76.13**	**84.25**	**88.25**	**81.75**	**77.88**	**77.63**
Cluster_4	42.14	62.71	81.86	41.71	51.43	66.29	80.57	66.57	63.14	60.57
Cluster_5	30.57	48.29	74.71	25.14	40.14	55.00	68.71	54.57	53.29	45.71
OVERALL _MEAN	**32.69**	**51.68**	**71.67**	**32.93**	**41.57**	**53.91**	**64.71**	**54.91**	**51.49**	**47.07**

Source: created by the authors based on Eurostat data (Eurostat, 2019).

Cluster 1: The countries in this cluster (countries with a lower level of development) have the lowest shares of the population that use the Internet to purchase goods and services, for all structuring criteria (age, occupational status, gender, education, income, residence environment), well below the general average for all European countries. Only 7% of the elderly (55-74 years) use these services for this purpose, 4 times less than the general average. This is not a surprising fact as, usually, in such countries, especially in those with a communist background, persons aged over 50 tend to have a lower level of digital literacy, especially when compared to their younger counterparts (Dragusin *et al.*, 2015). In terms of occupational status, only a third of employees and one in 9 inactive people shop online. By gender, only a quarter of men and women use the Internet for shopping, half of the European average. Only 9% on average of the population with a low level of education and less than 50% of the higher educated population have turned to such services. In terms of income, on average, 11.67% – respectively, 3 times fewer people living in low-income families – shop via the Internet, compared to the total average levels. At the same time, fewer than one in three people living in major cities and under one in five people in rural areas shop online.

Cluster 2: Encompasses the Southern European countries. Over half of the young and adult population of the countries in this cluster use the Internet for shopping, about 10% below the overall average; the shares decrease dramatically after the age of 45. As an occupational status, quite low shares (less than 50% of employees aged 25–64 years and less than 20% of those inactive or withdrawn from the labor market) use the Internet for shopping – below the general average. In terms of gender, quite low weights compared to the average levels are encountered in both genders, slightly superior in the masculine to the feminine. In terms of education, the population involved in e-commerce activities has quite low shares compared to the average levels, at all levels of education, but the average values of the cluster

approach the general averages of the sample of countries as the level of education increases. By income categories, between 17.75% and 48% of the population uses the Internet for e-commerce, quite low shares compared to other clusters in all income groups. The inhabitants of the big cities shop through the Internet in a higher share (although less than 50%) than those in rural areas (less than a third).

Cluster 3 includes the developed countries in Northern Europe, which have the largest shares of the population purchasing products and services online at all structuring criteria. Thus, online shoppers have the following characteristics:

- Over 80% of people aged 16–54 years shop online. This is the only cluster with wide involvement of the elderly population (55–74 years) in online shopping (with an average of 61%).
- Over 80% of people in employment shop online. This is the only cluster with more than 50% in the case of those inactive or withdrawn from the labour market (close to 70%, double the general average) that shop online.
- About 80% of men and women (slightly higher weighting in the case of the former) shop online, exceeding the general averages by 30%.
- More than two-thirds of the low-educated population use online services to shop, more than double the overall average levels. The positive differences between the averages of this cluster and the general one fade with the increase in the level of education. Almost 90% of people with higher education have shopped online in the last 12 months.
- This is the only cluster in which even low-income individuals use the Internet for shopping in a large proportion (68.38%, more than 2 times higher than the overall average percentage), while about 90% of those with the highest incomes do so.
- 81.75% of the inhabitants of large cities and 77.63% of those of rural areas shop online.

Cluster 4 is a rather heterogeneous cluster in terms of the countries included, with a different level of development, and location in different areas of Europe, nevertheless, it ranks second with quite high levels of Internet usage in the purchase of products and services at all clustering criteria; the cluster averages in all criteria are superior to the general averages. Thus, e-commerce consumers have the following common characteristics: there are almost three-quarters of employees and just under 50% of those withdrawn or inactive in the labour market; equal proportions (just over 63%) for the two genders; less than 50% of citizens with a lower level of education and over 80% of those with higher education; just over 40% of those living in low-income households shop online, with the percentage doubling for those with the highest incomes; between 60%-66% of those who live in rural areas, small towns and suburbs, as well as in major cities shop online.

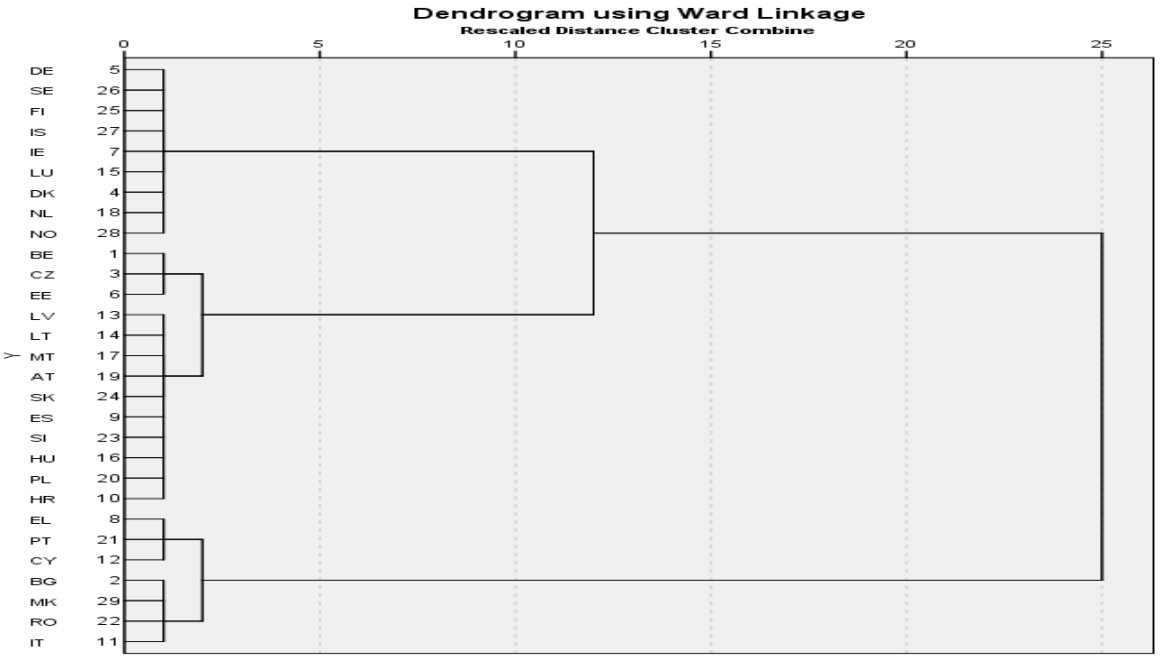
Cluster 5 includes less developed countries, former socialist countries. Usually, the means of this cluster have values close to the general averages, at the European level, with differences of opposite signs. The shares of the population up to 44 years old who shop online are higher for the countries in this cluster (on average) than the general average shares, while in the case of those over 45 years old, the shares are lower than the general averages. The share of employed persons who use such services is slightly higher than the general one (61.71%), while the share of retired or inactive people in the labour market is lower than the general one (below 30%). On average, about half of the men and women in these countries shop online (values very close to the general averages). The average percentages of people with lower or middle education in these countries are slightly lower than the general European

averages, while in the case of people with higher education the shares are higher. If in the case of people living in lower-income households (below the median income) the shares of those who shop online are below the general averages, for those with incomes above the median, the percentages are above the general averages.

3.3 Clusters Structure – 2020

The COVID-19 pandemic brought substantial changes in online shopping behaviour, the most visible one being the increase in online purchases. This statement is substantiated by the results obtained through the present analysis for the year 2020 compared to 2019, as further presented.

Studying the dendrogram for 2020 (*Figure 4*) it can be observed that the 29 European countries included in the analysis can be grouped also into five clusters that are presented in detail, by component, in *Table 9*.



Source: created by the authors based on Eurostat data (Eurostat, 2020).

Figure 4. **Dendrogram Using Ward Linkage for the Year 2020**

Table 9. Cluster structure - 2020

Cluster	European Countries - 2020
Cluster_1	Bulgaria, Romania, North Macedonia, Italy
Cluster_2	Greece, Cyprus, Portugal
Cluster_3	Luxembourg, Finland, Denmark, Netherlands, Sweden, Germany, Iceland, Norway, Ireland
Cluster_4	Belgium, the Czech Republic, Estonia
Cluster_5	Poland, Slovenia, Malta, Latvia, Lithuania, Croatia, Hungary, Austria, Slovakia, Spain

Source: created by the authors based on Eurostat data (Eurostat, 2020).

The application of Levene's test to test the hypothesis related to the non-existence of significant differences in the values of the data series dispersions represents the next step necessary for the analysis specific to the year 2020 (*Table 10*).

Table 10. Test of Homogeneity of Variances – 2020

Variables	df1	df2	Levene Statistic	Sig
AG_ 16-24	4	24	1.262	.312
AG_ 25-34	4	24	.942	.457
AG_ 35-44	4	24	2.106	.111
AG_ 45-54	4	24	1.339	.284
AG_ 55-74	4	24	1.120	.370
M	4	24	.931	.462
F	4	24	3.450	.123
OS_E	4	24	1.400	.264
OS_R/I	4	24	.867	.498
ED_L	4	24	1.485	.238
ED_M	4	24	.556	.697
ED_H	4	24	4.135	.111
IC_1st Q	4	24	1.844	.153
IC_2st Q	4	24	1.441	.251
IC_3st Q	4	24	1.009	.422
IC_4st Q	4	24	1.613	.203
RA_L	4	24	1.031	.412
RA_T/S	4	24	.974	.440
RA_R	4	24	1.090	.384

Source: created by the authors based on Eurostat data (Eurostat, 2020).

At the level of the year 2020, all the Values of the Levene Statistic are lower than F(0.05,4,24)=2.776 which is the critical value of the Fisher test. This is confirmed by the Sig. values higher than the significance level of 0.05 (95% confidence level). Thus, the obtained results indicate that the null hypothesis ($H_{0\text{-}1}$) is accepted. In this context, no significant differences occur between the values of the data series dispersions corresponding to the clusters.

The acceptance of the $H_{0\text{-}1}$ hypothesis, of homoscedasticity, allows further testing of the statistical significance of the mean values, at the level of each cluster, by applying the Robustness test (*Table 11*).

Table 11. Robust Tests of Equality of Means – 2020

Variables	Welch				Brown-Forsythe			
	Statistic[a]	df1	df2	Sig.	Statistic[a]	df1	df2	Sig.
AG_ 16-24	30.465	4	7.667	.000	40.050	4	18.001	.000
AG_ 25-34	26.072	4	6.618	.000	44.052	4	9.719	.000
AG_ 35-44	66.690	4	7.934	.000	90.869	4	6.846	.000
AG_ 45-54	74.816	4	7.972	.000	85.887	4	12.083	.000
AG_ 55-74	74.398	4	7.870	.000	66.095	4	10.710	.000
M	58.305	4	7.913	.000	59.098	4	10.833	.000
F	137.666	4	8.305	.000	166.515	4	18.644	.000
OS_E	74.720	4	6.998	.000	94.142	4	10.188	.000
OS_R/I	72.494	4	6.616	.000	70.582	4	12.062	.000
ED_L	59.436	4	8.805	.000	49.023	4	21.095	.000
ED_M	20.861	4	6.793	.001	21.959	4	9.916	.000
ED_H	21.393	4	6.648	.001	17.828	4	7.856	.001
IC_1st Q	88.023	4	8.339	.000	70.740	4	18.485	.000
IC_2st Q	142.562	4	8.250	.000	106.428	4	14.441	.000
IC_3st Q	58.146	4	7.529	.000	73.526	4	8.528	.000
IC_4st Q	28.425	4	8.000	.000	20.988	4	5.618	.002
RA_L	68.322	4	7.248	.000	85.794	4	11.793	.000
RA_T/S	61.894	4	7.621	.000	58.765	4	11.005	.000
RA_R	87.185	4	8.414	.000	70.924	4	8.617	.000

Source: created by the authors based on Eurostat data (Eurostat, 2020).

Table 11 includes some results that indicate that the average variables at the level of each cluster differ significantly (Sig < 0.05). The existing context highlights the belonging of each variable to the determined clusters. This aspect is further detailed by analysing the average values of the variables determined at the level of each country for 2020.

The data presented in *Table 12* and *Table 13* are results that characterise in detail the patterns of online shopping profiles of the 5 clusters, for the year 2020, after the pronounced evolution of the COVID-19 pandemic.

Table 12. Age-groups, Gender, Occupation status (%, 2020)

	AG (years)					OS		G	
Cluster	**16 - 24**	**25 - 34**	**35 - 44**	**45 - 54**	**55 - 74**	**OS_E**	**OS_R/I**	**M**	**F**
Cluster_1	52.50	54.25	47.25	35.50	15.25	47.50	18.25	36.75	36.75
Cluster_2	65.33	75.00	62.67	43.00	17.33	56.33	23.00	47.00	45.00
Cluster_3	87.33	92.44	91.56	86.00	66.78	89.44	72.33	82.00	82.00
Cluster_4	84.33	90.00	85.00	75.67	44.33	81.33	57.67	70.00	72.00
Cluster_5	80.20	83.90	77.20	59.30	30.40	71.10	40.90	60.70	59.90
OVERALL_ MEAN	**77.48**	**82.17**	**76.83**	**64.31**	**39.69**	**73.07**	**47.41**	**63.55**	**63.28**

Source: created by the authors based on Eurostat data (Eurostat, 2020).

Table 13. Education, Income, Residence Area (%, 2020)

	ED.			INC.				RA		
Cluster	**ED_L**	**ED_M**	**ED_H**	**1st Q**	**2nd Q**	**3rd Q**	**4th Q**	**RA_C**	**RA_T/S**	**RA_R**
Cluster_1	16.50	39.00	63.75	12.50	21.25	32.50	48.50	42.50	35.75	30.25
Cluster_2	16.33	50.33	73.33	23.33	35.33	50.67	63.33	51.33	45.67	36.33
Cluster_3	68.56	82.56	91.78	72.78	78.78	87.00	89.44	84.11	81.89	80.78
Cluster_4	54.67	68.67	85.33	41.67	59.00	74.00	86.00	72.33	70.33	68.33
Cluster_5	40.30	56.40	81.50	39.30	52.30	66.10	77.10	64.50	60.00	54.00
OVERALL_ MEAN	**44.79**	**62.76**	**81.79**	**44.59**	**55.17**	**67.17**	**76.48**	**67.00**	**63.03**	**58.69**

Source: created by the authors based on Eurostat data (Eurostat, 2020).

By performing the cluster analysis based on the same criteria, but using the 2020 data, a series of changes are revealed.

Clusters 1, 2 and 3 were generally more stable, in general, maintaining their structure, while the last two clusters were more volatile. Some changes occurred in their structure.

Thus, Italy moved from cluster 2 to cluster 1 (that of the countries with the most unfavourable situation). The explanation of this situation might be the following: although compared to 2019, the share of people who made online purchases in 2020 in Italy increased (by 6%), both on the total and each ranking criterion separately, this increase was, however, reduced in magnitude compared to the increases recorded by other countries. This was a consequence of the restrictions imposed by the local and central administrations because of the COVID-19 pandemic. Italy was one of the most severely affected countries by the health pandemic: the total quarantine was imposed for a long period of time, many businesses have reduced or even stopped their activity, revenues have decreased and therefore also the financial possibilities of purchasing products and services, given that the compensations offered by the government were not enough.

Ireland moved from cluster 4 to cluster 3 (with the most favourable position). The most significant increases in the share of the population who shopped online occurred in the older age groups (45-74 years) and those with low incomes (the first and second quartile), which means that the government has focused its strategy to counter the harmful effects of the

pandemic on supporting especially vulnerable groups. Many efforts were implemented in this sense such as policy measures adopted to support income generation and employment: technical unemployment schemes, subsidies to protect jobs, social benefits, temporary suspension of evictions and increases in rents, etc. (Comisia Europeana, 2020).

Three countries switched from Cluster 4 to Cluster 5 (in a cluster with a more unfavorable situation): Austria, Slovakia and Spain. The increases in 2020 compared to 2019 were more modest on the entire ranking criteria, in some categories of the population the share of those who shopped online in 2020 decreased, even, compared to 2019. This is the particular case of the elderly population in Austria and the young population, under 34 years in Slovakia, of the population with high formal education in Slovakia, the population with low incomes in Austria and Slovakia, but also the one with high incomes in Slovakia, or of the population living in large cities in Slovakia.

Conclusions

The development of e-commerce has improved online activity, triggered also by buyer intelligence which is accelerated by the use of technology (Nichifor *et al*., 2021, Bălăcescu, 2021), converting e-commerce into a significant channel for economic development at the European level. This aspect considers the unique behaviours of individuals that differ from one country to another, especially in the context related to the COVID-19 pandemic. Thus, the need to understand individual behaviour is extremely necessary to formulate and adopt, in the future, specific policies for the economic development of each country.

The situation registered at the level of the two analysed pre- and post-pandemic years (2019 and 2020) allowed, first, the development of an analysis of the categories of persons who purchased products and services online, taking into account demographic characteristics. Then, the study focused on the identification of clusters as patterns of online shopping profiles within the analysed European countries. Finally, a comparative analysis of these patterns before and during the pandemic has been developed, highlighting the changes that occurred between the two periods and the impact of the pandemic on e-commerce activity.

Thus, referring to the level registered by the analysed indicators in 2020 compared to 2019, various assessments can be made. Across the 29 analysed European countries, the share of individuals using the Internet for the purchase of goods and services increased in 2020, compared to 2019, by about 6%, reaching 63%. The same positive dynamic was registered among all five clusters, with different magnitudes, the largest increases being recorded in clusters with lower indicator values (cluster 1, 5), for almost all clustering criteria. With all these increases, indicator levels remain well below the overall average.

In cluster 1, increases in the share of people who made online purchases were mainly recorded in older age groups, in workers active in the labour market, in the highly educated population and in the population living in big cities.

The increases in the share of people who shopped online, in cluster 2, were recorded mainly in the population up to the age of 45, in the employed persons with higher education and in those who live in the big cities, the amplitude of the increase of the population's participation in the e-commerce activity increasing with the increase in incomes. In 2019, the countries in this cluster already had the largest shares of the population who used the Internet to purchase products and services but recorded the smallest increases in the magnitude of the indicator level in 2020 compared to the previous year. However, more significant increases have occurred in inactive or retired people, in the elderly population (55-74 years), among

women, among those with a medium level of education, as well as among residents of suburbs and rural areas.

Cluster 4 is the cluster that has undergone a restriction in the number of component countries, with four countries (Austria, Slovakia, Spain, and Ireland) leaving it. Across the cluster, the average percentage of individuals who purchased products online increased from 64% in 2019 to 71% in 2020. Increases occurred on all clustering criteria in general, but there were also negative developments (in the case of Estonia). In its entirety, the cluster remains in the second position in the hierarchy of the 5 clusters, with high values, above the general average, of the average percentages for various criteria such as age, gender, education, occupational status, income, or residence.

Cluster 5 increased its volume in 2020 with three countries from Cluster 4: Austria, Slovakia and Spain. In this cluster, the average percentage of people who used the internet for online purchases increased from 51% (2019) to 60% (2020), the second-largest increase in value among all clusters. More important favourable developments were registered in 2020 compared to 2019 in the following categories of population: those over 35 years old, inactive or retired people from the labour market, those with low education, those with low incomes (the first quartile), and residents of large cities.

The present study faces a couple of limitations that mainly translate into future research directions. For example, expanding the data set and including more countries in the analysis might enrich the magnitude of the analysis. Furthermore, expanding the volume of variables included in the analysis might result in a more complex and comprehensive view of the investigated phenomenon.

However, understanding and raising awareness about online shopping profiles is of high relevance for both the business and public environments. The practical contribution of the paper might be translated into the following aspects. On one hand, entrepreneurs might use the information presented in the paper to adapt their business strategies to better address and target specific customer segments. On the other hand, policymakers might approach the present paper as an adequate starting point in designing coherent policies aimed at increasing the level of digital literacy among vulnerable groups and, at the same time, their orientation towards e-commerce.

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EUROPOS ŠALIŲ APSIPIRKIMO INTERNETE PROFILIAI COVID-19 PANDEMIJOS METU

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SANTRAUKA

Šiuo darbu siekiama atkreipti dėmesį į apsipirkimo internetu profilius skirtingose Europos šalyse, būtent daugumoje Europos Sąjungos valstybių narių prieš COVID-19 pandemiją ir jos metu, atsižvelgiant tiek į demografines, tiek į ekonomines charakteristikas. Atlikta šešių svarbių kintamųjų (amžiaus grupės, lyties, profesijos statuso, formalaus išsilavinimo lygio, pajamų, gyvenamosios vietos) analizė leido nustatyti penkias grupes, kurių kiekvienai būdingas tam tikras apsipirkimo internetine profilis. Rezultatai rodo, kad internetu besinaudojančių asmenų dalis perkant prekes ir paslaugas 2020 m., palyginti su 2019 m., padidėjo tiek analizuojamose šalyse, tiek kiekvienos grupės lygmeniu. Siekiant pabrėžti apsipirkimo internete profilių modeliavimą 2020 m., palyginus su 2019 m., tyrimu nustatytas tas pats grupių skaičius, tačiau jų sudėtis ir profiliai šiek tiek skiriasi.

REIKŠMINIAI ŽODŽIAI: elektroninė prekyba; apsipirkimas internetu; apsipirkimo internetu profilis; elgsenos modeliai; COVID-19 pandemija.