COVID-19's Effects over E-commerce: A Preliminary Statistical Assessment for Some European Countries

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Abstract. The advent of e-commerce has surged during the recent COVID-19 pandemic period. Already in 2019, many habits of users concerning online shopping platforms have changed: the age of those buying online has risen, the average income has fallen and the contagion has reached all urban and rural areas, even the smaller towns and villages. Since March 2020, when increased restrictions were applied, an increase in shopping of various kinds in several European and non-European countries is recorded. Many operators had to modify their logistics and change their interfaces. In short, the emergency has given a huge cultural boost to e-commerce. Tens of thousands of small retailers found themselves in the position of not being able to welcome consumers into their shops or being forced to create e-shops in a very short period of time and thus they identified home delivery as an opportunity not to be missed. Remote payment was the first, but not the only, effect. The present paper analyses the correlation between online shopping habits and socio-demographic characteristics in 27 European countries. The results were obtained from a descriptive statistical evaluation and the correlation between the variables was defined by the chi-square calculation. The results lay the foundations for the definition of the change in transport demand by home-purchase motivation and allow to define some considerations on the emission patterns that characterise transport demand.

Keywords: E-commerce · Mobility and logistics · COVID-19 · Inferential statistics

1 Introduction

E-commerce has a long and rather interesting history, starting almost 40 years ago. The first experiences took place in the late '60s with the American company CompuServe, which is considered to be the first e-commerce company to be founded in 1969 [1], but it was only in 1979 that electronic shopping was introduced [2].

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For two decades, e-commerce remained a rather small sector. Since 1990, with the launch of World Wide Web (www), millions of people have been able to access e-commerce services on the Internet [3]. The '90s saw the founding of the current global e-commerce market leader with the establishment of the companies Amazon in 1995 [4], PayPal in 1998 [5] and Alibaba.com in 1999 [6] respectively.

In addition, Walmart launched its online shopping site in 2000, marking the entry of traditional retail players into e-commerce. The evolution of B2C (Business to Consumer i.e. direct sales to the consumer) is related to a number of factors such as the increased diffusion of the internet, which has made it possible for more people to buy goods online; the diffusion of smartphones and other mobile devices, making online buying easier, faster [7] so much and more secure so that some prefer to speak of "m-commerce" instead of "e-commerce" [8–11] or even of "u-commerce" [12] and a general optimisation in the logistics network, which has made deliveries more flexible and reduced the order-delivery lead-time allowing e-commerce platforms to modulate the offer according to the lead-time required by the user. The outbreak of COVID-19, which became a worldwide pandemic in March 2020, caused a further surge in e-commerce related retail sales [13]. A number of pandemic-related factors have made online shopping indispensable: restriction measures, blockades, social distancing and fear of contagion. These factors have also forced large segments of the population world widely who previously bought mainly at retail level to switch to online shopping.

Finally, entire sectors have had to adapt to the restrictions imposed by the pandemic, such as the food sector, which has seen online commerce as a real possibility as the last element in the supply chain [14–17], while other sectors inevitably grew up significantly during the pandemic as pharmaceutical e-commerce.

The changes imposed by the COVID-19 pandemic affected the whole world, although there were differences related to political and economic characteristics and the different ways in which blockades were implemented in different countries.

In the United States of America (USA), there has been a generalised growth in the share of e-commerce in the total retail market as well as in Canada [18], while a growth shared by the People's Republic of China [19] and India [20] are also recorded [21]. Europe has also been affected by this growth. Data predicts for around 27 European countries a growth in e-commerce sales orders of 30% in April 2020 compared to April 2019, while for the entire retail sector an overall decrease is predicted [22] as presented in Fig. 1. E-commerce has already influenced city mobility in the pre COVID-19 era, being characterised by a pervasive presence of last-mile logistics, which contributes to traffic congestion and pollution [23] and, for the same reason, has imposed heavy changes in companies' delivery methods.

In Europe, COVID-19 has strongly influenced transport modal choices [24–26] and main travel reasons [27–29]. This was mainly due to possible contagions and respect for social distancing [30, 31]. The psychosocial aspect played a role in the propensity of users to move outside their homes. This paper preliminarily investigates how the evolution of e-commerce together with COVID-19 might change the demand for transport in Europe. In addition, attention is paid to how e-commerce may affect transport [32] and logistics in urban areas. Starting from an analysis of the literature on e-commerce in the years 2015–2020, the main variables defining the demand for transport were investigated, as well

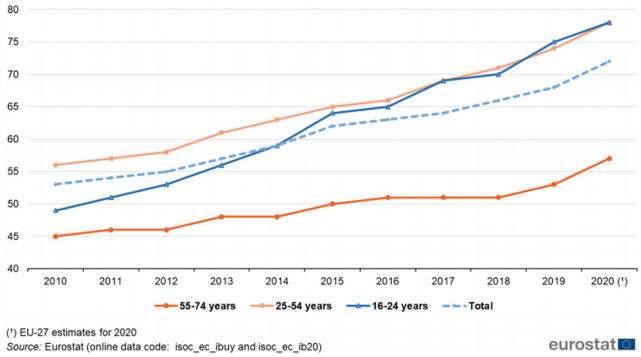

Fig. 1. Internet users who bought or ordered goods or services for private use in the previous 12 months by age group, EU-27, 2010–2020, Source: "E-Commerce statistics for individuals, Statistics Explained", Available online: https://ec.europa.eu/eurostat/statistics-explained/pdfscache/46776.pdf

as the correlations that exist between some psychosocial variables and the propensity to use devices such as Personal Computers or tablets/smartphones and sites related to online sales. The statistical correlations between the different variables highlighted a series of useful observations for the development of more in-depth research in the field of post-pandemic mobility and logistics.

2 Methodology

2.1 Case Study Area Description

The analysis was conducted through an initial survey step by selecting the countries with the largest accessible databases of population and e-commerce data. In particular the analyzed area defined by the 27 European countries highlighted and colored in red in Fig. 2 including United Kingdom, which was member of the European Union until December 31, 2020. The choice of survey area is related to data collection and comparison.

In addition, some of these countries have suffered the first impacts of COVID-19 and applied strong travel restrictions, such as Italy, followed by France and Spain. In addition, some of these countries have experienced a strong increase in the use of online shopping during the pandemic period, along with a growth in businesses and online services. The variables defining the area under investigation were obtained from the main international databases and are described in the following paragraphs.

2.2 Variables Selection

For the preliminary statistical survey, $\boldsymbol{n}$ = states were considered in a time period covering two years, i.e. $\boldsymbol{t}$ = 2019, 2020. The variables investigated are summarized in Table 1. The variables in the first section are related to the propensity of Internet usage and online



Fig. 2. Selection of country on Europe during period 2019–2020

Table 1. Investigated variables related to e-commerce habits and socio demographic

ID	Units	Variable descriptions	Sources	Details
1st e-commerce habits				
$NW_{i,t}$	[%] Percentage of people (Dimensionless variable)	The percentage of internet users (aged 16–74)	[33] [34]	where i = country and t = year
$NE_{i,t}$	[%] Percentage of people (Dimensionless variable)	The percentage of individuals aged 16–74 who purchased online		
2nd socio-demographic data				
$GDPpc_{i,t}$	[k$] Thousands of international dollars	Gross Domestic Product per capita	[33] [34]	
$MA_{i,t}$	[y] Years	Median Age of population		
$U_{i,t}$	[%] Percentage of people (Dimensionless variable)	Unemployment		
$E_{i,t}$	[%] Percentage of people (Dimensionless variable)	Population by educational attainment level (tertiary) and age (%) (15–64)		

shopping, while the second section shows some of the socio-demographic or economic characteristics commonly used in different studies of transport demand

Socio-demographic variables have been selected in accordance with [33, 34] and are among the most common and readily available variables to describe population. The variables have been considered as average values and the variable "median age" considers an algebraic average calculated considering the data series of 2018 and 2020. In addition, the unemployment rate was considered by analysing the fluctuation of the

different periods of the year and it is obtained considering the average value of the monthly value of unemployment for the entire year ***t***. The variable ***Ei,t*** was chosen as a socio-demographic variable in order to understand how well the working-age population can be correlated with the other variables related to e-commerce habits through a linear regression analysis.

3 Results

The statistical analysis was conducted by combining the variables "2 by 2", first with reference to the same section and then to the two different ones. For each of the pairs of variables considered, a scatter plot or scatter graph was obtained, which is a type of graph in which two variables of a data set are plotted on a Cartesian space and from which it was possible to evaluate the linear correlation coefficient ***r*** Nine different correlations were analysed/ considered:

1) correlation of two variables of the same section i.e. $\boldsymbol{NW_{i,t}}$ and $\boldsymbol{NE_{i,t}}$;
2) correlation between the propensity to e-commerce with respect to the economic parameter i.e. $\boldsymbol{NW_{i,t}}$ and $\boldsymbol{GDPpc_{i,t}}$;
3) correlation between the propensity to internet with respect to the economical parameter i.e. $\boldsymbol{NE_{i,t}}$ and $\boldsymbol{GDPpc_{i,t}}$;
4) correlation between the propensity to e-commerce with respect to the social parameter i.e. $\boldsymbol{NW_{i,t}}$ and $\boldsymbol{MA_{i,t}}$;
5) correlation between the propensity to internet with respect to the social parameter i.e. $\boldsymbol{NE_{i,t}}$ and $\boldsymbol{MA_{i,t}}$;
6) correlation between the propensity to e-commerce with respect to the labor parameter i.e. $\boldsymbol{NW_{i,t}}$ and $\boldsymbol{U_{i,t}}$;
7) correlation between the propensity to internet with respect to the labor parameter i.e. $\boldsymbol{NE_{i,t}}$ and $\boldsymbol{MA_{i,t}}$;
8) correlation to the propensity to e-commerce with respect to the educational parameter $\underline{\mathbf{NW_{i,t}}}$ and $\underline{\mathbf{E_{i,t}}}$;
9) correlation to the propensity to internet with respect to the educational parameter $\underline{\mathbf{NE_{i,t}}}$ and $\underline{\mathbf{E_{i,t}}}$;

Thus in Fig. 3, the two variables of the first section were correlated by placing $\boldsymbol{NW_{i,t}}$ on x-axis and $\boldsymbol{NE_{i,t}}$ on y-axis.

Among the hypotheses for the definition of the graph it results that

$$NW_{it} = NE_{it}, \forall i, t \tag{3.1}$$

This represents the bisector of the first and third quadrants, and identifies two different areas, characterised by the following relationships

$$\mathrm{NW_{it}} < \mathrm{NE_{it}}, \forall \mathrm{i}, \mathrm{t} \tag{3.2}$$

$$\mathrm{NW_{it}} > \mathrm{NE_{it}}, \forall \mathrm{i}, \mathrm{t} \tag{3.3}$$

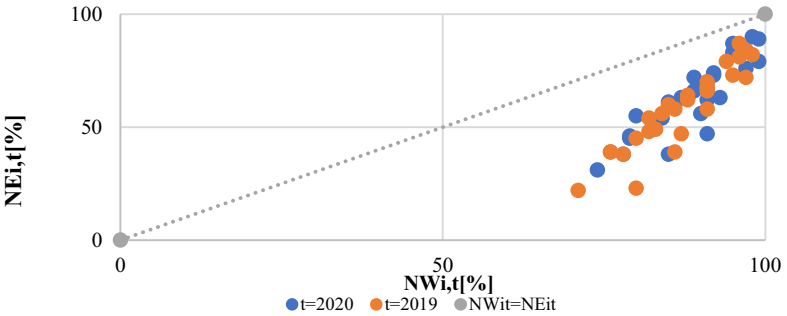

Fig. 3. Scatter plot between NW_{it} and NE_{it}

It can be noted that the points above the line represent unrealizable situations (expressed by Eq. 3.2, while the points below the line identify the domain of existence, through Eq. 3.3). Then considering the two straight lines whose equations are

$$NW_{it} = 0,5, \forall i, t \tag{3.4}$$

$$NE_{it} = 0,5, \forall i, t \tag{3.5}$$

They have identified four quadrants in the xy-plane, each of which is characterised by different conditions.

The upper left quadrant is a sector entirely in the non-existence domain:

$$\begin{cases} \mathrm{NW_{it}} < 0,5 \\ \mathrm{NE_{i,t}} > 0,5 \end{cases}, \forall \mathrm{i, t} \tag{3.6}$$

The upper-right quadrant locates points (states) in which most population both connects to the internet and purchases goods online

$$\begin{cases} \mathrm{NW_{it}} > 0,5 \\ \mathrm{NE_{i,t}} > 0,5 \end{cases}, \forall \mathrm{i, t} \tag{3.7}$$

The bottom right quadrant identifies states where the internet is widespread but e-commerce is lower

$$\begin{cases} \mathrm{NW_{it}} > 0,5 \\ \mathrm{NE_{i,t}} < 0,5 \end{cases}, \forall \mathrm{i, t} \tag{3.8}$$

Finally, the bottom-left quadrant locates point in which less than the 50% of population uses internet and e-commerce.

$$\begin{cases} \mathrm{NW_{it}} < 0,5 \\ \mathrm{NE_{i,t}} < 0,5 \end{cases}, \forall \mathrm{i, t} \tag{3.9}$$

The graph shows that most European countries are in the upper right quadrant. Some South East European countries such as Bulgaria, Cyprus and Greece are visible in the

lower right quadrant in the two time frames 2019 and 2020. Some North East European countries such as Hungary, Latvia and Lithuania were in the lower right quadrant in 2019 and were promoted to the upper right quadrant in 2020. The first correlation used identical data for France and Italy for 2019 and 2020. The linear regression associated with the two variables mentioned above is showed in Table 2.

Table 2. Value of r between $NW_{i,t}$ and $NE_{i,t}$

	$NE_{i,t}$	
r	$t = 2019$	$t = 2020$
$NW_{i,t}$	0,92	0,88

For both years a value of r close to one was obtained, i.e. a significant correlation. This result is also related to the fact that a greater diffusion of internet guarantees more opportunities for online shopping; similarly, an increase in the need to shop online, which occurred during the pandemic, forces the more reluctant sections of the population to adopt internet. The slight variation in the value of r is explained by the fact that the $NW_{i,t}$ variable is close to the maximum in many countries, and therefore has lower margins of growth, while online shopping is a widespread habit but with still several possibilities of further development. The second proposed correlation is presented in Fig. 4.

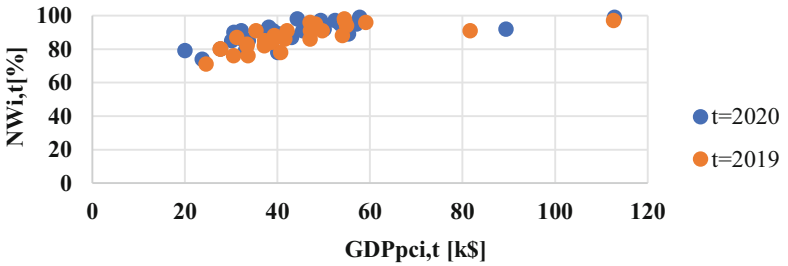

Fig. 4. Scatter plot between $NW_{i,t}$ and $GDP_{pci,t}$

The scatter plot examined shows the relationship between the number of people who had access to the internet and the gross domestic product per capita of a country.

Both sets of points, for $t = 2019$ and $t = 2020$, appear to show a linear correlation, although it is weaker than the relationship between the previous variables. The value of the variable on the x-axis is in the range 20 mo$ $<\mathbf{GDPCpc_{i,t}}<$60 mo$ for all countries considered. Exceptions are Ireland and Luxembourg, which show values above 80mo$, while $NW_{i,t}$ values are still high. It can be seen that the series referring to $t = 2020$ are higher than those referring to $t = 2019$, due to the already discussed increase in the number of online users, but at the same time has undergone a shift to the left at some points, due to the negative effects of the pandemic on the economy and thus on $GDPpc$. The third correlation is presented in Fig. 5.

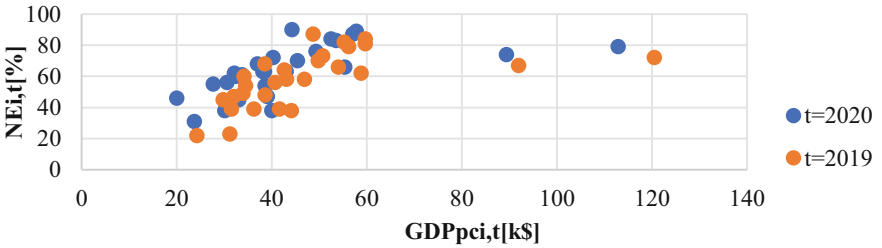

Fig. 5. Scatter plot between NE_{it} and $GDP_{pci,t}$

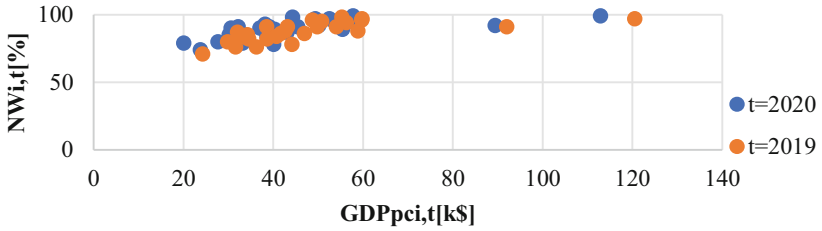

Fig. 6. Scatter plot between NW_{it} and $GDP_{pci,t}$

It can be seen that, unlike to the previous case, the values on the y-axis are more distributed, because online shopping is not yet a majority practice in all European countries, where internet is used by more than 70% of the population in all the states considered. It should also be noted that the $t = 2020$ series' values are also higher. This is due to a general increase in the value of NEi,t, but at the same time several values have shifted to the left, due to the negative effects of the pandemic on GDP. The value of the linear regression is presented in Table 3.

Table 3. Value of *r between* $NW_{i,t}/NE_{i,t}$ and $GDP_{pci,t}$

	$GDP_{pci,t}$	
r	t = 2019	t = 2020
$NW_{i,t}$	0,64	0,62
$NE_{i,t}$	0,56	0,59

The identified values, are higher than 0.5 for each pair of variables considered and for each value of t, therefore they show a good linear correlation between the variables considered. Note how the correlation between $NW_{i,t}$ and $GDPpc_{i,t}$ decreases by 0.04 between $t = 2019$ and $t = 2020$, due to the fact that the series $NW_{i,t}$ are close to the maximum and therefore they present margins of lower growth, as presented in Fig. 7.

It can be seen that for both values of t, there is an inverse correlation between the two parameters. This shows that the number of people accessing internet are inversely

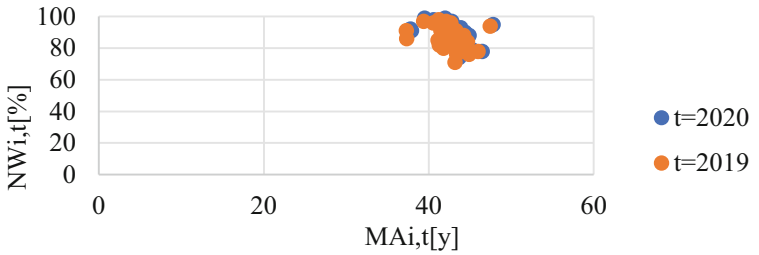

Fig. 7. Scatter plot between $NW_{i,t}$ and $MA_{i,t}$

correlated with the average age of a country's residents, while the respective values is higher for younger countries. Note that in this case, between $t = 2019$ and $t = 2020$, there was a simultaneous shift in the series upwards, with the generalised increase in $NW_{i,t}$, and to the right, indicating an average increase in $MA_{i,t}$ for the countries considered. One country that deviates significantly from this distribution is Germany, which has high values for mean age compared to high values for internet access as well. As far as the fifth correlation is concerned, it is presented in Fig. 8.

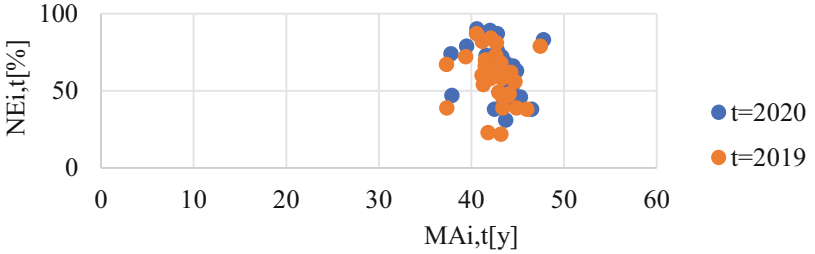

Fig. 8. Scatter plot between $NE_{i,t}$ and $MA_{i,t}$

The scatter plot shows a negative correlation between the two variables. Again, the larger magnitude of the ***NEi,t*** values is reflected in a wider distribution, covering a much wider range of ***y*** than the same range for the ***NWi,t*** value. However, the correlation seems to exist, but with less regularity: the curve is almost vertical and there are more outsiders than in the previous case.

Looking at the graph, however, the median age of a country can influence online purchases. The curve between years 2019 and 2020 presents a substantial increase in value with respect to the y-axis. Therefore, we proceeded with the evaluation of the ***r*** coefficient, obtaining the following from Table 4.

All values are negative, which means that the variables are linearly anti-correlated. However, we have proven that the correlation values between $NW_{i,t}$ and $MA_{i,t}$ are, for both ***t*** values, higher than the corresponding ***r*** values between $NE_{i,t}$ and $MA_{i,t}$, thus revealing a stronger negative link for online logins with average age. Moreover, between years 2019 and 2020, the values undergo a significant negative variation.

Table 4. Value of r between $NW_{i,t}/NE_{i,t}$ and $MA_{i,t}$

	$MA_{i,t}$	
r	$t = 2019$	$t = 2020$
$NW_{i,t}$	−0,30	−0,45
$NE_{i,t}$	−0,16	−0,28

The next step is to explore the correlation between the e-commerce propensity variables and the unemployment rate of country i. The objective is to identify whether a form of linear relationship can emerge between the state of a country's labor market and the country's e-commerce conditions, resulting Fig. 9.

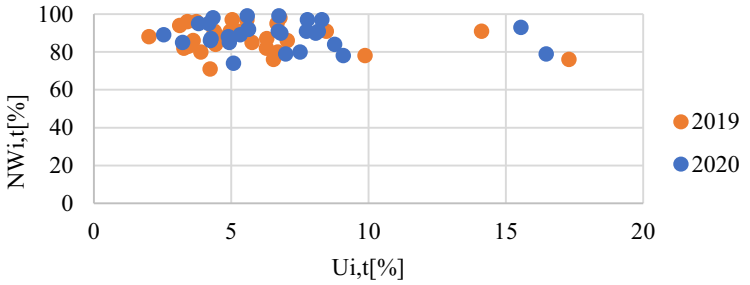

Fig. 9. Scatter plot between $NW_{i,t}$ and $U_{i,t}$

The scatter plot between $NW_{i,t}$ and $U_{i,t}$ does not seem to present a clear correlation between the two variables considered.

The variable $U_{i,t}$ has a large range, going from very low values of the order of 3.5% to very high values that exceed 15%.

Furthermore, the COVID-19 pandemic has had different effects on different countries, largely causing an increase in the percentage of unemployed, generating, in the graph under examination, a shift to the right of the series, as presented in Fig. 10.

The scatter plot between $NE_{i,t}$ and $U_{i,t}$ represented in Fig. 8 is rather similar, in terms of their characteristics, to the diagram represented in Fig. 7.

Even in this case, as for all the other $NE_{i,t}$ plots, the greater range implies a greater dispersion of the values. Compared to the previous case, Fig. 8 presents a form of negative linear correlation between the two values.

This fact could mean that higher unemployment would generate fewer online purchases, and this would be compatible with the already demonstrated positive correlation between $NE_{i,t}$ and $GDPpc_{i,t}$.

Correlation r is evaluated for the pairs considered as t varies. Results are presented in Table 5.

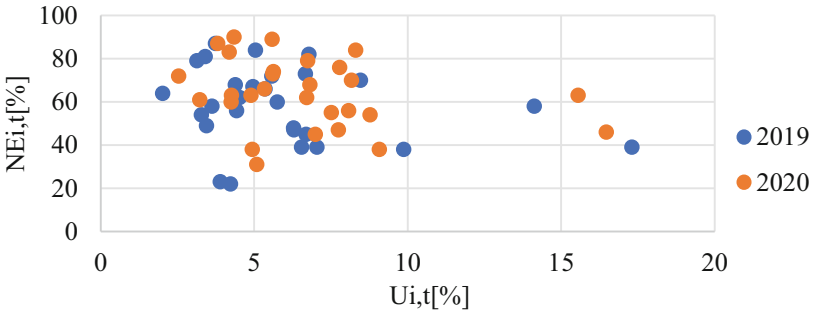

Fig. 10. Scatter plot between $NE_{i,t}$ and **Ui,t**

Table 5. Value of r between $NW_{i,t}/NE_{i,t}$ and $U_{i,t}$

	$U_{i,t}$	
r	$t = 2019$	$t = 2020$
$NW_{i,t}$	−0,21	−0,16
$NE_{i,t}$	−0,24	−0,29

The values of the coefficients are negative for all four cases considered; it is confirmed that $NE_{i,t}$ and $U_{i,t}$ have a negative correlation, but it is clarified that also the pair $NW_{i,t}$ and $U_{i,t}$ has a weak linear anticorrelation.

However, to confirm the considerations previously hypothesized, the values of the correlation $NW_{i,t}-U_{i,t}$ is, in absolute value, lower than the corresponding values of r for $NE_{i,t}-U_{i,t}$.

Furthermore, while for $NW_{i,t}-U_{i,t}$ there is a slight decrease in the absolute value of r, due to the fact that $NW_{i,t}$ has lower growth margins, in the case of $NE_{i,t}-U_{i,t}$ there is an increase in absolute value of r between $t = 2019$ and $t = 2020$.

The last two correlations concerned the variables in the first section of Table 1 with respect to the percentage of graduates aged 15–64, as presented Fig. 11.

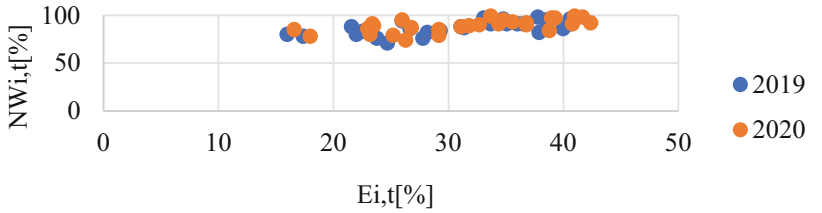

Fig. 11. Scatter plot between $NW_{i,t}$ and $E_{i,t}$

The graph presented in Fig. 11 shows a similar trend to other correlations already described with a narrow range of values for y and a range of high values for x due to the

great variability of the percentage of graduates in the different European countries. The distributions, for both years, seem to show a marked positive correlation; the change between 2019 and 2020 is linked to the increase in the value of $NW_{i,t}$, which is close to reaching its maximum for the reasons described above, and to the increase in $E_{i,t}$ in most of the countries considered. Finally, the last correlation is presented in Fig. 12.

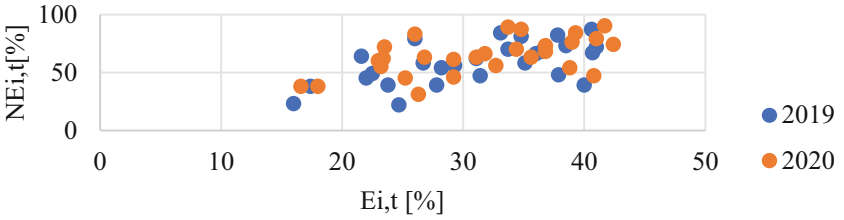

Fig. 12. Scatter plot between $NE_{i,t}$ and $E_{i,t}$

This diagram has the same characteristics as the diagrams where the variable $NE_{i,t}$ was examined. Both series considered for the two time values $t = 2019$ and $t = 2020$, have more dispersive values than in the previous case represented in Fig. 10. At the same time, however, a correlation is identified, albeit less pronounced than in the previously analysed case. These two graphs would therefore seem to present that, in countries where there is a higher percentage of university graduates in the population, the residents tend to use more online shopping and more online access. The considerations made through the calculation of r for the pairs of variables identified are verified. The results are summarised in Table 6.

Table 6. Value of r between $NW_{i,t}/NE_{i,t}$ and $E_{i,t}$

	$E_{i,t}$	
r	$t = 2019$	$t = 2020$
$NW_{i,t}$	0,67	0,63
$NE_{i,t}$	0,58	0,55

A linear correlation for the two pairs of variables considered when time varies is thus evident.

To confirm the hypotheses made previously, we note that, for each value of t, r is greater for the pair $(NW_{i,t})-(E_{i,t})$ than for the pair $(\mathbf{NE_{i,t}})-(E_{i,t})$ confirming thus that the correlation between the behaviour of the percentage of graduates is more marked with access to the internet than with purchases on the internet. Finally, Table 7 is given as a summary of the values in 2019 and 2020 relating to the mean values (A.V.), standard deviation (S.D), maximum (Max) and minimum (Min) value of each variable analysed.

Table 7. Trends of examined variables

	$GDP_{pci,t}$		$Nw_{i,t}$		$Ne_{i,t}$		$Ma_{i,t}$		$U_{i,t}$		$E_{i,t}$	
Year	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
A.V	47,5	44,5	87,1	89,0	58,2	64,0	42,5	42,9	6,0	6,7	30,6	31,5
S.D	19,7	19,1	7,3	6,7	17,7	16,0	2,2	2,3	3,3	3,2	7,4	7,4
Min	24,2	20,0	71,0	74,0	22,0	31,0	37,3	37,8	2,0	2,5	16,0	16,6
Max	120,5	112,9	98,0	99,0	87,0	90,0	47,4	47,8	17,3	16,5	41,0	42,4

4 Discussion and Conclusion

The perception of shopping as a leisure activity really only arose in the '80s and '90s, when leisure time and disposable income increased rapidly following an economic boom accompanied by a large flow of credit, which defined that era, creating habits as shopping trips mainly for people living in the richest countries of Europe. Consumer spending has become an extremely important component to be analysed when examining the overall state of an economy and its future prospects.

People during the COVID-19 pandemic had to spend a lot of time at home due to the restriction measures applied resulting the implementation of new and in some cases innovative solutions such as teleworking and distance learning. Inevitably people turned to online purchasing to cover their needs, basic or not.

In Europe, e-commerce has grown significantly during recent years and some of the world's most sophisticated e-commerce markets are located in the EU-27, such as France and the Netherlands. E-commerce has passed from the stage of being a trend to a new independent market which year by year becomes stronger and larger, affecting people's mobility and retail sector's operational characteristics. The growth of B2C (Business to Consumer) also has a social and economic impact that will grow in the coming years. The current study lays the foundations for a preliminary statistical survey that considered 27 European countries and the UK in order to assess the possible correlations between variables that often characterise the demand for mobility from a socio-demographic point of view and variables related to the use of the Internet and e-commerce. Rapid spread of e-commerce has had an impact on the liveability of our cities, where the sustainable and resilient development of local communities are two of the main objectives for various governments in order to guide the purchasing sector towards an effective and efficient model and towards an overall redevelopment of the sector itself. The results of the research carried out showed a direct proportionality between the propensity to buy online and internet access, since the greater availability of the network (e.g. the recent 5G) together with the free spread of Wi-Fi services mean that an increasingly large population can use this communication channel. The COVID-19 pandemic has affected the correlation of the gross domestic product variable associated with internet and e-commerce use. The scatter plots presented on the above, a direct proportionality between certain correlations which could lead to a post-pandemic modification of travel habits and motivations, generating a reorganisation of general urban mobility, reducing home-shopping trips and also the possible relocation of new commercial areas. Local

authorities will have to examine closely and through time the evolution of e-commerce, in order to design and implement new rules, aiming to integrate goods' delivery service with all other modes of transport, without ignoring at the same time the upturn in traffic already under way. Logistics operators will be called upon to be more sustainable by introducing, for example, the use of low-impact environmental-friendly vehicles. The development of e-commerce cannot disregard the definition of the right logistics' strategy, as it affects costs, consumer perception and satisfaction. The main consideration is that the major e-commerce players continue to move up the service benchmarks in B2C product delivery (e.g. home delivery).In the future, the distance between producers to consumers could become shorter, driving many countries to gear up in order to meet domestic demand. For e-commerce, the future of logistics will consist of the development of flexible and customised shipping solutions, tailored to the specific needs of individual e-shoppers and the definition of a calendar based on hourly (and no longer simply weekly or monthly) delivery times and/or shortened delivery times. Furthermore, the supply chain and the city logistic sector is expected to be modified as currently existing links might disappear or be transformed. Retail shops won't have to keep stocked products, urban consolidation centers might be upgraded as an intermediate link of the supply chain and overall last mile delivery will have to be reorganized to cover the needs of the consumers. Supply chain will have to be re-organized and even perhaps re-invented, without diverging from one of its primary targets, which is to become sustainable. Although the last years, environmental friendly vehicles were introduced as a possible solution for the last mile delivery, the last two years, drones have become for researchers the new favourite transport mode, combining sustainability, speed, low cost and reliability, as new technologies (i.e. 5G mobile networks) emerge. These new types of delivery bring new business models to the forefront which could make possible what seemed unthinkable only a few years ago. E-commerce from the beginning, was relying to the fast evolution of technology in order to grow up and increase its share. COVID-19 pandemic forced the majority of people to find solutions through new technologies, speeding up the adoption of e-commerce not only as an inevitable choice by the consumers but also as a preferable one.

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