Transition from physical to online shopping alternatives due to the COVID-19 pandemic

Claudia Andruetto (corresponding author)
E-mail: andru@kth.se
Address: Drottning Kristinas Väg 40, 114 28, Stockholm, Sweden
Integrated Transport Research Lab, KTH Royal Institute of Technology, Sweden

Elisa Bin
Integrated Transport Research Lab, KTH Royal Institute of Technology, Sweden

Yusak Susilo
University of Natural Resources and Life Sciences (BOKU), Vienna

Anna Pernestål
Integrated Transport Research Lab, KTH Royal Institute of Technology, Sweden

Abstract

By using 530 responses from an online questionnaire, this study aims to investigate the transition from physical to online shopping alternatives during the first wave of the COVID-19 pandemic period at the individual level. The focus areas of the study are Sweden and Italy, two European countries that implemented contrasting prevention measures. This study analyses the impacts of the pandemic to the shopping behaviour and identifies, among the respondents, who have changed the behaviour the most, how respondents have adopted different shopping strategies, what the main differences between Italian and Swedish responses are and the influence of population density on the behavioural change. Multivariate statistical analyses, including linear and binary logistic regressions and multinomial logit models were used to analyse the dataset. The results confirm the differences between Italy and Sweden in terms of social distancing measures, social structures and technology readiness. Moreover, the socio-demographic and household structures of the respondents were found instrumental in influencing the amount and the direction of change in shopping behaviour during the first wave of the pandemic period. The output of this study highlights the impact that contrasting policies have on citizens, and also the importance of having policies that are adaptable to different situations.

Keywords: COVID-19, behavioural change, online shopping, prevention measures

1. Introduction

During 2020 the world faced the COVID-19 pandemic: since it first appeared in Wuhan at the end of 2019, the virus has spread worldwide (Arimura et al., 2020). As a consequence, many governments have responded with different lockdown strategies (e.g. travel bans, stay-at-home orders, restrictions on gatherings) designed to control the outbreak (Arimura et al., 2020; De Vos, 2020; Malik et al., 2020; Rahman et al., 2020). Significant drops in the number of daily trips and public transport usage have been observed worldwide (Almlöf et al., 2020; Beck & Hensher, 2020; Bin et al., 2020; Lozzi et al., 2020; Molloy et al., 2020), but the pandemic had less effect on shopping trips (especially grocery and, to some extent, other shopping trips), which are seen as necessary (Parady et al., 2020).

Most of the analysis to date focuses on the impacts of the pandemic and the lockdowns on passenger movements, public transport riderships, and traffic reductions (e.g. Arimura et al., 2020; Chan et al., 2020; De Vos, 2020, p. 19, 2020; Kraemer et al., 2020; Kunzmann, 2020; Parady et al., 2020; Pepe et al., 2020; Warren & Skillman, 2020). Less focus has been paid to the behavioural transition process that individuals need to make in their daily activities: for example, the shifting behaviour to virtual activities due to the pandemic had a significant influence in shopping activities.

In this paper, the transition from physical to online shopping is studied through an online survey distributed during the first wave of the pandemic period. In this study, the term first wave refers to the first spike of cases of COVID-19, followed by a period of lockdown, in spring 2020 (Lisa Lockerd Maragakis, 2020). In particular, the analyses focus on Italy and Swedish respondents, two counterparts in Europe in terms of prevention measures, where Italy imposed a hard lockdown while Sweden's strategy was primarily based on recommendations from the government (Ministero della Salute, 2020; Regeringskansliet, 2020).

The main research question of the study is: *what are the impacts of the first wave of the COVID-19 pandemic period on the shift from physical to online shopping?* The research sub-questions are the following.

- **RQ1 Who has changed the shopping behaviour the most?**

  During the first wave of the pandemic period, many people have changed their usual behaviour, shifting towards online shopping and reducing the number of physical trips. In this paper, the characteristics of those who have changed the behaviour the most are examined.

- **RQ2 How do respondents adopt different shopping strategies during the first wave of the pandemic period?**

  During the lockdown period, people had different capabilities to evaluate the risk, adjust their daily patterns to the restrictions and adopt the alternative digital solutions for their daily shopping needs. Whilst such transformation may come natural to some groups of society, it is challenging for others. This could result in some socio-demographic groups who did not feel safe enough to travel, but at the same time were not capable enough to resort to virtual alternatives during the first lockdown period. These groups could be excluded from society and be not capable of fulfilling their daily needs.

- **RQ3 What are the main differences between Italy and Sweden?**

  During the first wave of the pandemic period, Italy and Sweden acted very differently in terms of policies and restrictions. In this paper, the different behaviour changes between respondents from the two countries are examined, together with the correlation of the differences with either the restrictions or with the socio-demographic of the respondents.

- **RQ4 Does the population density influence the shopping behaviour?**

  One of the questions that arise when looking at behaviour is whether the built environment represents an important influence. One of the research questions is therefore related to the influence of the respondents' residences and working environment on their behavioural change and adoption during the first wave of the pandemic period.

The remainder of the paper is structured as follows. In Section 2 a literature review on COVID-19 and online shopping behaviours is provided. Then it is followed by the methodology description in Section 3. In Section 4, the results of survey data from the online questionnaire are presented, followed by descriptive and multivariate analyses. The paper ends with discussion and conclusion sections.

2. Literature review

As COVID-19 has disrupted people's well-being and livelihood immensely, in the last few months there have been enormous efforts within the scientific community, to not only seek the medical cure of the disease but also to investigate how the disease has changed people's daily lives around the world. In particular, related to transport, different studies have been carried out to characterize the pandemic period in terms of i) changes in urban mobility and behaviour (Arimura et al., 2020; Chan et al., 2020; Dahlberg et al., 2020; De Vos, 2020, p. 19, 2020; Gao et al., 2020; Kavanagh et al., 2020; Kraemer et al., 2020; Kunzmann, 2020; Layer et al., 2020; Nielsen et al., 2020; Parady et al., 2020; Pepe et al., 2020; Quilty et al., 2020; Warren & Skillman, 2020, 2020), ii) impacts of lockdown strategies and social distancing (e.g. Malik et al., 2020; Rahman et al., 2020), iii) changes in shopping activity (e.g. Hashem, 2020). Moreover, there is also literature focusing on how to characterize the changes and what part of the population is impacted the most (e.g. Jay et al., 2020; Laurencin & McClinton, 2020; Yechezkel et al., 2020).

According to Rahman et al. (2020), adopting strict lockdown measures (seen as an effective way to maintain social distancing) significantly reduces overall mobility. The reduction is also associated with socioeconomics and institutional factors, such as average age, level of globalization and employment in service sectors (Rahman et al., 2020). Data from Google and Apple highlight that high-income countries experienced the most reduction in mobility (Apple, 2020; Google, 2020; Lozzi et al., 2020). Globally, public transport reached the lowest point of -76% in April, the drop reached -65% in driving and in walking -67% in walking (Apple, 2020; Lozzi et al., 2020). In Sweden, there has been a 64% increase of population in residential areas during working times, a decrease of maximum trip length of 38% and a 33% average decrease of daytime presence in industrial and commercial areas (Dahlberg et al., 2020). In Italy, there has been a reduction of 50% of the total number of trips between provinces (Pepe et al., 2020). Providing a full review is beyond the scope of this paper, instead, the authors provide a brief overview of the main findings in terms of COVID-19 policies and the transition behaviour to online shopping activities.

2.1 COVID-19 policies

Following the global outbreak of COVID-19 generated by the novel human Coronavirus SARS-CoV-2 at the end of year 2019 and beginning of year 2020, countries across the world are taking measures in order to reduce the spread of the virus, or at least to slow it down, in order to better cope with public health and better manage its limited resources (Musselwhite et al., 2020; WHO, 2020). Human-to-human transmissions of SARS-CoV-2 have been described with incubation times between 2-10 days, facilitating its spread via droplets, contaminated hands or surfaces (Kampf et al., 2020). While knowledge about the SARS-CoV-2 virus was limited at that time, many public health researchers had experiences with other infectious diseases that have some similar characteristics.

To help countries navigate through these challenges, the World Health Organization (WHO, 2020) provided operational planning guidelines in balancing the demands of responding directly to COVID-19 while maintaining essential health service delivery and mitigating the risk of system collapse. This includes prioritising the continuity of essential services deliveries and making strategic shifts to ensure that increasingly limited resources provide maximum benefit for the population, whenever is needed. Whilst doing that, the travellers also need to comply with the highest standard in precautions, especially in hygiene practices, and wearing personal protective equipment (WHO, 2020).

Whilst the prevention measures seem straightforward, for various other reasons, the implementation of those measures have been varied across countries. For example, different countries have reacted differently with various measures of social distancing which aim to prevent social contact and therefore prevent the spread of the virus. Some (including Italy) have enforced a hard lockdown, while others (including Sweden) have been less stringent (De Vos, 2020). The measures have been applied for different periods of time and it is expected that new waves result in changes in the measures (De Vos, 2020). Sabat et al. (2020) performed a study investigating the public sentiment towards the restrictive measures to contrast COVID-19 spreading in seven European countries. They report a general trust of citizens for their governments' decisions and they also found higher worries in southern Europe than in the northern parts.

2.2 Online shopping

The internet and communication technologies, in particular telecommuting and online shopping, have been promoted as an alternative to work and shop from home. Before the pandemic, online shopping (also referred to as e-commerce) is estimated to be about 20.7% of total retail sales in 2019 worldwide (E-marketer, 2019). In Sweden, online shopping turnover is expected to grow by 33% during 2020 compared with 2019 (Gardshol, 2020). Moreover, during the second quarter of 2020 (which corresponds to the period of this study), online shopping volume had a growth of 49%, and in particular grocery shopping enjoyed a growth of 115% (Gardshol, 2020). In Italy, according to the Osservatorio Politecnico di Milano-Netcomm, online shopping in 2020 will be worth 8% of total retail sales (Digital4, 2020). The overall increase in Italy for 2020 is expected to be 26%, compared to the previous year, while the increase in online grocery shopping during the first wave of the pandemic period and the coincidental lockdown was 56% compared to 2019 (Digital4, 2020). In Italy, grocery stores and supermarkets experienced an increase in revenue from online purchases of 300% during the first wave of the pandemic period (Lozzi et al., 2020).

Different studies suggest that consumers' online shopping and shopping travel behaviours are significantly influenced by their socio-demographics, internet experience, car ownership, and geographical factors (Brand et al., 2020; Shi et al., 2019). Shi et al. (2019) found that people who mostly start their shopping trips from urban or exurban areas are likely to have a higher online shopping share. In line with this, Saphores & Xu (2020) found that households in lower-density areas are less likely to order goods online, compared to their counterparts (however, the ones who do shop online, have a larger number of total deliveries). Whilst online shopping might be seen as a possible solution to mitigate urban congestion, due to the substitution effect of online shopping on shopping trips, it might even increase traffic (Bayarmaa & Susilo, 2014; Lee et al., 2017; Mokhtarian, 2002; Rotem-Mindali & Weltevreden, 2013, p.). Furthermore, previous studies have found that it is people who do not have a private car that are more likely to substitute online shopping for shopping trips (Shi et al., 2019). Brand et al (2020) explained that shoppers might be attracted to or repelled from online shopping for reasons of convenience, perceived benefits, costs and risks, technology affection, time pressures and fit into daily schedules (perceived behavioural control), as well as social and environmental dimensions of personal norms and beliefs.

Online shopping behaviour changes over time in line with the acceptance of digital technologies (Sunio et al., 2018) and with the change of one's time use allocations and commitments over time (Schmid, 2019). Saphores and Xu (2020), for example, demonstrate how age together with the level of education is

impacting the number of deliveries (younger generations and more educated people order more deliveries). Hoogendoorn-Lanser et al. (2019) found that females shop online more compared to their male counterparts, likely due to different in-home and out-of-home responsibility and activity engagements.

COVID-19 related restrictions around the world have significantly reduced physical mobility, changed the intra-households' responsibility arrangement and subsequently the household members' time-use allocations, which in many ways have shifted the behaviour from physical to online shopping alternatives (Hashem, 2020). The pandemic period also played an important role in improving the acceptance of new technological solutions for the public (e.g. acceptance of autonomous delivery robots for receiving online shopping deliveries) (Pani et al., 2020).

Whilst the shift of behaviours to online shopping is clear, and the evidence can be seen from the increase of online retail sales recorded in the 2nd and 3rd Quarters of 2020, to the best of the authors' knowledge, there is not much attention given to understanding this shift at the individual level. Therefore, the main scope of the study is to analyse the impacts of the first wave of the pandemic period restrictions to the reported online shopping behaviour and how individuals from different socio-demographic groups behave differently, given the virus containment strategy in the country, the type of the shopped goods, and the geographical characteristics of the respondents' place of residence.

3. Methodology

In the following subsections, first, the case study is defined: information on restrictive measures in place, main social differences and digital maturity between the two analysed countries are provided. Secondly, the methodology for data collection is included.

3.1 Studied areas: Italy and Sweden

Sweden and Italy are two counterparts in Europe in terms of prevention measures. To compare the impacts of the first wave of the pandemic period and the adaptation behaviours in the two countries, it is important to consider and account for the effects that the policies in place had on the population. In Table 1, the different social distancing measures taken by these two countries are described.

Table 1 - Restrictive measures in place at the time of data collection (20th April - 18th May 2020).
Sources: (Ministero della Salute, 2020; Regeringskansliet, 2020) Cited from Bin et al. (2020).

	Italy	**Sweden**
From 20th April till 4th May	The country was in lockdown at the release of the survey. - schools and universities were closed, - shops were closed (except grocery stores, pharmacies, tobacconists, newsagents and petrol stations), - markets were closed, - restaurants, pubs and cafes were closed (only home delivery allowed), - hair salons, beauticians and barbers were closed, - banks, post and public offices were open, - parks had been closed, - only specific kinds of physical activities outside in constant motion were allowed (e.g. running, jogging), - all the factories in non-essentials sectors were closed, - it was forbidden to travel outside the municipality of residence (except for certified working reasons or serious health conditions).	The following restrictions and guidelines were in place: - all restaurants, bars, cafés, school dining halls and other venues serving food and beverages had to ensure that tables were spaced appropriately to avoid crowding and customers had to be always seated when consuming, - it was prohibited to hold public gatherings and public events for more than 50 people, - pharmacies were not allowed to dispense more medications than patients needed for a three-month period, - it was not possible to visit the national care homes for the elderly, - it was forbidden to leave home if experiencing any flu-like symptoms (e.g. coughing, cold, fever), - it was recommended to work from home whenever possible, - it was strongly recommended to keep a social distance of 2 meters between people when possible. Moreover, from April many companies started a voluntary lockdown of their facilities.
From 4th May till 18th May	The country started opening again from 4th May, when it was allowed, while respecting social distancing and using facemasks in public places: - to travel in the region of residence for certified reasons (e.g. work, health, visit relatives), - to travel outside the region for certified reasons (e.g. work, health, urgent matters, coming back home), - to access parks, - to pick up take away food, - to go back to work for workers in the manufacturing and construction industry, as well as real estate agents and wholesalers.	

Moreover, there are differences both in the economic and in the social structure of the two countries. Table 2 shows the main social and economic characteristics of Italy and Sweden: population, density and gender gap ranking[1] are the most crucial differences, while in terms of employment rate and household structure (average household size in the number of people) there is a less significant contrast.

---

[1] Gender gap ranking is defined according to World Economic Forum (World Economic Forum, 2019)

Table 2 - Italy and Sweden economy and population statistics (data from 2019).

	Italy	Sweden	Sources
Density	200 hab/km^2	23 hab/km^2	(Worldometer, 2020a, 2020b)
Population	60 billion	10 billion	(Worldometer, 2020a, 2020b)
Gender Gap Ranking	76th place (in the world)	4th place (in the world)	(World Economic Forum, 2019)
Unemployment Rate	9.6% (2019)	6.8%	(Istat, 2020; SCB, 2019)
Average Household Size	2.4	2.2	(Istat, 2020; SCB, 2020)
Life expectancy	83.2	83.4	
Average age	45.4	41.3	

According to Harvard Business Review, Sweden was significantly better prepared for the work from a distance in terms of robustness of the digital platform compared to Italy (Chakravorti & Chaturvedi, 2020). According to the study, Sweden is the best positioned among European countries, in terms of socially distant work. This refers to the robustness of the key digital platforms and the use of digital money. On the other hand, Italy positions poorly among other European countries, being less resilient and with not sufficiently robust platforms (Chakravorti & Chaturvedi, 2020). From Eurostat statistics in 2019, it can also be seen the percentages of people that "usually" work from home, which is stated to be 3.6% in Italy and 5.9% in Sweden (Eurostat, 2019). An even higher difference comes in the percentage of people that "sometimes" work from home, which is stated to be 1.1% in Italy and 31.3% in Sweden (Eurostat, 2019).

3.2 Survey Description and Methodology

The methodology chosen in this paper to address the research questions is an empirical data collection, focusing on behavioural changes before and during the first wave of the pandemic period. In this paper, the analysis focuses on and explores the behavioural changes connected to shopping activities. Bin et al. (2020) published in a separate work summarized results from the analysis regarding the trade-off behaviours between virtual and physical activities. The responses analysed in this paper have been collected from 20th April 2020 to 18th May 2020, but include only respondents that live either in Sweden or Italy. To capture the early changes happening during the first wave of the pandemic period, the focus was on getting fast responses. As there was no choice to be more selective in the recruitment process, the survey was circulated through social media platforms and through the research centre network.

The survey has been made available in different languages (including Italian and Swedish), and it is divided into six sections: i) change in travelling behaviour to perform daily activities (commuting, grocery shopping, non-grocery shopping, order takeaway food, eat out, visit friends and family, go out for entertainment/hobbies, physical activities); ii) change in internet usage (entertainment, personal call, work or study, work or study meetings); iii) change in online shopping behaviour (grocery and non-grocery); iv) perceived safety in performing daily activities (travelling by public transport, travelling by car, visiting stores, being at the workplace or school, going to restaurants, pubs and cafés, going to the gym, spending time outside, receiving home deliveries); v) intention of keeping the new habits (travel and commuting, grocery and non-grocery shopping, work or study, handle meetings at work or school, free time, physical activities) after the pandemic period; and vi) personal information (Bin et al., 2020). In the survey and therefore in the paper, with the term online shopping the authors intend a purchase carried out through online services, with home delivery or delivery at a pickup point (Hoogendoorn-Lanser et al., 2019; Parady et al., 2020). For more information on the survey content, see **Appendix I - Survey structure**.

To address the objectives mentioned in the introductory section, a series of descriptive analyses are provided. In the following section, i) the change in the proportion of online and physical shopping behaviours between before and during the first wave of the pandemic period, ii) perceived safety during the first wave of the pandemic period, and iii) likelihood of keeping the new habits after the pandemic period is over are discussed descriptively. Then, to measure the impacts of individuals' socio-demographic, built environment, and perceived safety systematically to different types of online shopping behaviours, a series of linear and binary logistic regressions and multinomial logit models are used.

11

4. Survey Result Description

The total number of answers collected throughout the month of survey development is 781. However, as this study only focuses on respondents who live in Italy or Sweden, only 530 responses were used in the analysis. An overview of the demographic distribution in the two countries is shown in Table 3.

Based on statistical data from SCB for Sweden (SCB, 2020) and Istat for Italy (Istat, 2020), in the survey sample the percentage of males and females differs slightly from the general population. The reached respondents have a higher education level and employment rate. It is important to highlight that the majority of the Italian respondents live in the northern part of the country where the employment rate is larger. Istat (2020) reports 66.2% of employment rate in the given region, which is very close to the reported employment rate by the respondents. As for the comparison number from the Swedish side, the unemployment rate in Sweden is 9.1% according to SCB (2020) and in Stockholm is 6.2% according to the European Commission (European Commission, 2020). Lastly, it can be seen from the dataset that the Italian respondents live in less dense areas when compared to their Swedish counterparts. This might seem counterintuitive since the average density in Italy is 206 hab/km^2 (Worldometer, 2020a) and in Sweden it is 25 hab/km^2 (Worldometer, 2020b). The reason for this discrepancy is due to how the samples have been collected. In Sweden, the majority of the respondents come from Stockholm and Gothenburg, which are the areas with the highest density in the country. Similarly in Italy, the majority of the respondents come from the northern parts of the country which is also the highest density area in the country.

Table 3 - Overview of the demographic distribution and built environment of the respondents.
The statistical data from SCB (SCB, 2020) and Istat (Istat, 2020) is also shown in a dedicated column for both the countries.

		Total	Sweden		Italy	
			Survey	Statistics	Survey	Statistics
	Size of the sample (N)	530 (100%)	212 (40%)	SCB (2020)	318 (60%)	Istat (2020)
Gender	Female	54.3%	42.5%	49.7%	62.3%	51.2%
	Male	45.7%	57.5%	50.3%	37.7%	48.8%
Level of education	Less than high school	2.8%	0.5%	8%	4.4%	38%
	High school graduate, diploma or equivalent	20.9%	12.7%	46%	26.4%	62%
	Trade/technical/ vocal training	4.7%	3.3%	45%	5.7%	
	Bachelor's degree	19.6%	19.8%		19.5%	
	Master's degree	40.9%	41.5%		40.6%	
	Professional degree	2.5%	4.2%		1.3%	
	Doctorate degree	8.5%	17.9%		2.2%	
Employment	Employee	56.4%	62.7%	67.0%	52.2%	57.5%
	Self-employed	10.6%	7.5%		12.6%	
	Part time worker	2.5%	2.4%		2.5%	
	Student	16.4%	18.9%	--	14.8%	--
	Housewife/houseman	0.8%	0.0%	--	1.3%	--
	Volunteering	0.6%	0.0%	--	0.9%	--
	Military	0.0%	0.0%	--	0.0%	--
	Retired	10.0%	7.1%	--	11.9%	--
	Unemployed	2.8%	1.4%	--	3.8%	--
Density	Average inhabitants per km2	2551	3637	--	1827	--

*a) Number of trips[2] per month to grocery and non-grocery stores*
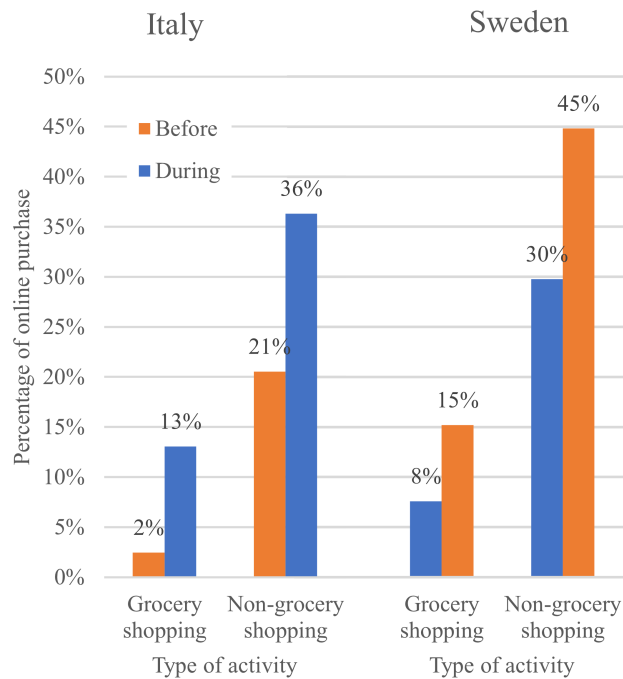
b) Percentage of online purchase of grocery and non-grocery items

Figure 1 - Graphs showing the a) number of trips[2] and b) percentage of online shopping. Numbers are compared before and during the first wave of the pandemic period and are divided by country of residence

---

[2] In the paper, *number of trips* refers to trips to a physical store

In Figure 1, it can be seen that the number of trips[2] for both grocery and non-grocery has decreased and the percentage of online purchases has been increasing among the respondents from both Italy and Sweden, comparing before and during the first wave of the pandemic period. Focusing on grocery related purchases, it is possible to observe a smaller decrease in physical trips (especially in Sweden) when compared to non-grocery shopping trips. In Italy the percentage of online grocery shopping (averaged from all the respondents) has increased from 2% to 13%, while in Sweden it was already higher before the pandemic period, and has barely doubled during the first wave of the pandemic period, shifting from 8% to 15%. For non-grocery, trips have decreased more substantially especially in Italy. This could be also due to the stricter policies in place in Italy, and to the fact that only a few non-grocery trips are considered as essential and therefore are carried out despite the risk of visiting the shop. It can be also seen how in Italy the increase in online shopping is greater when compared to Sweden.
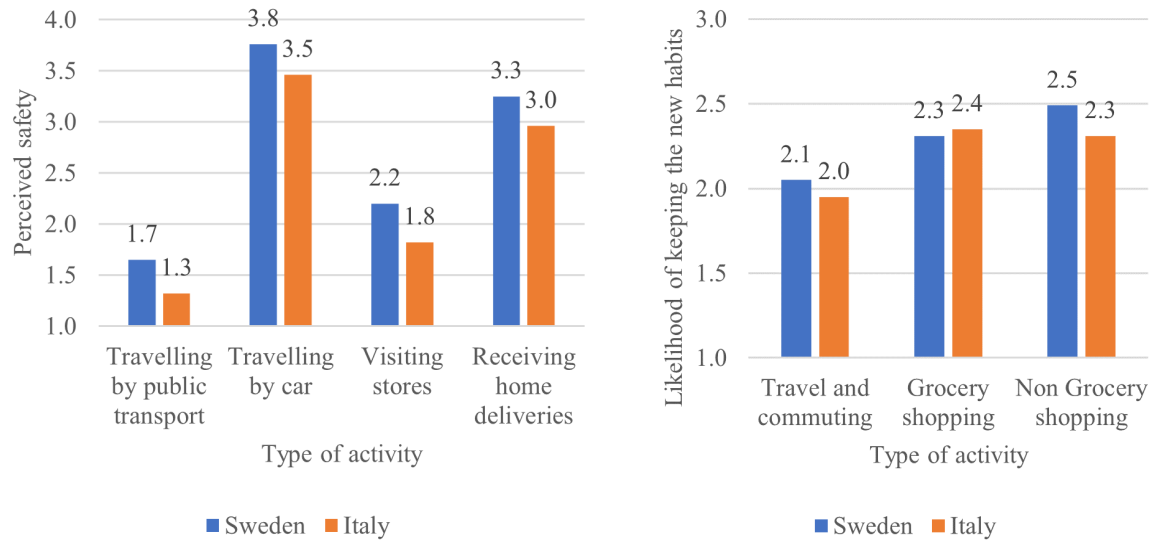
a) Perceived safety of the respondents while: travelling by car, travelling by public transport, visiting stores and receiving home deliveries. In the survey the respondents had the option to choose values between 1 (not safe at all) and 4 (very safe).

b) Likelihood of keeping the new habits adopted during the first wave of the pandemic period related to: travel and commuting, grocery shopping and non-grocery shopping. In the survey the respondents had the option to choose values between 1 (not likely) and 4 (very likely).

Figure 2 - Graphs of a) perceived safety and b) likelihood of keeping the new habits connected to activities related to shopping tasks, divided by country of residence.

In Italy, the perceived safety of doing activities connected to shopping (i.e. travelling by public transport, travelling by car, visiting stores and receiving home deliveries) is lower than in Sweden (Figure 2a). Moreover, the answers of the respondents regarding the likelihood of keeping the new habits connected to shopping (i.e. travel and commuting, grocery and non-grocery shopping) are very similar between the two countries (Figure 2b).

Table 4 - Purchased non-grocery items during the outbreak. In the survey the respondents had the option of selecting multiple types of non-grocery items. The information is divided by country of residence.

	Sweden	**Italy**	**Total**
Clothes	37%	21%	**27%**
Hobby related items	58%	53%	**55%**
Products for the house or garden	47%	42%	**44%**
Work related items	16%	24%	**21%**

Table 4 shows the percentage of respondents that bought the specific non-grocery item type (i.e. clothes, hobby related, products for the house or garden, work related) during the outbreak. In Italy, the percentages are slightly lower, especially clothes. The only type of non-grocery item that is more purchased by the respondents in Italy compared with their counterparts is work related. In general, hobby related items are the most bought by the respondents.

5. Multivariate Analysis

In this section, a series of linear regression, binary logistic and multinomial logit analyses are presented. First, the percentage of shopping that is performed online and the items that the respondents have indicated to have bought during the first wave of the pandemic period are analysed through linear and binary logistic regressions. Second, the results of four multinomial logit regressions are presented, two to investigate how the respondents behave during the first wave of the pandemic period in terms of online shopping and shopping trips, and another two to examine how the respondents have changed their behaviour compared to before the pandemic.

In Tables 5 and 6, the variables in the rows show the independent variables, while in the columns there are the dependent variables that have been tested. In Tables 8 and 10, the first column presents the independent variables, while the other columns present the different groups in which the sample is divided. B is the estimated unstandardized regression coefficient and t is the t-test statistics, indicating

either the significance of each independent variable to be correlated with the dependent variables (for Tables 5 and 6) or the significance of each variable in influencing the belonging with the specific group (for Tables 8 and 10). The variables that correlate at 95% confidence level are indicated by a star (*) while the ones that correlate at 90% confidence level are indicated by two stars (**). Moreover, in Tables 8 and 10, the positive coefficients indicate a likelihood of a certain demographic characteristic (e.g. Swedish residence) to be significant for the belonging with that group, while the negative coefficients indicate the likelihood to be significant for the non-belonging with that group.

5.1 Online shopping change and non-grocery items selection

Table 5 shows a linear regression model with as dependent variables the differences (between during and before the first wave of the pandemic period) in the percentage of shopping that is performed online. People with a full time or part-time employment are positively correlated with a higher online shopping for non-grocery items. Moreover, being highly educated is correlated (at 90% confidence level) with an increase in online non-grocery shopping compared to their counterparts. On the other hand, being a student is correlated (at 90% confidence level) with a smaller increase in online grocery shopping. The household structure appears to be not significant in this analysis. Respondents who have reduced their trips to non-grocery stores are associated with an increase in their online shopping for the same kind of items. This is though not true for grocery: it appears that buying more groceries online during the first wave of the pandemic period is not correlated with a reduction in grocery trips. The safety perception in visiting stores is inversely related to the percentage of online grocery shopping one person has. This suggests that the respondents who still feel safe while visiting stores are associated with a smaller percentage of online purchases compared to respondents who feel less safe in stores. Finally, participants living in more dense areas do more online shopping compared to people from less dense areas.

Table 5 - Linear regression on the difference in percentage of online shopping (for both grocery and non-grocery), comparing before and during the first wave of the pandemic period.

	Change in online grocery		Change in online non-grocery	
	B	t	B	t
(Constant)	0.111	1.422	0.040	0.444
Female	-0.005	-0.249	0.011	0.453
Worker	-0.050	-1.540	0.104	2.791*
Student	-0.075	-1.957**	-0.040	-0.916
Highly educated	0.031	1.335	0.051	1.878**
Have children in the household	-0.002	-0.091	-0.006	-0.250
Have adults in the household	0.007	0.300	-0.007	-0.258
Have elderly in the household	0.019	0.604	0.013	0.374
Swedish residence	-0.033	-1.422	-0.034	-1.265
Change in grocery trips	-0.001	-0.621	0.004	1.979*
Change in non-grocery trips	-0.005	-1.400	-0.014	-3.494*
Feel safe in stores	-0.072	-2.740*	-0.048	-1.602
Feel safe to receive home deliveries	0.006	0.239	-0.006	-0.210
Feel safe to travel with public transport	-0.017	-0.461	0.010	0.232
Feel safe to travel with car	-0.031	-0.835	0.006	0.139
Density of population in place of residence	8.734E-06	2.130*	1.036E-05	2.207
R	0.236		0.305	
R Square	0.056		0.093	
Adjusted R Square	0.028		0.066	
Std. Error of the Estimate	0.228		0.260	

In Table 6, it can be seen that females in the sample are more likely to buy clothes during the first wave of the pandemic period than their male counterparts; males instead are more likely to buy hobby related items. Being a Swedish resident is correlated with buying clothes and, marginally (at 90% confidence level) with buying houseware products. Italian respondents have a higher probability to buy work related items compared to their Swedish counterparts. Students and workers bought more work related items, while they bought less house or garden related items compared to their counterparts. Moreover, respondents who reported to have elderly in their household also found to have a higher probability to buy work related items. The density of population (calculated with respect to where the respondents live) was found not significant in influencing the type of non-grocery items that the respondents bought during the first wave of the pandemic period.

Table 6 - Binary logistic regression of the variables related to what types of items the respondents purchase during the first wave of the pandemic period.

	Ranges	Clothes		Hobby-related items		House or garden-related items		Work-related items	
		0, 1		0, 1		0, 1		0, 1	
		B	**t**	**B**	**t**	**B**	**t**	**B**	**t**
(Constant)	--	-3.040	-3.474	0.084	0.118	0.202	1.067	-2.560	-2.880
Female	0, 1	0.446	2.075*	-0.650	-3.417*	0.202	1.067	-0.346	-1.496
Worker	0, 1	0.226	0.634	0.151	0.513	-0.597	-2.025*	1.332	3.006*
Student	0, 1	-0.013	-0.031	-0.061	-0.175	-1.436	-3.890*	1.469	3.031*
Highly educated	0, 1	-0.205	-0.842	0.079	0.371	0.125	0.579	-0.118	-0.460
Have children in the household	0, 1	0.285	1.301	0.049	0.245	0.160	0.809	0.057	0.236
Have adults in the household	0, 1	0.155	0.647	0.019	0.090	0.111	0.527	0.013	0.052
Have elderly in the household	0, 1	-0.004	-0.013	-0.352	-1.266	-0.320	-1.108	0.696	2.186*
Swedish residence	0, 1	0.852	3.615*	-0.087	-0.411	0.362	1.710**	-0.610	-2.293*
Feel safe in stores	0, 1	-0.531	-1.943**	-0.021	-0.087	0.229	0.972	0.762	2.747*
Feel safe to receive home deliveries	0, 1	0.010	0.040	0.576	2.592*	-0.260	-1.165	-0.286	-1.053
Feel safe to travel with public transport	0, 1	0.589	1.624	-0.546	-1.627	-0.102	-0.301	-0.558	-1.259
Feel safe to travel with car	0, 1	0.926	2.001*	0.207	0.628	-0.389	-1.174	-0.364	-0.951
Density of population in place of residence	0, 1	-2.1E-05	-0.506	4.5E-05	1.211	-4.1E-05	-1.097	1.4E-06	0.030

	Clothes	Hobby-related items	House or garden-related items	Work-related items
-2 Log likelihood	585.800	699.654	696.511	514.696
Cox & Snell R Square	0.066	0.053	0.057	0.054
Nargel kerke R Square	0.096	0.071	0.076	0.084
Chi-Square	36.199	28.722	30.956	29.302

5.2 Respondents grouping based on shopping behaviour

To address to the research questions (especially first and second, regarding who has changed shopping behaviour the most and the pandemic impact on social exclusion) and to analyse the phenomenon of social exclusion and behavioural change systematically, the sample has been divided into different groups according to two grouping methodologies, i.e.: one based on the absolute number of trips and the percentage of online shopping made during the first wave of the pandemic period, and the other one based on the differences in the respondents' reactions (in terms of the number of physical trips and the difference in online shopping) between during and before the first wave of the pandemic period. The next two subsections explore these two grouping methodologies.

5.2.1 Activities during the first wave of the pandemic period

Table 7 presents the different groups in which the sample was divided for the analysis. Group 0 is the reference group for the following multinomial logit regression analysis and it includes respondents that did not travel (physically) for shopping purposes and did not buy online during the first lockdown period. Looking at the demographic of this group, it can be seen that more than 80% of the respondents that fall in this group are Italian. Group 1 represents respondents who are still visiting stores but are not using any e-commerce services. Group 2 includes respondents who are not travelling to visit stores but they are purchasing online. Finally, group 3 represents people that are still visiting stores but also using e-commerce services.

Table 7 - Grouping methodology for a) grocery shopping and b) non-grocery shopping. The grouping methodology in this case is related to behaviours of the respondents during the first wave of the pandemic period. In brackets, the number of respondents per group.

a) Grocery shopping

	Online during=0	Online during>0
# trips =0	Group 0 (48)	Group 2 (25)
# trips >0	Group 1 (309)	Group 3 (148)

b) Non-grocery shopping

	Online during=0	Online during>0
# trips =0	Group 0 (90)	Group 2 (259)
# trips >0	Group 1 (31)	Group 3 (150)

The results of the multinomial logit model shown in Table 8a for grocery show that female respondents are more likely to be part of group 1 or 3, which means they are more likely to visit grocery stores. Moreover, living in Sweden is correlated with a higher likelihood to be part of group 2 or 1, which means they either do only online or only physical grocery shopping. Finally, students are unlikely to be part of group 3, people who feel safer in stores are likely to be in group 1 (at 90% confidence level), and respondents living in dense areas are likely to be in group 3 (at 90% confidence level).

The results of the multinomial logit model shown in Table 8b for non-grocery shopping show that having children in the household is correlated with being part of group 1, 2 and 3. Belonging to group 1 is correlated with living in Sweden. It is also negatively correlated with having elderly in the household, which is probably because the respondents fear infecting their older household members. It is also negatively correlated with being a worker and a student. Being part of group 2 is correlated with being a worker and with feeling safe in receiving home delivery (at 90% confidence level). Finally, belonging to group 3 is correlated with being male, living in Sweden and feeling safe in receiving home deliveries.

Table 8 - Multinomial logit regressions for a) grocery shopping and b) non-grocery shopping, according to the groups in Table 7. The reference category is group 0.

a) Grocery shopping

	Range	Group 1		Group 2		Group 3	
		B	t	B	t	B	t
Intercept	--	1.744	2.667	-0.626	-0.624	0.972	1.405
Density	$[0, \infty]$	5.51E-05	0.766	9.1E-05	0.837	1.3E-04	1.728**
Female	0, 1	0.715	2.106*	0.668	1.232	0.715	1.988*
Have children in the household	0, 1	0.020	0.049	-0.450	-0.653	0.537	1.263
Have adults in the household	0, 1	-0.566	-1.208	-0.196	-0.281	-0.392	-0.788
Have elderly in the household	0, 1	-0.662	-1.456	-0.743	-0.960	-0.228	-0.474
Swedish residence	0, 1	1.319	3.056*	2.072	3.300*	0.485	1.058
Worker	0, 1	0.333	0.671	-1.005	-1.331	0.166	0.318
Student	0, 1	-0.424	-0.787	-1.352	-1.615	-1.314	-2.174*
Highly educated	0, 1	-0.377	-1.006	-0.284	-0.475	-0.334	-0.834
Feel safe in stores	0, 1	0.894	1.957**	-1.607	-1.435	0.554	1.142
Feel safe to receive home deliveries	0, 1	-0.321	-0.835	0.304	0.484	-0.230	-0.563

	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	1010.857			
Final	930.479	80.377	33	.000

	Pseudo R-Square
Cox and Snell	.141
Nagelkerke	.161
McFadden	.073

b) Non-grocery shopping

	Range	Group 1		Group 2		Group 3	
		B	t	B	t	B	t
Intercept	--	-0.552	-0.782	-0.540	-1.159	-2.590	-3.968
Density	[0, ∞]	0.000	1.948**	4.6E-05	0.808	4.5E-05	0.702
Female	0, 1	-0.472	-1.022	-0.077	-0.287	-0.649	-2.088*
Have children in the household	0, 1	1.362	2.370*	1.082	2.940*	1.019	2.540*
Have adults in the household	0, 1	-0.159	-0.301	0.248	0.792	0.892	2.238*
Have elderly in the household	0, 1	-1.931	-2.164*	-0.091	-0.248	-0.059	-0.120
Swedish residence	0, 1	1.354	2.510*	-0.093	-0.283	1.646	4.610*
Worker	0, 1	-1.423	-2.325*	0.829	2.295*	1.060	2.178*
Student	0, 1	-1.762	-2.373*	0.568	1.324	-0.328	-0.556
Highly educated	0, 1	-0.052	-0.103	0.249	0.888	0.020	0.058
Feel safe in stores	0, 1	-0.066	-0.117	-0.080	-0.237	0.061	0.165
Feel safe to receive home deliveries	0, 1	-0.246	-0.507	0.550	1.937**	1.199	3.268*

	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	1155.503			
Final	980.500	175.002	33	.000

	Pseudo R-Square
Cox and Snell	.281
Nagelkerke	.311
McFadden	.141

5.2.2 Difference in behaviour between during and before the first wave of the pandemic period

In this subsection, the focus is instead on the behavioural change: who has increased or decreased their number of shopping trips and who has increased or decreased their online shopping. In the previous subsection, the respondents have been grouped based on the number of their shopping trips and online shopping percentage during the first wave of the pandemic period, whilst in this subsection, the respondents have been grouped based on the change in behaviour compared to the period before the pandemic.

Table 9 - Grouping methodology for a) grocery shopping and b) non-grocery shopping. The grouping methodology in this case is related to the difference in behaviour between during and before the pandemic period. In brackets, the number of respondents per group.

a) Grocery shopping

	Online difference<0	Online difference=0	Online difference>0
# trips difference<0	Group 0 (23)	Group 1 (195)	Group 3 (81)
# trips difference=0		Group 2 (148)	Group 4 (50)
# trips difference>0		Group 5 (33)	

b) Non-grocery shopping

	Online difference<0	Online difference=0	Online difference>0
# trips difference<0	Group 0 (35)	Group 1 (172)	Group 3 (164)
# trips difference=0		Group 2 (84)	Group 4 (49)
# trips difference>0		Group 5 (26)	

Table 9 shows the different groups in which the respondents have been divided for this second part of the analysis. Group 0, which represents respondents that have reduced their online shopping regardless of the difference in the number of physical trips, is relatively small (23 people for grocery and 35 people for non-grocery shopping) and represents the reference group in the multinomial logit estimation. Group 2 represents the respondents that have not changed either of the behaviours, and it is one of the larger groups when considering grocery shopping. Group 1 and group 4 represent respectively the respondents who have not changed one of the two behaviours but have either decreased the number of trips or increased their online shopping. Group 1 is the largest in both grocery and non-grocery shopping. Group 3 represents instead the respondents that have increased their online shopping and at the same time have decreased the number of trips. Lastly, group 5 represents the respondents who had an increase in trip difference, and either did not change their online shopping behaviour or increased their online shopping during the first wave of the pandemic period: this group is also relatively small. The decision for combining all the respondents with a decrease in online shopping for group 0 and with an increase in the number of trips for group 5 is that otherwise groups with too few respondents would have been created.

The results of the multinomial logit estimation shown in Table 10a) for grocery show that respondents without children in the household are more likely to belong to group 2, group 5, group 1 and group 3 respectively. Moreover, at 90% confidence level, respondents without elderly in the household are more likely to belong to group 2. Swedish respondents and highly educated people are more likely to belong to group 4.

The results of the multinomial logit estimation shown in Table 10b) for non-grocery show that workers are more likely to belong, respectively, to group 3, group 4, group 2 and group 1. This correlation is the only correlation which was found significant at 95% confidence level. Being highly educated is negatively correlated with groups 1, 5, 2 (at 90% confidence level). Moreover, people that feel safe in going to the stores are more likely to be part of group 2. These people probably did not change their behaviour because they feel safe to still do part of their non-grocery shopping physically in the stores.

Table 10 - Multinomial logit regressions for a) grocery shopping and b) non-grocery shopping, according to the groups in Table 9. The reference category is group 0.

a) Grocery shopping

	Ranges	Group 1		Group 2		Group 3		Group 4		Group 5	
		B	t	B	t	B	t	B	t	B	t
Intercept	--	2.887	2.673	2.899	2.641	2.042	1.806	2.079	1.777	1.138	0.843
Density	$[0, \infty]$	-6.8E-05	-0.757	-5.5E-05	-0.604	-3.6E-06	-0.037	9.4E-05	0.921	-1.3E-05	-0.092
Female	0, 1	0.175	0.368	0.235	0.487	0.382	0.750	-0.273	-0.506	0.216	0.373
Have children in the household	0, 1	-1.233	-2.241*	-1.316	-2.362*	-1.270	-2.159*	-0.598	-0.971	-1.498	-2.254*
Have adults in the household	0, 1	-0.349	-0.501	-0.152	-0.215	-0.483	-0.668	-0.048	-0.062	0.970	0.971
Have elderly in the household	0, 1	-0.185	-0.237	-1.633	-1.896**	-0.290	-0.352	0.218	0.256	-2.105	-1.634
Swedish residence	0, 1	-0.533	-1.050	0.244	0.471	-0.469	-0.865	-1.656	-2.680*	-0.366	-0.572
Worker	0, 1	0.771	0.909	0.238	0.277	0.450	0.506	0.389	0.425	-0.029	-0.031
Student	0, 1	1.424	1.373	0.355	0.335	0.878	0.811	-0.189	-0.160	-0.447	-0.358
Highly educated	0, 1	-0.677	-0.980	-1.110	-1.591	-0.382	-0.525	-1.381	-1.863**	-1.033	-1.313
Feel safe in stores	0, 1	0.925	1.532	0.783	1.288	-0.189	-0.281	-0.043	-0.060	0.631	0.872
Feel safe to receive home deliveries	0, 1	0.041	0.076	0.310	0.566	0.184	0.325	0.311	0.511	0.015	0.023

	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1515.234			
Final	1410.478	104.755	55	.000

	Pseudo R-Square
Cox and Snell	.179
Nagelkerke	.188
McFadden	.064

b) Non-grocery shopping

	Ranges	Group 1 B	Group 1 t	Group 2 B	Group 2 t	Group 3 B	Group 3 t	Group 4 B	Group 4 t	Group 5 B	Group 5 t
Intercept	--	2.360	3.053	0.838	0.944	1.110	1.377	0.156	0.162	0.231	0.214
Density	$[0, \infty]$	-6.4E-05	-0.814	-9.3E-05	-1.080	-2.6E-05	-0.332	-8.1E-06	-0.088	1.7E-04	1.597
Female	0, 1	-0.056	-0.138	-0.549	-1.234	-0.264	-0.640	-0.596	-1.244	-0.385	-0.692
Have children in the household	0, 1	0.446	0.837	0.384	0.680	0.375	0.705	0.400	0.664	0.562	0.823
Have adults in the household	0, 1	-1.143	-1.909**	-0.975	-1.513	-0.769	-1.260	-0.688	-0.989	-0.244	-0.284
Have elderly in the household	0, 1	-0.109	-0.195	-0.029	-0.043	0.310	0.548	0.416	0.618	-0.710	-0.735
Swedish residence	0, 1	0.493	1.063	0.815	1.632	0.387	0.831	0.129	0.238	0.678	1.085
Worker	0, 1	1.098	1.979*	1.600	2.451*	1.773	3.072*	1.832	2.500*	0.291	0.378
Student	0, 1	0.082	0.143	0.387	0.562	-0.152	-0.246	0.548	0.708	-1.258	-1.423
Highly educated	0, 1	-0.905	-1.915**	-0.869	-1.690**	-0.293	-0.599	-0.544	-0.970	-1.179	-1.825**
Feel safe in stores	0, 1	0.638	1.171	1.035	1.827**	0.281	0.509	0.165	0.258	0.616	0.877
Feel safe to receive home deliveries	0, 1	0.074	0.171	0.476	0.949	0.232	0.530	0.171	0.331	-0.185	-0.303

	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1538.281			
Final	1456.227	82.054	55	.010

	Pseudo R-Square
Cox and Snell	.143
Nagelkerke	.150
McFadden	.049

6. Discussion

RQ1 Who has changed the shopping behaviour the most?

From the overall results of the survey, an increase in online shopping and a decrease in the number of physical shopping trips has been observed, as expected and in accordance with the literature presented (e.g. Digital4, 2020; Gardshol, 2020; Hashem, 2020). Workers and highly educated people are shown to have increased the most of their non-grocery online shopping behaviour (Table 5 and Table 8b), which is in line with the previous findings (Hashem, 2020; Hoogendoorn-Lanser et al., 2019). On the other hand, students are shown to have increased less their grocery shopping behaviour (Table 5). Overall, respondents who indicated that feel unsafe in the stores are more likely to shop online, together with people that live in most densely populated areas (Table 5). Moreover, respondents tend to reduce their shopping trips due to online shopping, and this supports the claim that online shopping has a substitution effect on the frequency of shopping trips in China (Shi et al., 2019).

When it comes to different purchased items, female respondents have a higher probability to buy clothes than their male counterparts (Table 6). Moreover, females are also more likely to have kept the habit of going to the stores for groceries, as it appears in the multinomial logit model (Table 8a). Unlike the result shown in Hoogendorn-Lanser et al. (2019), Hashem (2020) and Saphores and Xu (2020), the analysis does not show that females are associated with more online shopping (Table 5), neither for groceries nor for non-groceries. Being a worker is correlated with more transitions towards buying more non-groceries online, as shown in Table 10b, where it can be seen that workers mainly belong to group 3 (with an increase in online shopping and a decrease in the number of trips). The result is also in line with Table 8b, where it can be seen that workers mainly belong to group 2 and 3 (and therefore are actively shopping online).

Regarding work related items, the household structure is relevant since respondents who reported to have elderly within their household are more likely to buy more work related items: this could be a sign that, given that the pandemic has a stronger influence on older people (CDC, 2020), also other people around them take the necessary precautions to social distance themselves. Moreover, from Table 8b, households without children have stopped going to the stores more compared to their counterparts. The fact that households with children still shop for non-grocery items could be a sign that they regard non-grocery shopping as essential. This is also in line with the National Retail Federation consumer view, that confirms that children influence their parents' shopping. The two top categories of influence are toys and clothes (NRF, 2019).

RQ2 How do respondents adopt different shopping strategies during the first wave of the pandemic period?

For grocery shopping, the group of people that stopped both types of activity (online and physical) is extremely small in terms of size (Table 7a). Running demographic analysis on the group, it can be seen how most of the respondents are Italian residents. These people (i.e. elderly, children, young adults) did not buy groceries online nor in the physical store, therefore they might either need external help or have other members of the household in charge of buying essential items for them. It can also be seen how respondents that feel safe in the stores are more likely to belong to group 1 (at 90% confidence level), where the only way of shopping is going to the physical store. For non-grocery shopping, the group of people that stopped both types of activity is double in terms of size (Table 7b) compared with the grocery shopping one (Table 7a). This could simply be related to different people's perception of what types of shopping is essential. Moreover, the feeling of safety in receiving home deliveries is a determining factor in the decision of the respondents to shop online.

RQ3 What are the main differences between Italy and Sweden?

Due to the stricter restrictions in Italy compared to Sweden (Table 1), Italian respondents have shown to have reduced the number of trips more when compared to their swedish counterparts (Figure 1). An increase in online shopping has also been observed for both countries, as expected from literature (Digital4, 2020; Gardshol, 2020): in Italy the results show a higher increase during the first wave of the pandemic period when compared to before the pandemic. Two factors play a role in the higher online shopping: i) in Sweden there were less stringent restrictions in place (Table 1), and residents were always allowed to visit physical stores; ii) the already higher (when compared to Italy) figures in online shopping purchases (Digital4, 2020; Gardshol, 2020). Being a Swedish resident is correlated with being part of group 1 and 3 (Table 8b), who still choose to go to the physical store. This is in line with the considerations on policies in Sweden (Table 1).

In Italy, the respondents showed to buy more work related items compared to their swedish counterparts (Table 4 and 6): as Harvard Business Review points out, the population was not ready to work from a distance (Chakravorti & Chaturvedi, 2020), and therefore had a need to purchase items related to work. Another important statistic that is worth mentioning is how many people are used to work from home, which from Eurostat amounts to 37.2% in Sweden and only 4.7% in Italy (Eurostat, 2019). When the lockdown period started in Italy, a new regulatory framework for remote work was implemented in May 2020 (Ministero del Lavoro e delle Politiche Sociali, 2020). In Italy, there has been a hesitation towards remote working, associated with a resistance to allow employees to work independently, without the potential constant supervision that there would be in a regular office space (Betti, 2020).

RQ4 Does the population density influence the shopping behaviour?

The density of population is significant only in online shopping: participants living in denser areas are more engaged in online shopping activities compared to their counterparts (Table 5). In all other analyses, the density was found not significant, which is unique compared to previous evidence on the impacts of geographical locations to the propensity of doing online shopping (Saphores & Xu, 2020; Shi et al., 2019). The fact that for the remaining analysis density is not relevant could be biased by the size of the sample, to the nature of the pandemic-driven lockdown being deployed, and the fact that in the sample the average density for both Swedish and Italian respondents is higher than the average density in Sweden and Italy respectively.

Caveats

As discussed in Section 4, the survey sample has a higher education level and a lower unemployment rate than the corresponding averaged national statistics. This, that might be due to the way the respondents have been recruited, results in a bias since the sample does not represent the national population. Moreover, most of the Italian respondents come from northern Italy and most of the Swedish respondents come from either Stockholm or Gothenburg. Therefore, the results should be interpreted with caution. In the analysis, the authors did not distinguish between sub-periods correlated with different policies in place, which could have an effect on the respondents' answers.

7. Conclusion

Based on 530 responses from an online survey, this study investigates the impacts of the first wave of the COVID-19 pandemic on the behavioural transition from physical to online shopping. The descriptive results and multivariate analyses have been used to explore who have changed the shopping behaviour the most, how respondents have adopted different strategies, what the main differences between Italy and Sweden are and the influence of population density on the behavioural change. The study suggests that Italian residence is positively correlated with a larger increase in online shopping and a bigger reduction in physical trips when compared to their Swedish counterpart, in line with the reflections on differences in policies and the online shopping behaviour prior to the pandemic.

The main takeaways are the following:

1. In Italy, the respondents are more likely to buy work related items compared to their Swedish counterparts. This is presumably because, prior to the pandemic period, many Italian employees were not ready to work remotely and therefore many respondents were in need to buy work related items. Since, different policies have been implemented in Italy during the first wave of the pandemic period, to help workers adapt to the new working situation.

2. Previous literature shows a correlation between the population density and the probability of people adopting online shopping. This study does not support this correlation for most of the changes: the only behaviour that has a correlation with the density of population is the increase in the percentage of online shopping (i.e. living in denser areas is correlated with a higher engagement in online shopping activities). For the other activities, the respondents did not have a choice but were either enforced or recommended to act in certain ways by the policies in place.

3. The analysis shows that the respondents were impacted differently in terms of trips. Some respondents unconsciously excluded themselves from doing certain activities, since they reported not to do any grocery nor non-grocery shopping during the first wave of the pandemic period. The results also show that the group of respondents who did not shop for non-grocery items is larger than the group that do not shop for grocery items, which highlights the discrepancies of types of shopping the respondents may consider as essential.

4. The household structure of the respondents impacted their behaviour in different ways. Having elderlies in the household impacted the precautions that the members of the household took, including being prepared to work remotely and avoiding going to the physical store to buy non-grocery items. In this sense, the households with elderlies can also be categorised as a risk group who may end up being socially excluded, a group of population which have not been the focus of the current support policies. On the other hand, having children in the household is correlated with still visiting the non-grocery physical stores.

In summary, the results highlight the differences between the two study areas (i.e. Sweden and Italy) in terms of social distancing measures, social structures and technology readiness. These confirm the need for different policy strategies to help different groups of citizens comply with pandemic related measures, whilst still being able to fulfill their individual shopping needs (which are highly influenced by their socio-demographic characteristics, technology readiness, and household composition). The study also shows that different socio-demographic and household structures matter in determining the directions of the shopping behaviour transformation during the COVID-19 pandemic period.

Declarations

The content of this paper is under review for the special issue *Characterizing Health Pandemic Impacts on Transportation Systems and the Demand for Mobility* of the journal *Transportation Research Part A*.

Availability of data and materials

The datasets collected and analysed during the current study are not yet publicly available but are available from the corresponding author upon request.

Competing interests

The authors declare that they have no competing interests.

Funding

Authors contributions

All authors contributed to the ideation of the study.

CA and EB designed the survey under supervision of AP and YS.

CA, EB and YS analysed the data and interpreted the results.

All authors reviewed existing literature.

All authors contributed to the writing phase and approved the final manuscript.

Acknowledgements

References

Almlöf, E., Rubensson, I., Cebecauer, M., & Jenelius, E. (2020). *Who is still travelling by public transport during COVID-19? Socioeconomic factors explaining travel behaviour in Stockholm based on smart-card data*. https://doi.org/10.13140/RG.2.2.26330.36805

Apple. (2020). *COVID‑19 – Mobility Trends Reports*. Apple. https://www.apple.com/covid19/mobility

Arimura, M., Ha, T. V., Okumura, K., & Asada, T. (2020). Changes in urban mobility in Sapporo city, Japan due to the Covid-19 emergency declarations. *Transportation Research Interdisciplinary Perspectives*, *7*, 100212. https://doi.org/10.1016/j.trip.2020.100212

Bayarmaa, A., & Susilo, Y. O. (2014). Telecommuting and telecommunications. In M. Garrett (Ed.), *Encyclopedia of transportation: Social science and policy* (Vol. 1, pp. 1320–1322). Thousand Oaks, CA: SAGE Publications. https://sk.sagepub.com/reference/encyclopedia-of-transportation/n462.xml

Beck, M. J., & Hensher, D. A. (2020). Insights into the impact of COVID-19 on household travel and activities in Australia – The early days of easing restrictions. *Transport Policy*, *99*, 95–119. https://doi.org/10.1016/j.tranpol.2020.08.004

Betti, I. (2020, February 15). *Coronavirus impone maxi-test mondiale sullo smart working. De Masi: 'In Italia c'è una resistenza patologica'*. https://www.huffingtonpost.it/entry/coronavirus-impone-maxi-test-mondiale-sullo-smart-working -de-masi-in-italia-ce-una-resistenza-patologica_it_5e440ac7c5b61b84d3433541

Bin, E., Andruetto, C., Susilo, Y., & Pernestål, A. (2020). The Trade-Off Behaviours between Virtual and Physical Activities during COVID-19 Pandemic Period. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3698595

Brand, C., Schwanen, T., & Anable, J. (2020). 'Online Omnivores' or 'Willing but struggling'? Identifying online grocery shopping behavior segments using attitude theory. *Journal of Retailing and Consumer Services*, *57*, 102195. https://doi.org/10.1016/j.jretconser.2020.102195

CDC. (2020, February 11). *Coronavirus Disease 2019 (COVID-19)*. Centers for Disease Control and

       Prevention. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html

Chakravorti, B., & Chaturvedi, R. S. (2020, April 29). *Which Countries Were (And Weren't) Ready for*

       Remote Work? https://hbr.org/2020/04/which-countries-were-and-werent-ready-for-remote-work

Chan, H. F., Moon, J. W., Savage, D. A., Skali, A., Torgler, B., & Whyte, S. (2020). *Can psychological*

       traits explain mobility behavior during the COVID-19 pandemic? [Preprint]. PsyArXiv.

       https://doi.org/10.31234/osf.io/5q3jv

Dahlberg, M., Edin, P.-A., Grönqvist, E., Lyhagen, J., Östh, J., Siretskiy, A., & Toger, M. (2020). *Effects*

       of the COVID-19 Pandemic on Population Mobility under Mild Policies: Causal Evidence from

       Sweden. 32.

De Vos, J. (2020). The effect of COVID-19 and subsequent social distancing on travel behavior.

       Transportation Research Interdisciplinary Perspectives, *5*, 100121.

       https://doi.org/10.1016/j.trip.2020.100121

Digital4. (2020, July 8). *Acquisti online, crescita record grazie al lockdown: +26%*. Digital4.

       https://www.digital4.biz/marketing/ecommerce/acquisti-online-2020-polimi-netcomm/

E-marketer. (2019). *Global Ecommerce 2019*. Insider Intelligence.

       https://www.emarketer.com/content/global-ecommerce-2019

European Commission. (2020). *EURES - Labour market information—Stockholms län—European*

       Commission.

       https://ec.europa.eu/eures/main.jsp?countryId=SE&acro=lmi&showRegion=true&lang=en&mode

       =text&regionId=SE0&nuts2Code=SE01&nuts3Code=SE010&catId=2615

Eurostat. (2019). *Employed persons working from home as a percentage of the total employment, by sex,*

       age and professional status. https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Gao, S., Rao, J., Kang, Y., Liang, Y., & Kruse, J. (2020). Mapping county-level mobility pattern changes

       in the United States in response to COVID-19. *ArXiv:2004.04544 [Physics, q-Bio]*.

       http://arxiv.org/abs/2004.04544

Gardshol, A. (2020). *E-barometern Q2 2020—PostNord i samarbete med Svensk Digital Handel och HUI Research* (2020 Q2; e-barometer, p. 34). PostNord.

Google. (2020). *COVID-19 Community Mobility Report*. COVID-19 Community Mobility Report. https://www.google.com/covid19/mobility?hl=en

Hashem, T. N. (2020). Examining the Influence of COVID 19 Pandemic in Changing Customers' Orientation towards E-Shopping. *Modern Applied Science*, *14*(8), 59. https://doi.org/10.5539/mas.v14n8p59

Hoogendoorn-Lanser, S., Olde Kalter, M.-J., & Schaap, N. T. W. (2019). Impact of different shopping stages on shopping-related travel behaviour: Analyses of the Netherlands Mobility Panel data. *Transportation*, *46*(2), 341–371. https://doi.org/10.1007/s11116-019-09993-7

Istat. (2020). *Statistiche Istat*. http://dati.istat.it/

Jay, J., Bor, J., Nsoesie, E., Lipson, S. K., Jones, D. K., Galea, S., & Raifman, J. (2020). *Neighborhood income and physical distancing during the COVID-19 pandemic in the U.S.* [Preprint]. Infectious Diseases (except HIV/AIDS). https://doi.org/10.1101/2020.06.25.20139915

Kampf, G., Todt, D., Pfaender, S., & Steinmann, E. (2020). Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *Journal of Hospital Infection*, *104*(3), 246–251. https://doi.org/10.1016/j.jhin.2020.01.022

Kavanagh, N. M., Goel, R. R., & Venkataramani, A. S. (2020). *Association of County-Level Socioeconomic and Political Characteristics with Engagement in Social Distancing for COVID-19* [Preprint]. Health Policy. https://doi.org/10.1101/2020.04.06.20055632

Kraemer, M. U. G., Yang, C.-H., Gutierrez, B., Wu, C.-H., Klein, B., Pigott, D. M., Open COVID-19 Data Working Group†, du Plessis, L., Faria, N. R., Li, R., Hanage, W. P., Brownstein, J. S., Layan, M., Vespignani, A., Tian, H., Dye, C., Pybus, O. G., & Scarpino, S. V. (2020). The effect of human mobility and control measures on the COVID-19 epidemic in China. *Science*, *368*(6490), 493–497. https://doi.org/10.1126/science.abb4218

Kunzmann, K. R. (2020). Smart Cities After Covid-19: Ten Narratives. *DisP - The Planning Review*,

56(2), 20–31. https://doi.org/10.1080/02513625.2020.1794120

Laurencin, C. T., & McClinton, A. (2020). The COVID-19 Pandemic: A Call to Action to Identify and

Address Racial and Ethnic Disparities. *Journal of Racial and Ethnic Health Disparities*, *7*(3),

398–402. https://doi.org/10.1007/s40615-020-00756-0

Layer, R. M., Fosdick, B., Larremore, D. B., Bradshaw, M., & Doherty, P. (2020). *Case Study: Using*

Facebook Data to Monitor Adherence to Stay-at-home Orders in Colorado and Utah [Preprint].

Public and Global Health. https://doi.org/10.1101/2020.06.04.20122093

Lee, R. J., Sener, I. N., Mokhtarian, P. L., & Handy, S. L. (2017). Relationships between the online and

in-store shopping frequency of Davis, California residents. *Transportation Research Part A:*

Policy and Practice, *100*, 40–52. https://doi.org/10.1016/j.tra.2017.03.001

Lisa Lockerd Maragakis. (2020, November 17). *Coronavirus Second Wave? Why Cases Increase*.

Hopkins Medicine.

https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/first-and-second-w

aves-of-coronavirus

Lozzi, Rodrigues, Marcucci, Teoh, Gatta, & Pacelli. (2020). *Research for TRAN Committee – COVID-19*

and urban mobility: Impacts and perspectives. European Parliament, Policy Department for

Structural and Cohesion Policies, Brussels.

https://www.unwto.org/impact-assessment-of-the-covid-19-outbreak-on-international-tourism

Malik, A. A., Couzens, C., & Omer, S. B. (2020). *COVID-19 related social distancing measures and*

reduction in city mobility [Preprint]. Epidemiology. https://doi.org/10.1101/2020.03.30.20048090

Ministero del Lavoro e delle Politiche Sociali. (2020, maggio). *Smart working, le novità del Decreto*

Rilancio.

https://www.lavoro.gov.it/notizie/Pagine/Smart-working-le-novita-del-Decreto-Rilancio.aspx

Ministero della Salute. (2020). *Notizie*.

http://www.salute.gov.it/portale/nuovocoronavirus/archivioNotizieNuovoCoronavirus.jsp

Mokhtarian, P. L. (2002). Telecommunications and Travel: The Case for Complementarity. *Journal of*

Industrial Ecology, *6*(2), 43–57. https://doi.org/10.1162/108819802763471771

Molloy, J., Tchervenkov, C., Hintermann, B., & Axhausen, K. W. (2020). Tracing the Sars-CoV-2 Impact:

The First Month in Switzerland. *Findings*. https://doi.org/10.32866/001c.12903

Musselwhite, C., Avineri, E., & Susilo, Y. (2020). Editorial JTH 16 –The Coronavirus Disease COVID-19

and implications for transport and health. *Journal of Transport & Health*, *16*, 100853.

https://doi.org/10.1016/j.jth.2020.100853

Nielsen, B. F., Sneppen, K., Simonsen, L., & Mathiesen, J. (2020). *Heterogeneity is essential for contact*

tracing [Preprint]. Epidemiology. https://doi.org/10.1101/2020.06.05.20123141

NRF. (2019). *Fall 2019 Consumer View*.

https://cdn.nrf.com/sites/default/files/2019-10/NRF%20Consumer%20View%20Fall%202019.pdf

Pani, A., Mishra, S., Golias, M., & Figliozzi, M. (2020). Evaluating public acceptance of autonomous

delivery robots during COVID-19 pandemic. *Transportation Research Part D: Transport and*

Environment, *89*, 102600. https://doi.org/10.1016/j.trd.2020.102600

Parady, G., Taniguchi, A., & Takami, K. (2020). Travel behavior changes during the COVID-19 pandemic

in Japan: Analyzing the effects of risk perception and social influence on going-out

self-restriction. *Transportation Research Interdisciplinary Perspectives*, *7*, 100181.

https://doi.org/10.1016/j.trip.2020.100181

Pepe, E., Bajardi, P., Gauvin, L., Privitera, F., Lake, B., Cattuto, C., & Tizzoni, M. (2020). *COVID-19*

outbreak response: A first assessment of mobility changes in Italy following national lockdown

[Preprint]. Infectious Diseases (except HIV/AIDS). https://doi.org/10.1101/2020.03.22.20039933

Quilty, B. J., Diamond, C., Liu, Y., Gibbs, H., Russell, T. W., Jarvis, C. I., Prem, K., Pearson, C. A. B.,

Clifford, S. J., Flasche, S., CMMID COVID-19 working group, Klepac, P., Eggo, R. M., & Jit, M.

(2020). *The effect of inter-city travel restrictions on geographical spread of COVID-19: Evidence*

from Wuhan, China [Preprint]. Epidemiology. https://doi.org/10.1101/2020.04.16.20067504

Rahman, Md. M., Thill, J.-C., & Paul, K. C. (2020). COVID-19 Pandemic Severity, Lockdown Regimes,

and People's Mobility: Early Evidence from 88 Countries. *Sustainability*, *12*(21), 9101.

https://doi.org/10.3390/su12219101

Regeringskansliet. (2020, September 4). *Decisions and guidelines in the Ministry of Health and Social*

Affairs' policy areas to limit the spread of the COVID-19 virus [Text]. Regeringskansliet;

Regeringen och Regeringskansliet.

https://www.government.se/articles/2020/04/s-decisions-and-guidelines-in-the-ministry-of-health-

and-social-affairs-policy-areas-to-limit-the-spread-of-the-covid-19-virusny-sida/

Rotem-Mindali, O., & Weltevreden, J. W. J. (2013). Transport effects of e-commerce: What can be

learned after years of research? *Transportation*, *40*(5), 867–885.

https://doi.org/10.1007/s11116-013-9457-6

Sabat, I., Neuman-Böhme, S., Varghese, N. E., Barros, P. P., Brouwer, W., van Exel, J., Schreyögg, J., &

Stargardt, T. (2020). United but divided: Policy responses and people's perceptions in the EU

during the COVID-19 outbreak. *Health Policy*, S0168851020301639.

https://doi.org/10.1016/j.healthpol.2020.06.009

Saphores, J.-D., & Xu, L. (2020). E-shopping changes and the state of E-grocery shopping in the US -

Evidence from national travel and time use surveys. *Research in Transportation Economics*,

100864. https://doi.org/10.1016/j.retrec.2020.100864

SCB. (2019). *Arbetsmarknadssituationen för hela befolkningen 15-74 år, AKU 2019*.

https://www.scb.se/contentassets/9d3fad266baf4bef96321252f80c7710/am0401_2019a01_sm_a

m12sm2001.pdf

SCB. (2020). *Gender statistics*. Statistiska Centralbyrån.

http://www.scb.se/en/finding-statistics/statistics-by-subject-area/living-conditions/gender-statistic

s/gender-statistics/

Schmid, B. (2019). *Connecting Time-Use, Travel and Shopping Behavior: Results of a Multi-Stage*

Household Survey [Doctoral Thesis, ETH Zurich]. https://doi.org/10.3929/ethz-b-000370588

Shi, K., De Vos, J., Yang, Y., & Witlox, F. (2019). Does e-shopping replace shopping trips? Empirical

evidence from Chengdu, China. *Transportation Research Part A: Policy and Practice*, *122*,

21–33. https://doi.org/10.1016/j.tra.2019.01.027

Sunio, V., Schmöcker, J.-D., & Kim, J. (2018). Understanding the stages and pathways of travel behavior

change induced by technology-based intervention among university students. *Transportation*

Research Part F: Traffic Psychology and Behaviour, *59*, 98–114.

https://doi.org/10.1016/j.trf.2018.08.017

Warren, M. S., & Skillman, S. W. (2020). Mobility Changes in Response to COVID-19.

ArXiv:2003.14228 [Cs]. http://arxiv.org/abs/2003.14228

WHO. (2020, December 8). *Advice for the public on COVID-19 – World Health Organization*.

https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

World Economic Forum. (2019). *The global gender gap report 2020*.

https://www.weforum.org/reports/global-gender-gap-report-2020

Worldometer. (2020a). *Italy Population (2020)—Worldometer*.

https://www.worldometers.info/world-population/italy-population/

Worldometer. (2020b). *Sweden Population (2020)—Worldometer*.

https://www.worldometers.info/world-population/sweden-population/

Yechezkel, M., Weiss, A., Rejwan, I., Shahmoon, E., Ben Gal, S., & Yamin, D. (2020). *Human mobility*

and poverty as key factors in strategies against COVID-19 [Preprint]. Epidemiology.

https://doi.org/10.1101/2020.06.04.20112417

Appendix I - Survey structure

Before COVID-19

Question	Activities	Options
How often did you use to do these activities before the coronavirus outbreak?	Commute to work or school	Less than once a month
	Travel to grocery stores	Once a month
	Purchase groceries online	Once every second week
	Travel to non-grocery shopping	Once a week
	Purchase non-groceries online	2-4 times a week
	Order take away food	5-7 times a week
	Eat out in restaurants, bars, cafes	More than daily
	Travel to visit friends and family	
	Go out for entertainment/hobbies	
	Perform physical activities	
How did you use to travel to perform these activities before the coronavirus outbreak? If you use multimodal travelling, select the mode which covers the most distance and most commonly used.	Commute to work or school	Car (driver)
	Travel to grocery stores	Car (passenger)
	Travel to non-grocery shopping	Motorcycle
	Eat out in restaurants, bars, cafes	Public transport or train
	Travel to visit friends and family	Bicycle or by foot
	Go out for entertainment/hobbies	Other
	Perform physical activities	N/A
How long did it take to travel to these activities before the coronavirus outbreak? According to the mode selected above, estimate the average of one-way trip	Commute to work or school	< 10min
	Travel to grocery stores	10-30min
	Travel to non-grocery shopping	30-60min
	Eat out in restaurants, bars, cafes	1-2 hours
	Travel to visit friends and family	3-5 hours
	Go out for entertainment/hobbies	> 5 hours
	Perform physical activities	N/A
For how long did you use to use the internet connection for the following activities before the coronavirus outbreak? Answer considering an average in hours per week.	For entertainment	< 1 h
	For personal videocall/call/chat	1-2 h
	For work or study	3-5 h
	For work or study meetings and calls	6-10 h
		11-15 h
		15-20 h
		20-25 h
		>25 h
To what extent does the coronavirus outbreak influence your daily life?		1 - not at all
		2
		3
		4 - a lot

During COVID-19

Question	Activities	Options
How often do you do these activities now?	Commute to work or school	Less than once a month
	Travel to grocery stores	Once a month
	Purchase groceries online	Once every second week
	Travel to non-grocery shopping	Once a week
	Purchase non-groceries online	2-4 times a week
	Order take away food	5-7 times a week
	Eat out in restaurants, bars, cafes	More than daily
	Travel to visit friends and family	
	Go out for entertainment/hobbies	
	Perform physical activities	
How do you travel to perform these activities now? If you use multimodal travelling, select the mode which covers the most distance and most commonly used.	Commute to work or school	Car (driver)
	Travel to grocery stores	Car (passenger)
	Travel to non-grocery shopping	Motorcycle
	Eat out in restaurants, bars, cafes	Public transport or train
	Travel to visit friends and family	Bicycle or by foot
	Go out for entertainment/hobbies	Other
	Perform physical activities	N/A
How long does it take to travel to these activities now? According to the mode selected above, estimate the average of one-way trip	Commute to work or school	< 10min
	Travel to grocery stores	10-30min
	Travel to non-grocery shopping	30-60min
	Eat out in restaurants, bars, cafes	1-2 hours
	Travel to visit friends and family	3-5 hours
	Go out for entertainment/hobbies	> 5 hours
	Perform physical activities	N/A
For how long do you use the internet connection for the following activities now? Answer considering an average in hours per week.	For entertainment	< 1 h
	For personal videocall/call/chat	1-2 h
	For work or study	3-5 h
	For work or study meetings and calls	6-10 h
		11-15 h
		15-20 h
		20-25 h
		>25 h

Online shopping behaviours

Question	Activities	Options
Before the coronavirus outbreak, how much of your shopping was online?	Grocery shopping	0% [online]
	Other shopping	10%-30%
		40%-60%
		70%-90%
		100% [online]
How much of your shopping during the coronavirus outbreak is online?	Grocery shopping	0% [online]
	Other shopping	10%-30%
		40%-60%
		70%-90%
		100% [online]
Which kind of items do you usually shop during the coronavirus outbreak (not considering groceries)? [Multiple choice]		Clothes
		Hobbies related items (sport, art, music equipment, technology, stationery, books..)
		Items for the house, garden
		Work related items
		Others [Specify]

Perceived safety and likelihood of keeping the new habits

Question	Activities	Options
During the coronavirus outbreak, how safe do you feel while engaging in the following activities, considering possible precautions that you take?	Travelling by public transport or train	1 - not safe at all
	Travelling by car	2
	Visiting stores	3
	Being at the workplace or school	4 - very safe
	Going to restaurants, pubs and cafes	
	Going to the gym	
	Spending time outside	
	Receiving home deliveries	
If you have changed your behaviour since the coronavirus outbreak, how likely are you to keep your new habits when the threat from the virus is removed?	Travel and commuting	1 - not likely
	Grocery shopping	2
	Shopping	3
	Work or study	4 - very likely
	Handle meetings at work or school	no change
	Free time	
	Physical activities	

Demographics

Question	Options	Number
Where do you currently live?	List of UN recognized states	
What is your postal code?	Open question	
What is your country of origin?	List of UN recognized states	
What gender do you identify with?	Female	
	Male	
	Other [Specify]	
How many people in these age groups live in your household?	Children (<18 years old)	None
	Adults	1-3
	Elderly (>65 years old)	More than 3
What is your highest level of education?	No schooling completed	
	High school graduate, diploma or equivalent	
	Trade/technical/vocal training	
	Bachelor's degree	
	Master's degree	
	Professional degree	
	Doctorate degree	
	Other [Specify]	
What is your main employment?	Employee	
	Self-employed	
	Housewife/houseman	
	Student	
	Part time worker	
	Volunteering	
	Military	
	Retired	
	Unemployed	
	Other [Specify]	
Do you have any comments to add?	Open question	