



Research article

Psychological pressure and changes in food consumption: the effect of COVID-19 crisis

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ABSTRACT

In this paper, we investigate the short-term and long-term effects of the COVID-19 emergency on consumers' decision of changing dietary habit. We used a certified dataset reporting information about 456 Italian consumers during the lockdown in the first wave of the pandemic emergency (April 2020). The survey collected data about changes in food purchases, respondents' mood during the lockdown, conspiracist beliefs, exposure to the virus, and planned food purchasing behavior after the lockdown. We used the data to construct measures of the psychological pressure exerted by the COVID-19 emergency on consumers. We use an endogenous selection regression model to assess the impact of psychological pressure on the decision of changing food purchased. The analysis identified two opposite approaches to change in food purchasing decisions: impulsive approach and reflective approach. The former is associated with a higher probability of changing food purchase but a lower probability to keep the changes in the long run than the latter. Our results suggest that COVID-19 psychological pressure was associated with impulsive approach to buy food. Consequently, food-purchasing behavior is expected to revert to pre-COVID 19 habits when the emergency is over.

1. Introduction

The objective of this paper is to assess the association between consumers' experience with COVID-19 and the changes in their purchasing decisions about food in the short-run (i.e., during the lockdown) and in the long-run (i.e., after the pandemic emergency will be over). Our main goal is to assess whether the changes in consumer behavior during the lockdown will vanish with the COVID-19 emergency or we can expect that at least some effects will last over time. The main contribution of the paper is the investigation of association between the psychological impact of the lockdown and the expected duration of the change in consumption patterns. Our analysis considers psychological factor linked to the impact of the lockdown – such as the attitude toward the disease and fear of being exposed to the risk of contracting the virus – and assesses the association with current (i.e., during the lockdown) and planned (i.e., after the emergency will be over) purchasing decisions. This approach allows us to test the hypothesis that differences in the intensity of the experience are associated with different reaction in terms of food purchases over time.

The topic is of particular interest given the recent developments of the pandemic emergency. As the second wave of contagion is sweeping through Europe, agri-food firms must consider future investments carefully. A long-lasting effect on consumption may call for sizable investments. Instead, if a quick reversion toward old consumption habits is expected, the focus may be on short-run survival strategies.

Our paper contributes to a fast-growing literature about the COVID-19 impact on food consumption. As argued by Cranfield (2020), the COVID-19 pandemic is “an unprecedented episode in the last 100 years of human history”, different from others unpredictable catastrophic events in terms of consequences of public health and of economic downturn. Extraordinary containment measure has been adopted in most countries, such as the total confinement of the population in their homes, generally referred as “lockdown”.

Across the world, scholars are starting to investigate how COVID-19 pandemic have affected the consumers' food behavior. Specifically, some authors focused their studies on consumers' dietary habits. For example, Romeo-Arroyo et al. (2020), through a Hierarchical Cluster Analysis (HCA), explored food related behavior of the Spanish

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population during the COVID-19 confinement period. Their findings indicate the existence of three consumer segments (low-cooking engagement, health-concerned, and health-disregarded) with different food related habits (i.e. the health-disregarded group of consumers was characterized by having unhealthier attitudes, maybe related to the lower emotional mood of respondents belonging to this cluster). In Poland, [Sidor & Rzymiski \(2020\)](#) found that during the pandemic-related confinement, a significant percentage of individuals could experience modification of dietary habits, manifested by eating and snacking more. In the Italian context, [Di Renzo et al. \(2020\)](#) investigated the relationship between eating habits, mental and emotional mood during the COVID-19 confinement period, founding that a high percentage of respondents experienced a depressed mood, anxious feelings, hypochondria, and insomnia. Moreover, almost half of the interviewed consumed comfort food and were inclined to increase food intake to feel better, with age inversely related to dietary control. Similar results are found by [Ammar et al. \(2020\)](#) and [Scarmozzino and Visioli \(2020\)](#). Furthermore, focusing on a sample of adolescents from different countries (Spain, Italy, Brazil, Colombia and Chile) aged between 10 to 19 years, [Ruiz-Roso et al. \(2020\)](#) discovered that COVID-19 pandemic has modified their dietary trends, increasing their sweet food consumption probably due to the boredom and stress produced by the confinement. On the other hand, they also found that families had more time to cook and improve eating habits, even though this did not increase the overall adolescents' diet quality.

Other studies investigated whether consumers' food shopping behavior and demand have been affected by the COVID-19 related lockdown. For instance, [Long and Huy Khoi \(2020\)](#) and [Khan \(2020\)](#) adopted the Theory of Planned Behavior model (TPB) in combination with the theory of consumer risk perception to understand the factors that affect the hoarding food behavior of Vietnamese and Bangladeshi consumers during COVID-19 pandemic. The results from these studies indicate that the risk perception of the COVID-19 pandemic has positively affected consumer attitudes towards the intention to hoard the food. Similarly, [Li et al. \(2020\)](#) adopted the TPB in order to provide early empirical insights into changes in consumer food shopping in China. Their findings highlighted the existence of considerable levels of switching behaviors among consumers, with local small independent retailers characterized by the highest levels of resilience in terms of customer retention. In Canada, [Cranfield \(2020\)](#) provided an early assessment of the factors related to COVID-19 that might affect consumer demand for food. These factors include the structure of preferences in the context of a pandemic, income and time constraints, and price effects. Similarly, focusing on New Zealand as a case study, [Martin-Neuning and Ruby \(2020\)](#) evaluated the likely consequences of the lockdown on consumer grocery purchasing habits, reporting that under the new shopping conditions, consumers, are more likely to raise their overall supermarket spend due to impulse buying and time pressure, decreasing spending in other areas. Moreover, authors suggested that, given the restriction to the availability of some food products, consumers might buy unfamiliar brands, changing their habits. Finally, [Laato et al. \(2020\)](#) examined how online information sources affect Finnish consumers behavioral change during the COVID-19 pandemic adapting the Stimulus-Organism-Response (S-O-R) framework by adding unusual purchasing and voluntary self-isolation variables. Results showed the existence of a strong link between self-intention to self-isolate and intention to make unusual purchases. Furthermore, results revealed that the exposure to online information sources increased the health anxiety, and consequently, the intention to make unusual purchases and engaging in voluntarily isolation.

Overall, the above-mentioned studies confirm that COVID-19 pandemic have widely affected consumers' food choice behavior in terms of dietary habits and food shopping behavior. However, no previous studies have investigated the persistence of the effects of the COVID-19 emergency in the long run. Compared to existing studies concerning consumer behavior during the lockdown, our research

focuses on the long-term changes and our main objective is to assess whether dietary changes during the lockdown might be permanent or not.

The remainder of the text is organized as follows. In section 2, we illustrate the conceptual framework of the analysis, we introduce the dataset and present the approach to variable measurement and the design of the econometric model. In section 3, we report the results of estimations. In section 4, we discuss the results and report our conclusions.

2. Material and methods

As shown by the above-mentioned literature, the lockdown due to COVID-19 emergency caused a demand shock that affected the food market. The changes in consumer behavior had several causes: stay-at-home lifestyle, social distancing, smart-working, and the greater use of social networks deeply affected nutritional choices. We investigated the changes in consumer decision using the data of 456 Italian consumers that responded to an online questionnaire on the likelihood that a product that was bought by a consumer during the lockdown for the first time becomes part of the usual shopping basket (i.e., it will be bought after the lockdown).

This study contributes to the recent literature by investigating if the effect of the lockdown experience on consumer's purchase decision and whether such impact is expected to last after the lockdown or not. To this end, we collected data from a sample of Italian consumers regarding (i) stated innovation in food purchase, (ii) conspiracist attitudes towards COVID-19, (iii) personal feelings during COVID-19 crisis, (iv) personal experiences with COVID-19 virus, (v) sociodemographic characteristics.

2.1. Conceptual framework: COVID-19 emergency and the decision to purchase "new" products

[Figure 1](#) explains the conceptual framework. We assume that the food purchase before lockdown can be considered as a valid counterfactual, i.e., it predicts what the consumers would have bought if there was no COVID 19 emergency. Then, the lockdown effect can be measured as a deviation from the counterfactual. Innovation of food purchases can be considered as a realization of such deviation.

The lockdown influences consumer purchasing decisions in two ways. It affects consumers' shopping opportunities (i.e., it prevents consumers from shopping from the usual outlets because of movement limitation), as suggested by [Cranfield \(2020\)](#), [Martin-Neuning and Ruby \(2020\)](#). Also, it affects consumers' psychological conditions because of the lockdown stress, as in [Di Renzo et al. \(2020\)](#) and [Ruiz-Roso et al. \(2020\)](#). The constraints on the outlet choice and the psychological pressure might lead consumers to change their consumptions decisions (compared to the counterfactual) resulting in the purchasing of "new" food (as suggested by [Latoo et al., 2020](#)).¹

After the COVID-19 emergency, the consumers must decide whether to keep the new food in the shopping basket or not. In the post-lockdown period, the movement limitations are removed so that there are no constraints on the outlet choice anymore. As a consequence, the decision to keep the innovation depends on the consumption experience (i.e., whether the consumer liked it or not) and on possible long-term psychological effects of the pandemic (i.e., whether the emergency led to a permanent change in the consumer's set of preferences). A positive statistical association between the decision of keeping the new product and

¹ By "new food" we mean a food product that the consumer never bought before. This definition allows us to identify definite changes in purchasing behavior and to ask an unambiguous question to consumers. We acknowledge that change in consumption decision might concern food that was already known to the consumers (for example, eating more chocolate), however collecting information regarding such changes in habits required extensive data collection that was beyond the available resources.

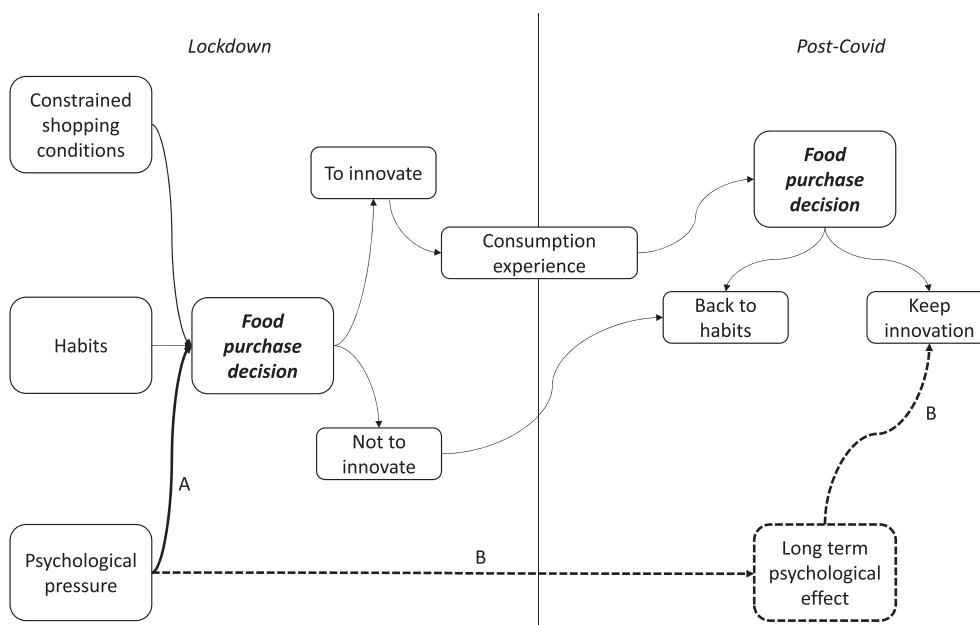


Figure 1. Conceptual framework.

the variables describing the psychological pressure during the lockdown is considered as an empirical evidence supporting the existence of a long-term psychological effect. In this case, we can affirm that the COVID 19 lockdown has a long-term effect on consumption.

Our approach tests the effect of the psychological pressure on the decision to innovate during the lockdown (short-term effect, connector A in Figure 1) and to keep the innovation after the emergency (long-run effect, connectors B in Figure 1). To this purpose, we build an econometric model to test the association between the psychological pressure and consumer's choice.

2.2. The dataset and construct measures

We used a dataset from the “2020 Meat Consumption Survey”, a yearly survey of meat consumption in Italy by the University of Milan performed using the Qualtrics XM online platform. The survey collects data from a representative sample of 456 Italian consumers.² The data were collected in Italy between 27th of April and 3rd of May 2020. That was a critical week for Italian households. On May 4th 2020 the lockdown phase ended and uncertainty about future was still high. The respondents were recruited to participate to a more extensive research focused on meat perception. This research was conducted by an external panel provider who was a guarantee for the quality of the data collected (Qualtrics Panels service³). Following a quota sampling method based on the Italian population quota by age and gender, the final dataset is composed by 456 Italian citizens aged between 18-80 years. Respondents took 19'16" on the average to complete the extended version of the questionnaire (median time of completion 15'34"). In this research, we used the following sections of the questionnaire: stated innovation in food purchase,

² The use of an existing dataset (instead of an ad-hoc survey) allowed us a timely collection of representative data during the lockdown that would have been impossible if we had to organize the survey from scratch. However, because the survey was not designed for the study question the econometric model suffered from data limitations. However, we are confident that the benefits of this choice exceed the costs.

³ Qualtrics is an international leading company for on-line surveys. The subjects' recruitment is certified for the traceability of the procedure by the Qualtrics Esomar28 and ISO 20252 management systems standards.

conspiracist attitudes towards COVID-19, personal feelings during COVID-19 crisis, personal experiences with COVID-19 virus, consumption habits and sociodemographic characteristics.

2.2.1. Stated innovation in food purchase

To investigate the introduction of new products in households' food purchase during and after COVID-19 crisis, we used two questions. The first one investigated whether consumers had introduced any new food in their food purchases during the lockdown phase. The answers are collected in the variable NEWFOOD which assumes the value 0 if the consumers did not purchase any new food during the lockdown, 1 otherwise. Only the 127 consumers that declared the consumption of new products answered a second question that investigated whether the consumers expected to maintain the new food in their food purchases in the next future. These answers are collected in the variable KEEPNEW that assumes the value 0 if the consumers stated that they did not intend to maintain the new products in their food purchase, 1 if the stated that they intended to maintain the new products in their food purchase.⁴

2.2.2. Measuring COVID-19 psychological pressure: threat perception

We assumed that the psychological impact of COVID-19 on consumers can be summarized into two main dimensions: “threat perception” and “attitude effect” (Figure 2). Threat perception measures the degree of health concern and the awareness of personal danger. The attitude effect measures the psychological reaction to the lockdown (e.g., Di Renzo et al., 2020). In our model, the threat perception captures the intensity of the pressure, while the attitude effect refers to how the consumer reacted to such pressure.

The threat perception refers to the consumer's subjective assessment of the personal threat of being infected (with possibly severe consequences). With this dimension we want to capture the intensity of the psychological pressure, under the assumption that the more the consumer is concerned about own or family's health, the higher the psychological pressure is. We measured the threat perception using two variables: i) a subjective assessment of the likelihood of being exposed to

⁴ Consumers with NEWFOOD = 0 had a missing value of KEEPNEW.

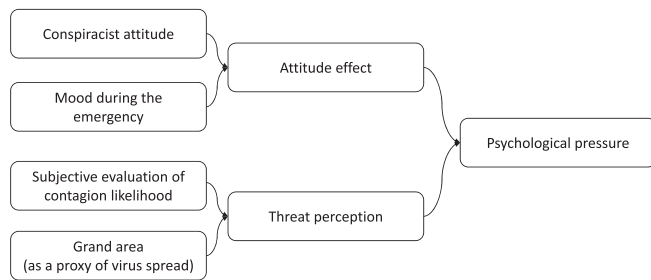


Figure 2. Measuring the psychological impact of COVID-19 on respondents.

the virus and ii) the grand area the consumer lives in, because the spread of the virus varied greatly across regions.

The COVID-19 threat perception has been explored asking to respondent their perceived probability that (s)he or someone of (her)his close relatives or friends have been infected by COVID-19. The variable that contains this information is called COVIDPER and ranges from 1, if the infection is considered not likely at all, to 10 if the infection is considered actual. Because the spread of the virus was much more severe in Northern Italy than elsewhere, the area of residence (AREAS) at NUTS1 level (Classification of Territorial Units for Statistics of the European Union), distinguished in North-West, North-East, Central Italy, South and Islands was used as a proxy for the severity of contagion in the respondent's area.⁵ In order to avoid perfect correlation with the intercept (the so-called dummy variable trap) the North-West area variable was omitted.

2.2.3. Measuring COVID-19 psychological pressure: attitude effect

We modelled the attitude effect using two drivers: the conspiracist attitude and the mood during the lockdown.

To understand the consumers' attitudes towards COVID-19 we considered the tendency of certain groups of consumers to endorse conspiracy theories as an explanation for events that are perceived to negatively influence everyone's life. Consumers who believe in conspiracy theories affirm that there are highly organized and malevolent groups of few people that weave secret plots to regulate the world for their own benefits (Moulding et al., 2016). The degree of conspiracist attitude is considered as a proxy for the respondent propensity to believing in news provided by unofficial sources. Such beliefs are expected to influence the consumer's mood during the lockdown and, ultimately, food consumption. For example, during the lockdown phase a steam of news (both true and fake) ran on social networks regarding the virtuous behaviors (including diet) capable of making people more resistant to COVID 19.⁶

We created a specific scale to measure the conspiracist attitudes towards Covid-19 that have been inspired by the Conspiracy Mentality Questionnaire (CMQ – Bruder et al., 2013) and the Generic Conspiracist Beliefs scale (GCB – Brotherton et al., 2013). While these two scales are general measures of personal conspiracist tendency, our scale focuses specifically on the COVID-19 crisis and was composed by eight items presenting different potential origin of the COVID-19 virus and the respondents were asked to state how likely they believe that the statements were true. This scale is called Conspiracist Attitudes towards COVID-19

⁵ Unlike the attitude effect, we did not combine the two indicators with a clustering. The area variable captures several local factors affecting purchasing decision, including for example different consumption habits or heterogeneity in social characteristics. Including the area variable in a clustering algorithm would reduce the precision of the information greatly.

⁶ The growing literature about the COVID-19 infodemic and its effect on consumer behavior goes beyond the scope of this paper. Interested readers can refer for example to Hua and Shaw (2020) and related literature. About the intersection between the infodemic and conspiracy theory see for example Georgiou et al. (2020).

(CA-COV) and it is presented in Table A1 in the appendix. The CA-COV scale is composed by eight statements represent conspiracist (1, 3, 4, 5, 8 indicated with C) and not conspiracist (2, 6 and 7 - indicated with NC) explanations for the COVID-19 disease.

Several contributions to the literature found that the mental and emotional mood during the lockdown can affect food purchasing decision (e.g., Di Renzo et al., 2020; Scarmozzino and Visioli 2020; Ammar et al., 2020). To explore the consumers' feelings during the pandemic, the Italian validated version of the Scale of Positive and Negative Experience was used (SPANE - Giuntoli et al., 2017; Diener et al., 2010). The SPANE scale is widely used to evaluate general and specific sentiments. To make the scale more informative and credible, each respondent stated their condition referring to what (s)he felt in the in the last month as explained in Table A2 in the appendix. SPANE offers different scoring options; in the present paper we calculate typical two scores used to infer positive (SPANE-P) and negative (SPANE-N) feeling. The values are calculated by adding the scores of the six positive items (positive, good, pleasant, happy, joyful, and contented) or the six negative items (negative, bad, unpleasant, sad, afraid, and angry) respectively.

A specific section of the questionnaire focused on the individual conspiracist attitudes towards COVID-19 and feelings during the lockdown using the CA-COV scale and the SPANE scale respectively. The scales are composed by two constructs each, namely the conspiracist (C-CA-COV) and not conspiracist attitudes towards COVID-19 (NC-CA-COV) and the positive (SPANE-P) and negative (SPANE-N) feelings. All these scores are calculated summing up the score of the corresponding statements. Thus, using the statements collected it is possible to calculate two scores measuring conspiracist (C-CA-COV) and not conspiracist attitudes (NC-CA-COV) respectively by summing up the scores of the corresponding items.

A multi-dimensional representation of the psychological pressure allowed us to capture heterogeneous reaction to the lockdown (e.g., Pfefferbaum and North 2020; Gualano et al., 2020). In order to summarize the four scores in a consistent description of the attitude effect, consumers were grouped into homogeneous profiles using a two-step cluster analysis. The used clustering techniques (instead of the original scale) provides an easy-to-interpret description of the attitude effect, and it makes the subjective assessment more robust to possible respondents' reporting bias by reducing the dimensions of the indicator.

2.2.4. Consumption habits and demographics

The survey provided also information about the weekly consumption of white meat before lockdown (WMC) that ranges from 1 (no consumption) to 7 (every day). Furthermore, some demographics have been collected such as the age measured in years (AGE) and gender (GEN) of the respondents, that assumes value 1 if the respondent is male and 2 if the respondent is female. Finally, consumers were asked if they have a college degree (CDR) or a family monthly income lower than € 2,000 before lockdown (LIN), both these variables are dichotomous and assume value 1 if the condition is respected, 0 otherwise.

2.3. Specification of the econometric model

In order to test the association between the psychological pressure and consumer purchasing decisions, we develop an econometric model. We assume that a consumer buys a new product if the expected utility from the basket (N) is greater than the utility from consumption of the most efficient basket (H) composed only of products that have been experienced before. Noticeably, the choice is conditional to a set of *shopping conditions* including product availability (e.g., access to different retailers, available assortment, etc.), personal income and all other exogenous factors affecting consumption decisions.

The COVID-19 emergency can affect the consumption decisions in two ways. Firstly, the lockdown can affect the shopping conditions: for example, stores and products may become unavailable due to movement restrictions or consumers may suffer for sharp reduction in income and

wealth. Secondly, psychological factors, such as stress, restriction or fear of contagion, may influence consumers' decision to try new food. For example, they might be keener to try new food as a form of comfort or – on the contrary – they might prefer avoid the risk of innovation during such challenging period.

Define the expected utility gain (*EUG*) of consumer *i* from trying basket *N* conditional to the lockdown shopping condition *L* as:

$$EUG_i(NL) = E[U_i(NL)] - U(HL)$$

so that we expect that

$$NEWFOOD_i = 1 \text{ if } EUG_i(NL) > 0$$

and

$$NEWFOOD_i = 0 \text{ if } EUG_i(NL) \leq 0.$$

The conditional probability that for consumer *i*, given a vector of observable explanatory variables X_i we observe $NEWFOOD_i = 1$ is given by:

$$p(NEWFOOD_i = 1 | X_i) = p(\alpha' X_i + \varepsilon_i > 0 | X_i) \quad (1)$$

where α is a parameter vector to be estimated, ε_i is a heteroskedastic error term. The probability is assumed to be normally distributed. The conditional probability of $NEWFOOD_i = 0$ is equal to $1 - p(NEWFOOD_i = 1 | X_i)$, being the two events exhaustive and mutually exclusive.

It must be noted that the survey provided a set of possible explanatory variables that do not include information about shopping conditions such as reduced retailers and product availability. Therefore, the effect of these variables is captured by the error term.⁷

After the lockdown, consumer *i* keeps on buying the new product if basket *M*, defined as the utility maximizing basket including the new product, is weakly preferable to basket *K*, defined as the utility maximizing basket without the new product, given the post-lockdown shopping condition *PL*. Note that *M* and *K* may or may not coincide con *N* and *H*, respectively. So that we have:

$$KEEPNEW = 1 \text{ if } U_i(MIPL) \geq U_i(KIPL)$$

and

$$KEEPNEW = 0 \text{ if } U_i(MIPL) < U_i(KIPL)$$

The conditional probability that we observe $KEEPNEW_i = 1$, given a vector of observable explanatory variables X_i and given that consumer *i* bought a new product during the lockdown, is defined as:

$$p(KEEPNEW = 1 | X_i, NEWFOOD = 1) = p(\beta' X_i + \nu_i > 0 | X_i, \alpha' X_i + \varepsilon_i > 0) \quad (2)$$

The expected correlation between ν_i and ε_i provides a justification for our choice of controlling for endogenous selection problems.

3. Results

In this section, we present the results of the empirical analysis. First, we illustrate the outcome of the cluster analysis summarizing the attitude effect. Then, we report an explorative statistics of the variables *NEWFOOD* and *KEEPNEW*, measuring innovation in purchasing decisions. Finally, we report the outcome of the econometric model.

⁷ We maintain the assumption that the omitted variables are uncorrelated to the *X*'s in the dataset. We support this assumption noting that the consequences of a national lockdown are expected to be independent of the individual characteristics that are described in *X*.

3.1. The cluster analysis on the conspiracy attitudes

The appendix reports the results for CA-COV scale (Table A3) and the SPANE scale (Table A4) with a brief comment. Given these first results, a two-step Cluster Analysis was performed using the four scores obtained from two-items scales, to control for the presence of homogeneous groups among consumers with different conspiracist attitudes towards COVID-19 and experienced different feelings during the lockdown phase. Three clusters were found using the two-step algorithm. ANOVA was used to compare the mean scales' score between groups. In Table 1 the results of this analysis show that the null hypothesis of all scores' mean equality must be rejected by *F*-test and clearly represent the differences that helped us to classify the different clusters in the sample.

The first cluster (28.73% of the sample, $n = 131$) contains consumers that has been classified as *Depressed conspiracy theorists*, because they present the highest level of conspiracist attitudes (21.87) and negative feelings during the lockdown phase (21.31). The second cluster (43.20% of the sample, $n = 197$) is the biggest identified cluster in the sample and contains the so-called *Serene conspiracy theorists*. Like the first clusters, these respondents show quite high mean value for conspiracist attitudes toward COVID-19 (17.48), however they show the highest score in the sample for positive feeling (21.69). Finally, we described the third cluster (28.07% of the sample, $n = 128$), described as the *Not conspiracy theorists*. Consumers pertaining to this cluster, in fact show the highest score for the Not conspiracist attitudes index (13.08) and the lowest score the Conspiracist attitudes index (11.82) respectively. They cannot be classified as depressed or serene, because their SPANE-P (18.01) and SPANE-N (18.16) are very close to the mean of the whole sample.

3.2. Innovative vs non-innovative consumers during COVID-19 crisis

In this section, we provide descriptive statistics of the survey variables *NEWFOOD* and *KEEPNEW*, describing changes in consumption during the COVID-19 emergency and the planned future behavior. Our research hypothesis is a statistical association between the variable *KEEPNEW* and the variables measuring the COVID-19 psychological pressure. We speculate that the way a consumer lived the COVID-19 emergency might impact food purchases in the medium or long run.

The dataset included 127 observation of consumers who stated that they bought new products during the lockdown ($NEWFOOD = 1$). Seventy-six of them (59.8%) stated that they expect to keep buying at least some of those products in the future ($KEEPNEW = 1$), the rest have no intention to continue the purchase. Table 2 investigates the association between the variable *KEEPNEW* and those describing the consumer's experience with COVID-19. In the interpretation of the results, we maintain a 90% confidence level threshold for claiming statistical significance throughout the paper. P-values of the test statistics are reported for the readers interested in a precise assessment.

The χ^2 tests of pairwise association between *KEEPNEW* and the cluster and consumer location failed to reject the null hypotheses of independence (Panels A and B in Table 2, respectively). A t-test did not detect any statistically significant difference in the mean value of the variable *COVIDPER* between consumers who keep and do not keep the new product (Panel C in Table 2). Apparently, we have no association between the variables measuring the COVID-19 experience and the medium/long run decision to change diet.

These direct measures of association consider the subsample of consumers who bought at least one product. However, it must considered that the selection is not random, because the decision to keep a new product can be safely assumed to be correlated with the decision to buy it in the first place. Without the first purchase, the permanent change in diet would not be possible. Table 3 illustrates the association between *NEWFOOD* and the variables defining the COVID-19 psychological pressure. In this case, we found a positive association with the cluster and the subjective threat perception (*COVIDPER*).

Table 1. Clusters' average scores.

	Total sample n = 456	Cluster 1 n = 131 28.73%	Cluster 2 n = 197 43.20%	Cluster 3 n = 128 28.07%	F statistics (F-test)
Conspiracist attitudes towards Cov-19	17.15	21.87 ^a	17.48 ^b	11.82 ^c	94.175***
Not conspiracist attitudes towards Cov-19	11.97	12.59 ^a	10.84 ^b	13.08 ^a	17.647***
Positive feelings	18.38	13.78 ^a	21.69 ^b	18.01 ^c	301.967***
Negative feelings	16.60	21.31 ^a	12.45 ^b	18.16 ^c	372.232***
Cluster classification		Depressed conspiracy theorists	Serene conspiracy theorists	Not conspiracy theorists	

Significance levels: ***p < 0.001; **p < 0.010; *p < 0.050.

^{a, b, c} Indicate significantly different means using one-way ANOVA and post hoc Dunnett T3 multiple comparison test (equal variances not assumed).

Table 2. Association between the decision to keep a new product in the shopping basket (KEEPNEW) and the variable measuring the COVID 19 experience.

Panel (A)	KEEPNEW (Frequencies)		Total	
CLUSTER	0	1		
Depressed conspiracy theorists	12	16	28	
Serene conspiracy theorists	18	30	48	
Not conspiracy theorists	21	30	51	
Total	51	76	127	
Pearson's	$\chi^2_{(2)} =$	0.248		
	p-value =	0.883		
Panel (B)	KEEPNEW (Frequencies)		Total	
AREAS	0	1		
North-West	16	25	41	
North-East	12	12	24	
Central Italy	6	16	22	
South	8	14	22	
Islands	9	9	18	
Italy	51	76	127	
Pearson's	$\chi^2_{(4)} =$	3.366		
	p-value =	0.498		
Panel (C)	KEEPNEW	Obs	COVIDPER	
			Mean	Std. Err.
	0	51	4.529	0.466
	1	76	4.526	0.364
	Combined	127	4.528	0.286
	Difference		0.003	0.592
	t-stat =	0.005		
	p-value =	0.996		

The result confirms that the assessment of the medium/long term effect of the COVID-19 experience cannot ignore the short-term effect. As a consequence, we must control for a possible sample selection bias in our analysis (Heckman, 1979). In order to account for the problem, we run a probit estimation of the variable KEEPNEW with a correction for sample selection (Van de Ven and Van Pragg, 1981).

3.3. Estimation of the econometric model

We estimated the probability of buying new food (NEWFOOD = 1) and keeping the new food after the lockdown (KEEPNEW = 1) jointly. To this purpose, we used a probit regression with endogenous sample selection according to the specification by Van de Ven and Van Pragg (1981). In this approach, the results of the first-step probit regression of NEWFOOD were used to correct the model for KEEPNEW, obtaining unbiased estimates. The estimation was performed using the *heckprobit* procedure in Stata Statistical Software (StataCorp LLC, College Station, TX).

Table 4 reports the results of the joint estimation of the variables NEWFOOD and KEEPNEW. A Wald test rejected the null hypothesis of uncorrelated error terms with a p-value less than 0,001, confirming the endogenous selection. The regressions have been estimated using clustered robust standard errors, with clusters centered on the five geographical Areas.

The regressions supported our hypothesis that the COVID-19 threat perception affects the decision of buying new products. The coefficients of COVIDPER are statistically different from zero. High perceived probability of having COVID-positive friends and family are associated with high probability of buying new products and low probability of keeping the innovation in the long run. A 10 per cent point increase in the perception of the likelihood of having a relative or friend infected is expected to increase the probability of buying at least a new product by 2.3 per cent points, keeping all other variables constant at the mean. The same variation is associated with a reduction of .8 per cent points in the probability of keeping the new product in the basket after the lockdown. Area coefficients are statistically different from zero as well. Consumers in North-West Italy (where the epidemic was more severe) are expected

Table 3. Association between the decision buy a new product during the lockdown (NEWFOOD) and the variable measuring the COVID 19 experience.

Panel (A)		NEWFOOD (Frequencies)		Total
CLUSTER		0	1	
Depressed conspiracy theorists		103	28	131
Serene conspiracy theorists		149	48	197
Not conspiracy theorists		77	51	128
Total		329	127	456
Pearson's		$\chi^2_{(2)} =$	13.088	
		p-value =	0.001	
Panel (B)		NEWFOOD (Frequencies)		Total
Areas		0	1	
North-West		101	41	142
North-East		49	24	73
Central Italy		62	22	84
South		82	22	104
Islands		35	18	53
Italy		329	127	456
Pearson's		$\chi^2_{(4)} =$	4.413	
		p-value =	0.353	
Panel (C)		COVIDPER		
NEWFOOD	Obs	Mean	Std. Err.	Dev. Std.
0	329	3.410	0.153	2.777
1	127	4.528	0.286	3.224
Combined	456	3.721	0.138	2.948
Difference		-1.117	0.324	
t-stat =	-3.443			
p-value =	0.001			

Table 4. Results of probit estimation with endogenous selection.

	NEWFOOD				KEEPNEW			
	Coeff.	St. Err.	p-Val	Marg. Eff.	Coeff.	St. Err.	p-Val	Marg. Eff.
AGE	-0.027	0.004	0.000	-0.009	0.014	0.006	0.011	0.002
GEN	0.008	0.051	0.876	0.014	-0.084	0.076	0.267	-0.014
CDR	0.171	0.198	0.387	0.048	0.242	0.166	0.145	0.041
LIN	-0.170	0.116	0.142	-0.065	0.105	0.220	0.633	0.018
WMC	-0.184	0.084	0.028	-0.059	0.202	0.108	0.061	0.034
CLUSTER								
Serene conspiracy theorists	0.061	0.107	0.568	0.019	-0.057	0.230	0.803	-0.009
Not conspiracy theorists	0.379	0.059	0.000	0.117	-0.313	0.070	0.000	-0.056
COVIDPER	0.082	0.023	0.000	0.023	-0.047	0.016	0.003	-0.008
AREAS								
North-East	0.259	0.050	0.000	0.087	-0.247	0.055	0.000	-0.051
Central	0.104	0.039	0.008	0.026	0.223	0.104	0.032	0.035
Southern	-0.152	0.055	0.006	-0.051	0.287	0.105	0.006	0.043
Islands	0.230	0.063	0.000	0.060	-0.184	0.056	0.001	-0.037
Constant	1.058	0.332	0.001		-0.199	0.567	0.726	

to be less keen to innovate consumption than those in other areas (except Southern Italy). The areas coefficients in the KEEPNEW regression exhibited coefficient signs that are difficult to interpret. Once we controlled with threat perception, the effect of area variables seems to be unable to support clear conclusion. The result was expected because of the many local drivers that are captured by the area variables.

The model supports the conclusions that the attitude effect affects the purchasing decision as well. *Serene conspiracy theorists* on average are more likely to innovate and less likely to keep the innovation than *Depressed conspiracy theory*. The result suggests that the mood during the emergency can affect purchasing behavior during and after the lockdown. Not conspiracy theorists are less likely to keep the innovation after

the lockdown, but the model failed to provide evidence of distinctive behavior during the lockdown.

The econometric model, confirmed that the COVID-19 threat perception affects the decision of buying new products, with high perceived probability of having COVID-positive friends and family associated with high probability of buying new products and low probability of keeping the innovation in the long run. Furthermore, the model supports the conclusions that the attitude affects the purchasing decision as well, suggesting that the personal feeling during COVID-19 crisis can affect consumer's purchasing behavior during and after the lockdown.

Notably, consumers with higher rate of consumption of white meat are less likely to innovate, but – if they do – are more likely to keep the

new product after the lockdown. A similar result is found for elder consumers. The common pattern is consistent with a conservative approach to innovation of consumers that are concerned with health issues. However, further research is needed to substantiate this speculation.

4. Discussion and conclusions

In a competitive system, there are several factors determining the level of innovation. Among these, a key role is played by consumer demand for new products. Our results support the conclusion that exceptional events, such as COVID-19 pandemic, affects such demand. This result is consistent with existing literature (e.g., Sidor and Rzymiski 2020).

This effect was characterized by Porter (1990) as the “chance factor”, that is an unpredictable event that flexible firms may exploit to capture new profit opportunities, while others fail to adapt to the new environment. In this setting, the understanding of the factor driving the demand for new products is a key competitive advantage for firms.

A key result of the analysis is the switch in the signs of almost all coefficients between the two regressions. Only the binary variable identifying consumers in Central Italy have the same sign in the two regressions (possibly because of specific local conditions). This result is consistent with two opposite approach to the purchase of new food. *Impulsive approach* is associated to a higher likelihood than average to buy new products under the lockdown, a lower likelihood to keep them in the basket once the emergency is over. The *reflective* approach, on the opposite, is based on a lower probability to buy new products, but higher likelihood to keep the innovation in the long run.

Impulsive approach is associated with young consumers who perceive a high COVID 19 threat and have no dietary issues (low consumption of white meat). Psychological pressure is a behavioral driver as well. Threat perception might induce innovation, but the effects are expected to fade away once situation reverts to normal. The analysis of the attitude effect concludes that *Not-conspiracy-theory* consumer mood exhibits an association with impulsive approach. The result is consistent with the observed behavior between the first and the second wave of contagion (summer 2020), when young Italians reverted to pre-COVID 19 habits quite rapidly.

Conservative innovation is associated to elder consumers with dietary issues who are not concerned about contagion and have a conspiracist attitude. These consumers are more cautious when deciding whether to buy a new product or not, but such consideration may result in a higher probability of keeping the innovation in the long run.

Our analysis suggests that psychological pressure and consumer characteristics must be considered in the design of marketing strategies facing the changes in demand due to the COVID 19 emergency. Firms targeting young consumers may expect short-lived behavioral changes. Instead, elder consumers are more likely to adopt changes in the long run.

The results from this study have implications for both the literature and for practice. From the literature side, our findings provide the first description of the propensity to keep the changes in food purchasing

choices even after the lockdown. On the practice side, our results could help companies in understanding consumers' behavior in order to identify new trends and possible long-term implications. Data suggest that high psychological pressure is associated with impulsive behavior. It might induce short-lived innovation. As a consequence, it might be unwise to plan permanent marketing strategies based on consumer behavior during the emergency. However, the empirical model finds that market segmentation is possible on multiple dimensions. We found that, on average, older consumers have a more conservative behavior than younger one. Also, non-conspiracist are, on average, more impulsive than conspiracist consumers. This result suggests that consumers' overall attitude must be considered in the design of marketing strategies facing the changes in consumer behavior. However, further research is needed to achieve a complete profiling of consumers with a long-term effect of psychological pressure.

The main limitation of the present research is related to the use of secondary data. On consequence, the econometric model suffered from data limitations. For instance, the survey does not included information about shopping conditions and product availability and the lack of some targeted information may limit the interpretation of the results obtained. Further analysis with a questionnaire designed *ad hoc* may better validate the interpretation given to our data and the resulting deductions described in this paper.

Declarations

Author contribution statement

Mariarosaria Simeone and Carlo Russo: Analyzed and interpreted the data; Wrote the paper.

Eugenio Demartini, Maria Elena Marescotti and Anna Gaviglio: Conceived and designed the experiments; Wrote the paper.

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Data availability statement

The data that has been used is confidential.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix

According the analysis, the most endorsed conspiracist theories by our Italian sample are that the Governments are purposely concealing the truth about the coronavirus (47.59%) and that the virus has been created in a laboratory and then spread outside because of a human error (42.54%). On the

Table A1. The Conspiracist Attitudes towards Covid-19 scale (translated from Italian)

Please indicate the degree to which you believe each of the following statements about the new coronavirus is likely to be true using the proposed scale that ranges from 1 (=Certainly not true) to 7 (=Certain).

		Certainly not true			Not sure	Certain		
		1	2	3	4	5	6	7
1	The most important Countries of the work agree in concealing the truth about the virus origin - C	1	2	3	4	5	6	7
2	The virus originated from a not intended contact between humans and some bats species - NC	1	2	3	4	5	6	7
3	Governments purposely present the negative effects of Covid-19 on human health worse than what they actually are - C	1	2	3	4	5	6	7
4	The virus has been created in a laboratory and then spread outside because of a human error - C	1	2	3	4	5	6	7
5	A powerful Country purposely created the virus for military purposes - C	1	2	3	4	5	6	7
6	The virus originated because someone ate infected bat meat - NC	1	2	3	4	5	6	7
7	The virus spreads easier in the most polluted areas of the world - NC	1	2	3	4	5	6	7
8	The virus spreads easier where 5G instruments have been installed - C	1	2	3	4	5	6	7

Table A2. The Scale of Positive and Negative Experience (SPANES)

Please think about what you have been doing and experiencing during the past 4 weeks. Then report how much you experienced each of the following feelings, using the scale below.

		Very rarely or never	Rarely	Sometimes	Often	Very often or always
1	Positive	1	2	3	4	5
2	Negative	1	2	3	4	5
3	Good	1	2	3	4	5
4	Bad	1	2	3	4	5
5	Pleasant	1	2	3	4	5
6	Unpleasant	1	2	3	4	5
7	Happy	1	2	3	4	5
8	Sad	1	2	3	4	5
9	Afraid	1	2	3	4	5
10	Joyful	1	2	3	4	5
11	Angry	1	2	3	4	5
12	Contented	1	2	3	4	5

Table A3. Conspiracist and Not conspiracist attitudes towards COVID-19

	Certainly not true 1	2	3	Not sure 4	5	6	Certain 7	Mean	St. Dev.
	%	%	%	%	%	%	%		
Conspiracist attitudes towards COVID-19 (C-CA-COV)									
The most important Countries of the work agree in concealing the truth about the virus origin	14.47	8.77	8.55	20.61	16.01	14.25	17.32	4.27	1.99
Governments purposely present the negative effects of COVID-19 on human health worse than what they actually are	21.71	12.94	17.54	22.59	11.40	6.36	7.46	3.38	1.82
The virus has been created in a laboratory and then spread outside because of a human error	17.11	10.09	6.80	23.46	16.67	14.25	11.62	4.02	1.95
A powerful Country purposely created the virus for military purposes	23.90	14.25	10.09	26.32	10.31	8.77	6.36	3.37	1.86
The virus spreads easier where 5G instruments have been installed	51.75	17.32	7.46	17.98	2.41	2.19	0.88	2.12	1.45
Not conspiracist attitudes towards COVID-19 (NC-CA-COV)									
The virus originated from a not intended contact between humans and some bats species	11.18	9.21	9.65	26.54	19.52	17.32	6.58	4.12	1.72
The virus originated because someone ate infected bat meat	21.49	10.09	11.18	27.63	14.47	10.96	4.17	3.53	1.79
The virus spreads easier in the most polluted areas of the world	10.09	7.46	6.58	28.73	20.61	16.89	9.65	4.32	1.71

Table A4. Positive and negative feelings during the COVID-19 lockdown

	Very rarely or never 1	Rarely 2	Sometimes 3	Often 4	Very often or always 5	Mean	St. Dev.
	%	%	%	%	%		
Positive feelings (SPANE-P)							
Positive	5.04	17.98	40.79	32.46	3.73	3.12	0.92
Good	1.32	10.31	36.62	43.86	7.89	3.47	0.83
Pleasant	2.63	17.32	41.45	34.87	3.73	3.20	0.86
Happy	8.33	21.27	41.67	24.34	4.39	2.95	0.98
Joyful	7.68	28.29	42.32	18.86	2.85	2.81	0.93
Contented	7.89	25.44	44.08	20.18	2.41	2.84	0.92
Negative feelings (SPANE-N)							
Negative	7.24	26.75	30.70	30.92	4.39	2.98	1.02
Bad	24.12	34.43	28.95	10.75	1.75	2.32	1.01
Unpleasant	14.04	35.75	30.48	17.11	2.63	2.59	1.01
Sad	9.43	19.52	36.84	27.41	6.80	3.03	1.06
Afraid	16.23	21.93	33.99	21.49	6.36	2.80	1.14
Angry	11.40	22.37	37.06	24.34	4.82	2.89	1.05

other hand, almost half of the respondents think that it is likely that the coronavirus originated from a not intended contact between humans and some bats species (43.4%) and that it spreads easier in the most polluted areas of the world (47.15%), which were not proved phenomenon at the time the data collection was carried out, however were presented as possible scientific explanation for the pandemic origin and circulation. Considering self-reported feelings, on the average the respondents seem to have experienced more positive than negative emotion during the lockdown. In fact, if we consider the three most endorsed positive and negative statements of the SPANE scale, consumers stated that they felt “good”, “pleasant” and “positive” often or very often during the lockdown in the 51.75, 38.60 and 36.18 per cent of the case respectively, while they felt “negative, “sad” and “angry” often or very often in the 35.31, 34.21 and 29,17 per cent of the case respectively.

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