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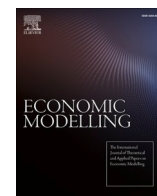
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# What drives the acceptability of restrictive health policies: An experimental assessment of individual preferences for anti-COVID 19 strategies

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## ABSTRACT

The public acceptability of a policy is an important issue in democracies, in particular for anti-COVID-19 policies, which require the adherence of the population to be applicable and efficient. Discrete choice experiment (DCE) can help elicit preference ranking among various policies for the whole population and subgroups. Using a representative sample of the French population, we apply DCE methods to assess the acceptability of various anti-COVID-19 measures, separately and as a package. Owing to the methods, we determine the extent to which acceptability depends on personal characteristics: political orientation, health vulnerability, or age. The young population differs in terms of policy preferences and their claim for monetary compensation, suggesting a tailored policy for them. The paper provides key methodological tools based on microeconomic evaluation of individuals' preferences for improving the design of public health policies.

## 1. Introduction

In economics, the notion of individual preferences is central. It is at the core of public policy evaluation. This notion has slowly but surely been incorporated into other scientific domains. For instance, one of the most famously cited papers in recent years in public health science is “Stop the silent misdiagnosis: patients’ preferences matter,” published by Mulley et al. (2012) in the *British Medical Journal*, a leading journal of medicine. The idea is that the omission of patients’ preferences among treatment choices (including the option of no treatment) is the origin of considerable welfare losses, as expected for many diagnostic errors. In the domain of epidemic control policies, many “treatments” compete with each other: confinement, travel restrictions, sectoral lockdowns (bars, restaurants, spectator events), and reductions in public transportation services. All of these cause inconvenience (disutility), although they are certainly helpful for epidemic control. The paramount discussion, of course, is about the epidemiological benefits of each

policy (Haug et al., 2020). However, local populations’ preference ordering of these policies is also critically important. Neglecting the respective degrees of acceptance—or rejection—associated with each control policy would be a form of social misdiagnosis and, more importantly, could lead to distrust and noncompliance (Nivette et al., 2021). As an indicative of the current debate, Jelnov and Jelnov (2022) have shown that a lack of trust in government is linked with a reduction in the population’s demand for vaccination.<sup>1</sup> More extensively, the need to understand the acceptance of public policies by the population is part of a broader concern to prevent any erosion of democracy (Lewkowicz et al., 2022). Indeed, in some countries, the COVID-19 pandemic has led to a decline in democracy and an increase in authoritarian tendencies (Edgell et al., 2021), and in some situations even to riots and violence against civilians (Gutiérrez-Romero, 2022).

The social and behavioral sciences can provide valuable insights for managing the COVID-19 pandemic and its impacts (e.g., Van Bavel et al., 2020). Economics is well equipped to measure economic preferences

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<sup>1</sup> In general, mistrust in government can have major consequences for the effectiveness of public policy, with lower efficiency in countries with a lower level of trust in politicians (Bargain and Aminjonov, 2020, regarding trust and mobility policies; or Guillon and Kergall, 2020, concerning trust and quarantine agreement levels).

(Müller and Rau, 2021), subjective beliefs (Harrison et al., 2022), risk perception, policy preferences in relation with political orientation (Bruine de Bruin et al., 2020), observe what affects policy preferences (Romano et al., 2020), and discuss social choices and welfare. Several methods already applied to inform policymaking on the welfare consequences of public decisions are available, e.g., surplus analysis (Currie et al., 1971; Hicks, 1941), revealed preferences (Drichoutis and Nayga, 2022; Shachat et al., 2021), stated preferences (Adema et al., 2022), and discrete choice experiments (DCE; see, e.g., Louviere et al., 2000 or Dong et al., 2020; McPhedran and Toombs, 2021; Sicsic et al., 2022 in the COVID-19 context). The present paper reports the findings of the DCE method, which we implemented to assess respondents' preference for alternative "menus" of COVID-19 control policies. A significant issue is the welfare assessment of confinement devices relative to alternative restriction strategies, softer but longer. For instance, do people prefer a radical lockdown for an additional six weeks or a longer freedom restriction in some domains of their daily lives, as restaurants closing, for an entire year? Another issue is the likelihood of adherence by specific strata of the population, e.g., the youngest or the most vulnerable, to anti-COVID-19 strategies. Lockdown measures, social distancing, and leisure place closures have suddenly changed social life and the daily routines of the populations, with a particularly high cost and no direct benefit for the youngest. The question of (monetary) compensation is therefore raised.

The study was conducted at the end of the first lockdown period during the first epidemic wave in France (March–May 2020) and before the development and administration of a vaccine. Our main findings are the following. The French population was willing to accept most restrictions and constraints imposed by the anti-COVID-19 policies of the first wave of the COVID-19 pandemic: wearing a mask, mobility restrictions, and digital tracking were well accepted. In contrast, our data reveal a strong rejection of additional weeks of confinement and an increasing aversion to confinement with its duration. We also observe a massive rejection of the closure of bars, restaurants, and festival venues. Most people do not require monetary compensation for accepting restrictions, except the young. Finally, we provide a preference ranking of some emblematic anti-COVID-19 policies, which shows that the government strategy was well accepted by all population strata.

The remainder of the paper is organized as follows. In Section 2, we introduce our empirical design and method. Section 3 presents our results. Section 4 offers a discussion and conclusion.

## 2. Empirical design and method

We managed a web-based survey among a representative sample of the French population (see Appendix 1). Online questionnaires were available for 2 weeks, from May 4, 2020 to May 16, 2020, during which 1154 respondents participated (questionnaire completed). The online application was developed using the oTree platform (Chen et al., 2016). The questionnaire was broken into several blocks, including the DCE block, which offered an extensive set of anti-COVID-19 policies. In this paper, we report our key findings from the DCE block. We also rely on a few demographic variables (e.g., gender and age) from another block.

The DCE methodology elicited individuals' preferences for various attributes (Hensher et al., 2015) (attributes of prophylactic strategies, in our case). This method has been frequently applied in the health domain, particularly for adopting alternative medical treatments with various side effects as attributes (de Bekker-Grob et al., 2012; Ostermann et al., 2020). In our study, choice options were framed as "menus" of anti-COVID-19 policies. Two options were presented at a time

representing a scenario, and individuals were asked to select one of them. Each participant participated in three scenarios, which varied across individuals. The attributes of the choice options were the different prophylactic measures possibly applied, sometimes at various levels (e.g., *No mask* (level 0); *Mask in public places* (level 1); *Mask in all circumstances* (level 2)). Each option was made of an integrated set of prophylactic measures. Some of them corresponded to an emblematic anti-COVID-19 national strategy, such as the one of the French government or the US administration.

### 2.1. Attributes

The list of attributes was determined in April 2020 after an attentive consideration of the debates in the press and following a discussion with public health experts, particularly at the *Observatoire Régional de la Santé*.<sup>2</sup> These attributes did not lose their relevance so far: mask (three levels), restrictions in bars, restaurants, and festival venues (two levels), restrictions on leisure travel (three levels), adaptation in the public transportation system (two levels), digital tracking (two levels), monetary compensation (four levels), and additional weeks of confinement (three levels). A detailed description of the attributes and their levels is provided in Table 1. From all the possible combinations of the levels of these seven attributes (i.e., a full factorial design consisting of 864 possible combinations), we selected 84 options (with a D-efficiency of 83% for main effects and first-order interactions), which we divided randomly into 42 scenarios (hence, each scenario included two options, A and B). Each respondent chose three consecutive options from three randomly selected scenarios. Fig. 1 provides a screenshot of a typical decision screen (translated from French).

Based on the random utility theory of Luce (1959), we studied the determinants of our 3462 binary choices (3 scenarios  $\times$  1154 respondents) using the conditional logit model (see Appendix 2). Our target variables are (1) *Extended lockdown*, (2) *Masks*, (3) *Bars, restaurants, and festival venues closed*, (4) *Public transportation adapted to work hours*, (5) *Travel restrictions*, (6) *Tracking system*, and (7) *Monetary compensation*. These variables, and their corresponding labels, are summarized in Table 1. After testing for various specifications, we estimated our model using the functional form of equation (1):

$$X' \beta = \beta_1 (EXTD-LOCKDOWN)^2 + \beta_2 MASK-PUBLIC + \beta_3 MASK-EVERYTIME + \beta_4 RESTO-SUMMER + \beta_5 TRANSP-ADAPTED + \beta_6 TRAVEL-FR + \beta_7 TRAVEL-100KM + \beta_8 TRACKING + \beta_9 BONUS. \quad (1)$$

We estimated the conditional logit model of equation (1) by maximum likelihood. In our initial estimations of the model, we controlled for some characteristics of the respondents, e.g., age, gender, and date of the survey, for the general population. None of these variables affected the signs and the magnitudes of the coefficients  $\beta$ .

### 2.2. Selected prophylactic strategies

The DCE model can be used to rank acceptability, which we define as the probability of selecting a given package of policies. We identified six integrated programs based on some "emblematic" public health strategies. First, we considered the set of measures deployed by the French government, which we call "*Government strategy*." An alternative to the former strategy is provided by an extension of confinement for three more weeks, for which we consider two variants: without compensation ("*Lockdown*") and with a compensation of 500€ ("*Lockdown with bonus*"). We compare these strategies to more extreme policies. At one end, we define the "*Laissez-faire*" strategy, which imposes no constraint

<sup>2</sup> ORS PACA (Marseille), [www.orspaca.org](http://www.orspaca.org).

**Table 1**  
Variables and corresponding labels used in equation (1).

Variable	Label	Type	Levels/Values	Reference level
(1) Extension of lockdown	EXTD-LOCKDOWN	Quantitative	0, 1, or 3 weeks	/
(2) Mask	NO MASK MASK-PUBLIC MASK-EVERYTIME	Qualitative	Three levels	NO MASK
(3) Bar, restaurants, and festival venues closed	UNTIL MID-JUNE RESTO-SUMMER	Qualitative	Two levels	UNTIL MID-JUNE
(4) Public transportation adapted to work hours	NORMAL TRANSP TRANSP ADAPTED	Qualitative	Two levels	NORMAL_TRANSP
(5) Travel restriction	NO RESTRICTION TRAVEL_FR (restricted to France) TRAVEL_100 KM (restricted to 100 km)	Qualitative	Three levels	NO RESTRICTION
(6) Tracking system	NO DIGITAL_TRACKING TRACKING	Qualitative	Two levels	NO_DIGITAL_TRACKING
(7) Monetary compensation	BONUS	Quantitative	0 €, 500 €, 1500 €, 2200 €	/

and foresees no prophylactic measures. At the other end, we define the “*Maximalist*” scenario, where all prophylactic measures are at their maximum (except lockdown). Finally, we also consider the most preferred public health policy, named *Max-U*, which hereafter is defined by the set of attribute levels giving the maximum utility to the whole sample, i.e., to the “average representative French population.”

Note that the programs based on lockdown extension present a radical alternative to the other prophylactic measures that would effectively combat virus replication. The *Laissez-faire* program, akin to the US Trump government policy, is the exact opposite of the *Maximalist* policy, the most restrictive (i.e., liberticide) policy. We take the *Maximalist* policy as a benchmark for estimating the likelihood of choosing each alternate policy. The *Max-U* policy was identified thanks to the estimated coefficients of our regression model, as explained in the result section.

### 3. Results

#### 3.1. Representativeness

As a preliminary step, we check whether our survey sample (CONFINOBS) reproduces the composition of the French population. Fig. 2 compares the data obtained with our sample to the National Institute of Statistics and Economic Studies data.

Statistical tests demonstrate that our sample represents regions but is weakly unbalanced in gender and age composition (see Appendix 1, Table A for detailed tests and Figure A for additional comparisons).

#### 3.2. DCE estimates

Table 2 reports our DCE estimates for the entire population and several subsamples: vulnerable, young, poor, elderly, women, and those on the political right.<sup>3</sup> Clinical vulnerability was defined by two conditions: vulnerable oneself or living with a vulnerable person. These conditions were elicited through self-reported questions.<sup>4</sup>

Among the general population, the attribute “Extension of lockdown” is generally poorly accepted: the scenarios that include it are associated with a reduction in their probability of selection. We also note

<sup>3</sup> As our DCE is unlabeled, marginal effects are not relevant to present here. The reader can refer to Appendix 3 for details on the calculation of MEMs for each policy attribute on the choice probability. Table B reports the estimated MEMs for the whole sample.

<sup>4</sup> The exact wording of the two questions (translated from French) was:(a): « Do you have a chronic illness or a health problem that could make you fear developing a severe form of COVID-19? » (Yes/No/I do not know).(b): « Do you live with an elderly person or with someone who has a health problem that might cause them to fear developing a severe form of COVID-19? » (Yes/No).

that the best statistical fit for this variable is a quadratic form: the negative effect increases more than proportionally with the number of additional weeks of confinement—for example,  $-0.024$  for one week,  $-0.216$  for three weeks, and  $-1.54$  for eight weeks.<sup>5</sup> This effect is also pronounced for those who identify as politically conservative ( $-0.055$ ). Conversely, this is not the case for people in a COVID-19 vulnerable situation (Columns 2–4): the coefficient is low and nonsignificant for both own vulnerability and living with a vulnerable person. Wearing a mask in public locations is very well accepted. But it is less unanimously chosen when it is extended to every place and time. The same stands for leisure travel: restrictions are accepted but not when they are strong (less than 100 km from home). The closure of bars, restaurants, and festival venues is universally rejected at a greater magnitude when the population is young. The population generally is in favor of public transportation adapted to working hours. Digital tracking is accepted but in distinctly different ways depending on the population category: young people are hostile to it ( $-0.430$ , which is a strong disagreement, of the same magnitude as “bar, restaurant, and festival venues closed”). Finally, the proposal of monetary compensation does not attract choices; it would even tend to push people to refuse the options (the coefficient is negative and significant for women, vulnerable, or living with a vulnerable person, the elderly, or a politically conservative person). We note, however, that the scenarios with financial transfer seem to appeal to the youngest ( $+0.252$ ). On the whole sample scale, monetary compensation negatively affects the choice of a scenario that would include this type of incentive.

#### 3.3. Preferences ranking of policies for various population sub-groups

Based on the regression model, we could determine the “most preferred scenario” by the general population, i.e., the *Max-U* scenario: no more lockdown, mask in public places, bars and restaurants opened, public transportation adapted to working hours, leisure travel restrained to France only, and access to digital tracking. We compare the *Max-U* scenario to four other emblematic public health policies discussed in Section 2: the *Government strategy*, *Lockdown*, *Lockdown with bonus*













<sup>5</sup> Using the whole population, the model with the quadratic term for additional weeks of lockdown is preferred to the model with the linear counterpart (both of them has the same number of degrees of freedom, or number of parameters, i.e., 10) following several criteria: higher log-likelihood value ( $-2200$  vs  $-2210$ ), higher pseudo- $R^2$  ( $0.079$  vs  $0.078$ ), lower Akaike information criterion ( $4429$  vs  $4431$ ), and lower Bayesian information criterion ( $4490$  vs  $4492$ ). We also run a model with two dummies for additional weeks of lockdown (1 and 3 weeks). This model, with higher degrees of freedom (11), does not however give a better performance than the presented model: it delivers equal values for log-likelihood, pseudo- $R^2$ , and AIC, but higher BIC ( $4497$  vs  $4490$ ).

# Part 2

## Situation 1 over 3

Read again the explanations

Please choose the option that you prefer among the two given in the table below (Option A or Option B).

	Option A	Option B
Lockdown extension	No extension	Three weeks extension
Wearing mask	 Mandatory, but only in public gathering places (shops, transport ...) 	 Non mandatory 
Closing of cafés, restaurants and festive places	 Closing until mid June 	 Closing all summer 
Functioning of daily public transport (urban and regional)	 Reduced but adapted to working hours 	 Normal 
Vacation and leisure travels	 Restriction to metropolitan France 	 No restrictions 
Stop Covid tracking device	 Implementation with free participation 	 Implementation with free participation 
Financial compensation per household	 500€ 	 1500€ 
Your choice	<input type="radio"/>	<input type="radio"/>

Next

Fig. 1. Screenshot illustrating a typical scenario involving two choice options, A and B.

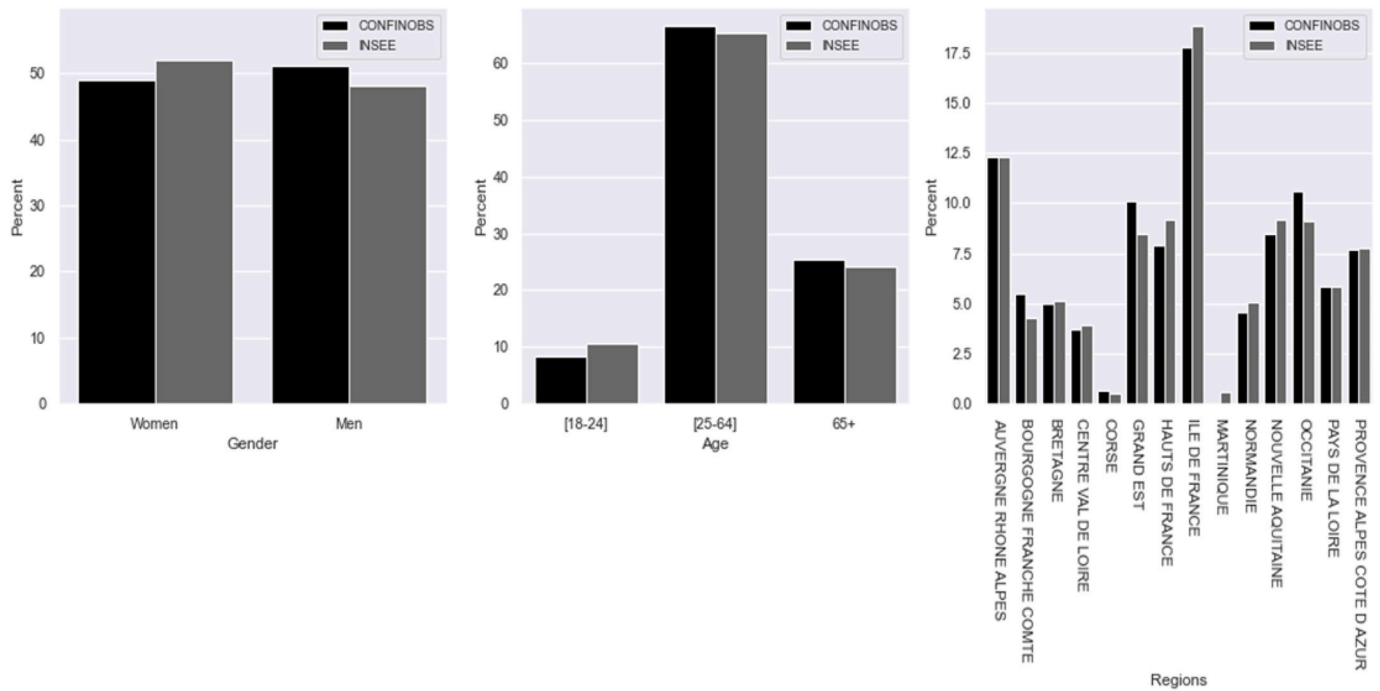


Fig. 2. Sample characteristics (gender, age, and location) compared with the national population.

Table 2  
Estimation results of the DCE model.

Attributes	DCE estimated coefficients (standard errors in parentheses)								
	Whole sample	Vulnerable	Vulnerable oneself	Living with a vulnerable person	Young (18–25 years old)	Elderly (65 and over)	Women	Politically right	Poor
Extension of lockdown (quadratic shape for one unit of additional week)	<b>-0.024</b> (0.011)	-0.005 (0.018)	-0.013 (0.022)	0.019 (0.025)	-0.025 (0.035)	-0.022 (0.022)	-0.018 (0.016)	<b>-0.055</b> (0.025)	0.026 (0.041)
Masks (ref. = no mask)									
- in public locations	<b>0.860</b> (0.078)	<b>0.978</b> (0.129)	<b>0.943</b> (0.161)	<b>0.975</b> (0.174)	<b>1.045</b> (0.250)	<b>1.038</b> (0.159)	<b>0.911</b> (0.113)	<b>0.657</b> (0.176)	<b>1.285</b> (0.299)
- every time	<b>0.351</b> (0.105)	<b>0.574</b> (0.177)	<b>0.587</b> (0.218)	<b>0.503</b> (0.246)	<b>0.776</b> (0.334)	0.190 (0.212)	<b>0.673</b> (0.153)	<b>0.502</b> (0.249)	-0.126 (0.367)
Bar, restaurant, and festival venues closed	<b>-0.495</b> (0.062)	<b>-0.356</b> (0.103)	<b>-0.289</b> (0.127)	<b>-0.374</b> (0.143)	<b>-0.605</b> (0.196)	<b>-0.455</b> (0.127)	<b>-0.505</b> (0.090)	<b>-0.569</b> (0.149)	-0.377 (0.235)
Public transportation limited to working hours	<b>0.127</b> (0.058)	<b>0.191</b> (0.098)	<b>0.229</b> (0.121)	<b>0.254</b> (0.133)	-0.059 (0.183)	-0.069 (0.123)	<b>0.265</b> (0.084)	<b>0.273</b> (0.136)	0.023 (0.212)
Leisure travel (ref. = no restriction)									
- limited to France	<b>0.289</b> (0.066)	<b>0.261</b> (0.109)	<b>0.327</b> (0.133)	<b>0.327</b> (0.150)	0.163 (0.221)	0.255 (0.137)	<b>0.282</b> (0.096)	<b>0.533</b> (0.159)	-0.278 (0.239)
- limited to 100 km around	<b>-0.176</b> (0.070)	-0.124 (0.117)	0.089 (0.144)	<b>-0.316</b> (0.159)	-0.120 (0.224)	-0.235 (0.143)	<b>-0.229</b> (0.102)	0.047 (0.162)	-0.215 (0.257)
Digital tracking	<b>0.240</b> (0.067)	<b>0.222</b> (0.111)	<b>0.254</b> (0.139)	<b>0.255</b> (0.147)	<b>-0.430</b> (0.223)	<b>0.385</b> (0.136)	0.110 (0.097)	0.235 (0.153)	0.059 (0.249)
Monetary bonus (1000 euros)	<b>-0.054</b> (0.028)	<b>-0.150</b> (0.047)	-0.093 (0.058)	<b>-0.241</b> (0.062)	<b>+ 0.252</b> (0.094)	<b>-0.279</b> (0.059)	<b>-0.071</b> (0.041)	<b>-0.122</b> (0.065)	0.135 (0.113)
ASC	0.041 (0.072)	0.031 (0.119)	-0.053 (0.146)	0.225 (0.166)	-0.248 (0.237)	0.115 (0.147)	0.083 (0.105)	0.067 (0.166)	-0.019 (0.276)
Number of observations	3462	1266	828	720	330	882	1677	663	252
Log likelihood	-2200	-803	-529	-445	-208	-537	-1060	-414	-156
McFadden R <sup>2</sup>	0.079	0.085	0.078	0.108	0.090	0.115	0.085	0.084	0.106
Likelihood ratio test (p-value)	378 ( <b>&lt;0.0001</b> )	149 ( <b>&lt;0.0001</b> )	90 ( <b>&lt;0.0001</b> )	108 ( <b>&lt;0.0001</b> )	41.2 ( <b>&lt;0.0002</b> )	139 ( <b>&lt;0.0001</b> )	197 ( <b>&lt;0.0001</b> )	75.8 ( <b>&lt;0.0001</b> )	37 ( <b>&lt;0.0001</b> )
Proportion predicted with success	63.8%	64.10%	63.4%	65.3%	67.00%	67.3%	64.00%	64.00%	63.5%

Notes: ASC: alternative-specific constant. Significance at the 5% level in bold, 10% level in italics. Reading indication: (line Bar, restaurant, and festival venues closed), the estimated coefficient of -0.495 for the whole population means that the options that include the attribute “Bar, restaurant, and festival venues closed” generate a disutility of -0.495 magnitude (the coefficient measures how much the options with this prophylactic constraint were less frequently selected). This magnitude value can be compared across subpopulations and attributes (when comparable). Two variables were introduced as continuous: additional weeks of lockdown (quadratic shape) and bonus (linear shape).

(500€), and the *Laissez-faire* policy.<sup>6</sup> These programs and their characteristics (e.g., lockdown extension, masks, or travel restrictions) are summarized in Table 3. We take the *Maximalist* strategy as a benchmark, i.e., the policy for which all prophylactic measures are activated at their maximum level (except the lockdown).

Table 4 provides a quantitative assessment of the preferences of the survey sample concerning the emblematic public health policies defined in Section 2, each one compared with the *Maximalist* scenario. A probability above 0.5 and a confidence interval that does not contain 0.5 mean that the alternative policy is more likely to be chosen (or preferred) than the *Maximalist* policy. Conversely, a probability lower than 0.5 and a confidence interval that does not include this value mean that the *Maximalist* policy is preferred. For instance, the likelihood that the *entire population chooses the Government strategy* against the *Maxi-*

$$V_{Govt-Strategy}^{18-25}(\Delta BONUS) = \beta_2^{18-25} \times MASK\_PUBLIC + \beta_8^{18-25} \times TRACKING + \beta_9^{18-25} \times \Delta BONUS$$

malist scenario is 0.732.

The extension of confinement (with and without bonus) is never chosen in the general population. Besides the *Max-U* policy (which has the highest probability of being selected by definition), the *Government strategy* ranks first in the general population before the *Laissez-faire* policy. Looking at the strata, the young (18–25) and the elderly (over 65) seem to exhibit similar patterns. The elderly are almost indifferent (in probability terms) between the *Government strategy* and the *Max-U*. Overall, the choice probabilities of the various policies for the young and the elderly are quite close.

### 3.4. A monetary compensation for the young

The young (18–25) is the only category, given our strata, that favors scenarios offering monetary compensation. The DCE coefficient of the monetary bonus for the young is +0.252 and significant. The same coefficient takes the significant value of -0.279 for the elderly, who are clearly against a monetary incentive to accept constraining measures. Overall, for the general population, this coefficient is also negative. The singularity of the young concerning monetary compensations raises the issue of their acceptability of the government policy, which seems widely acclaimed by the general population. Therefore, it is interesting to question what level of monetary compensation would be required for the young to maximize their compliance with government policy.

In the remainder of this subsection, we propose a calculation of the corresponding level of monetary compensation targeting the young. More precisely, what level of monetary compensation for the young would make them indifferent between the *Government strategy* and the strategy that maximizes their utility?

Let  $V_{MaxU}^{18-25}$  denote the level of utility corresponding to the *Max-U* policy specific to the young. That is,  $V_{MaxU}^{18-25}$  is the utility-maximizing policy for the young without monetary compensation. Similarly, let  $V_{Govt-Strategy}^{18-25}$  stand for the utility of the *Government strategy* for the young. According to our estimates reported in Table 2, we have:

<sup>6</sup> It should be noted that a formal comparison between the coefficients obtained from regressions based on subgroups of population is not an easy task because of the nonlinear nature of our DCE model. Among the reasons mentioned in the literature, this comparison would be biased if the alternative-specific constant was significant (which is fortunately not our case, see Leeper et al., 2020). Another reason is related to group differences in unobserved heterogeneity making traditional tests (like Chow test) irrelevant (Allison, 1999). We thus adopt the approach based on predicted probabilities proposed by Long and Mustillo (2021) to perform comparison across subgroups.

$$V_{MaxU}^{18-25} = \beta_2^{18-25} \times MASK\_PUBLIC + \beta_9^{18-25} \times BONUS,$$

and

$$V_{Govt-Strategy}^{18-25} = \beta_2^{18-25} \times MASK\_PUBLIC + \beta_8^{18-25} \times TRACKING,$$

where the superscript 18–25 indicates the young. Note that we only rely on significant coefficients.<sup>7</sup>

By definition,  $V_{MaxU}^{18-25} \geq V_{Govt-Strategy}^{18-25}$ ; we can therefore identify the monetary compensation to be paid to the young that makes them indifferent between the *Max-U* policy and the *Government strategy*. Let us call this compensation  $\Delta BONUS$ . We can now redefine the utility of the young by taking into account the  $\Delta BONUS$ , as follows:

Equalizing  $V_{Govt-Strategy}^{18-25}(\Delta BONUS)$  to  $V_{MaxU}^{18-25}$  and solving for  $\Delta BONUS$ , leads to:

$$\Delta BONUS = -\beta_8^{18-25} \times TRACKING / \beta_9^{18-25} = -\beta_8^{18-25} / \beta_9^{18-25} = 0.430 / 0.252 = 1.706$$

If young people were to receive monetary compensation of 1706€,<sup>8</sup> they would achieve the same level of utility with the actual *Government strategy* as with the strategy maximizing their strata utility.

## 4. Discussion

We assess the reception by the general population of six preventive measures against the COVID-19 pandemic. Our study informs about individuals' preferences regarding various prophylactic measures. We do this for each measure one by one and for packages of measures, some of which correspond to actual policies. Our main purpose is to help define public health prophylactic strategies against COVID-19 that consider their acceptability to citizens. After weeks of total lockdown that were perceived as painful by most people and were economically costly, studying the level of acceptability of more subtle prophylactic measures became a necessity after May 2020, when the “delockdown” strategy was discussed. In more recent times, the second (and sometimes third) waves raging in Europe (e.g., France, Spain, the United Kingdom, or Germany) have reinforced the need for public policies to select a package of prophylactic measures that can be adopted and followed by the people for long-lasting periods. This is a condition for their repeated use by governments over time, depending on the epidemiological data (for example, on increases in incidence rates or the saturation of intensive care units) while awaiting the widespread vaccination of populations to achieve sufficient herd immunity. This study is therefore a first step that can contribute to the definition of public policies that are socially sustainable over time in the face of the COVID-19. It can be added to the new literature studying the social and political acceptability of the COVID-19 prophylactic strategies (see, e.g., Bol et al., 2021; Aksoy et al., 2020; Devine et al., 2021).

We obtained some results that, first, could inform the policymaker

<sup>7</sup> Note that tracking does not enter into the calculation of the *Max-U* utility for the young because its coefficient is negative.

<sup>8</sup> This level of monetary compensation can be interpreted as the young's WTA (compensating surplus) digital tracking, since it is the only attribute that enters into the calculation of the bonus.

**Table 3**  
Characteristics of the target policy programs for the general population.

Scenario	ASC	Ext_lockdown	Mask public	Mask Every time	Restaurants closed	Transport adapted	Travel FR	Travel 100 km	Tracking	Bonus
Lockdown	1	3	0	0	0	0	0	0	0	0
Lockdown, bonus = 500€	1	3	0	0	0	0	0	0	0	0.5
Max-U	1	0	1	0	0	1	1	0	1	0
Government strategy	1	0	1	0	0	1	0	1	1	0
Laissez-faire	1	0	0	0	0	0	0	0	0	0
Maximalist	0	0	0	1	1	1	0	1	1	0

Note: ASC = alternative-specific constant.

**Table 4**  
Preferences for emblematic health policies with the *Maximalist* benchmark for the entire population and targeted strata.

	LockdownvsMaximalist	Lockdown with bonusvsMaximalist	Max-UvsMaximalist	Government strategyvsMaximalist	Laissez- fairevsMaximalist
General population	0.434 [0.334; 0.544]	0.427 [0.327; 0.534]	<b>0.813</b> [0.762; 0.854]	<b>0.732</b> [0.676; 0.779]	0.488 [0.408; 0.565]
Female	0.449 [0.307; 0.606]	0.44 [0.297; 0.591]	<b>0.778</b> [0.689; 0.848]	<b>0.677</b> [0.590; 0.749]	0.449 [0.338; 0.559]
Poor	0.5 [0.17; 0.80]	0.5 [0.169; 0.827]	<b>0.783</b> [0.553; 0.923]	<b>0.783</b> [0.578; 0.90]	0.5 [0.235; 0.751]
Young 18–25	0.564 [0.258; 0.832]	0.595 [0.284; 0.851]	0.705 [0.475; 0.861]	<b>0.705</b> [0.521; 0.842]	0.564 [0.324; 0.794]
Elderly 65+	0.576 [0.355; 0.76]	0.541 [0.325; 0.738]	<b>0.879</b> [0.794; 0.93]	<b>0.816</b> [0.721; 0.883]	0.576 [0.414; 0.724]
Politically right	0.331 [0.149; 0.579]	0.317 [0.14; 0.55]	<b>0.778</b> [0.636; 0.878]	<b>0.673</b> [0.53; 0.788]	0.449 [0.28; 0.623]
Clinically vulnerable	0.347 [0.211; 0.515]	0.33 [0.20; 0.506]	<b>0.735</b> [0.623; 0.823]	<b>0.681</b> [0.586; 0.766]	0.347 [0.241; 0.462]
Oneself vulnerable	0.314 [0.163; 0.527]	0.314 [0.162; 0.521]	<b>0.725</b> [0.591; 0.838]	<b>0.656</b> [0.53; 0.761]	0.314 [0.198; 0.457]
Vulnerable regarding others	0.42 [0.214; 0.659]	0.391 [0.191; 0.625]	<b>0.816</b> [0.69; 0.90]	<b>0.7</b> [0.56; 0.811]	0.42 [0.263; 0.605]

Notes: Monte Carlo 90% confidence intervals (with 2000 draws) are reported in brackets (These draws were obtained from a multivariate normal distribution, with the mean and variance provided by the vector of DCE coefficients and the corresponding variance-covariance matrix). Bolded figures mean that the alternative policy is preferred. Underlined figures mean that Maximalist policy is preferred.

about the acceptability of anti-COVID-19 policies taken separately. Extra weeks of lockdown are associated with marked disutility in the general population. However, the magnitude of that disutility can change from one population group to another. For instance, vulnerable people, as well as women and the elderly, are not hostile to the extension of lockdown. The media controversy about the mask seems irrelevant.<sup>9</sup> In our representative sample, the mask is well accepted by all populations, even considering the nonvulnerable. This undoubtedly reflects a good “understanding” of this measure by the general population. In detail, the mask seems to be associated with greater utility when worn only in public places, but not everywhere and every time. Measures that restrict mobility (transport network and travel) are also fairly well accepted, and it does not appear that the subgroups accept them any differently. Travel limited to the country is well accepted too, while a public device of travel limited to 100 km tends to be associated with a disutility for the entire population, particularly for female respondents. The closure of bars, restaurants, and other places of leisure is the only measure to fight against the epidemic, which seems to arouse reluctance in the French population overall. This particular feature could be justified by the population’s attachment to French gastronomic culture and traditions. We note that this result holds even for the vulnerable populations.

Digital tracking is not seen as a constraint; quite to the contrary, options integrating this characteristic are perceived as more attractive, with the same magnitude as, for example, leisure travel restrictions limited to France. However, the young are strongly hostile to it, a largely

<sup>9</sup> In France, according to the media, there is an anti-mask lobby. This lobby is probably the result of minority groups but undoubtedly very active in terms of communication. It is not found among our participants.

unexpected result. Although perceived personal threats could play a role (Wnuk et al., 2020), this result could be explained by a particular need of this population for data protection. As this population has a high intensity of smartphone use, digital tracking can be experienced as a continuous violation of privacy. In the same way, the young population is the only category that is significantly in favor of receiving a bonus (i. e., monetary compensation) in the packages of proposed measures.

All this draws a picture of the French population that perceives the prophylactic measures relatively well, not only as constraints but also as a necessary evil. Wearing a mask, restrictions on mobility, and digital tracking are prophylactic policies that people adhere to, except when they are designed with (too much) intensity. In the same vein, the quadratic nature of the aversion to additional weeks of confinement shows that confinement is rejected even more widely when its duration is long. On this last point, we learned that vulnerable people tolerate confinement and other expected differences in preferences: a fairly strong acceptance of the mask and a low disutility when restaurants are closed. However, these differences between subpopulations remain modest. This reveals either a strong concern of the nonvulnerable toward the vulnerable (the former closely incorporate the latter’s welfare into their preferences) or a weak singularity of the vulnerable in terms of preferences.

Young people are arguably the most dissonant segment of the population regarding preferences. Interestingly, they are clearly in favor of monetary compensation. We calculated the required level of monetary compensation that would achieve the same level of utility with the actual *Government strategy* as with the strategy that maximizes their utility, to be equal to 1706€. As said, this attitude is specific to the young. (All other segments of the population reject such compensation, meaning that, except for the young, the acceptability of prophylactic



constraints does not require any kind of material compensation. Acting responsibly resembles more a categorical imperative than a commodity that could be traded off. This implies that monetary incentives to trigger compliance with the restrictions are not the appropriate tool for the general population. Worse, it could crowd out their moral motivation to act this way). However, a monetary incentive could be an efficient instrument if targeted toward the young, who would likely adhere to the restrictions if compensated. Several factors could explain their willingness to trade-off compliance for money. First, the health consequences in case of infection are more benign than for older generations. Second, they have lower revenues and lower revenue expectations (Aucejo et al., 2020), implying a higher marginal utility for current money. Third, they might feel excluded from the job market and might have developed a syndrome of “sacrificed generation.” Fourth, they may have different other-regarding preferences than other subpopulations. This result about younger individuals being less prosocial, and/or more responsive to monetary incentives, echoes some recent papers in the literature (Matsumoto et al., 2016; Spaniol et al., 2015).

In any case, policymakers should consider this segment of the population to be targeted for special treatment, as they face many costs in this period without a clear (medical) benefit. Since the young population appears to have played a key role in the emergence of the second wave in France, taking their preferences into account is a priority.

Conversely, those over 65, those who are vulnerable, and women are strongly averse to the idea of monetary compensation; this is the interpretation we can have when reading the negative coefficients associated with monetary compensation. (Politically right people are not far from this position, with a (negative) coefficient that is less significant, however). These groups seem to have difficulty associating financial rewards with behaviors that protect the health of the population in general and themselves in particular. For the most vulnerable, the rejection of any trade-offs between health-protective measures and material compensation is quite strong. For these segments of the population, intrinsic motivations and extrinsic incentives might stand in conflict, a situation that could potentially lead to partial crowding out of intrinsic motivations (Frey, 1997; Kreps, 1997; Benabou and Tirole, 2003). Worse, financial incentives could lead to total crowding out of moral motivations (Bowles, 2008) to adhere to constraining prosocial public health measures.

One advantage of this exercise is that it makes it possible to quantitatively assess the collective welfare attached to various packages of policies to fight COVID-19 (some emblematic national strategies) and even to determine the strategy that would receive the most support. The preferred strategy by the French population, which we named *Max-U*, would be the following: no more lockdown, mask in public places, restaurants opened, public transportation adapted, leisure travel restrained to France only, and access to digital tracking. In April 2020, this set of measures was consistent; it was a logical alternative to a complete lockdown device, although surely less efficient for controlling the epidemic (Ferraresi et al., 2020). The issue of closing restaurants and festival venues is problematic. This is through this point that the population’s preferred package of prophylactic policies was different from the “wise one.” But data on the propagative effect of restaurants were not yet available in April 2020, so these preferences could have changed after the survey date. Note that in April, the *Government strategy* did not include closing restaurants for the summer period but was effectively restored in France and many other countries a few months later.

In the general population, acceptance of the Governmental strategy was almost the same as the *Max-U*. This finding means that the Macron government remained not far from the preferences of the French people. It can also mean that the authorities were unwilling to take unpopular measures in April 2020 after eight weeks of lockdown. If we consider stratified “voting,” poor and elderly 65+ people most supported the governmental package (with voting probabilities around 0.8, compared with the Maximalist benchmark); this could reveal the implicit target followed by the French executive authority. We may add that clinically

vulnerable individuals are also somehow in line with the *Government strategy*. They reject all the other strategies: *Laissez-faire* or *Lockdown* (and this, with exceptionally low acceptance rates: 0.35).

Last, a lockdown associated with monetary compensation (bonus) is poorly rated, whatever the strata, except by the young who have a voting probability above 0.5 (but insignificant) and the Elderly-65+, but the latter do not require a bonus for giving their consent. In principle, a lockdown is an entirely prophylactic strategy that should be assessed relative to the various substitutive epidemic-fighting measures that could be implemented. In the general population, the scenario with three additional weeks of confinement is never “elected” compared with all other alternatives (results not shown). This is probably of interest to the government, which currently faces the dilemma between reconfinement or a package of daily prophylactic limitations. Lockdown appears to be quite unpopular for nearly all segments of the population, and all other options are preferred, even those as restrictive as in the Maximalist strategy.

Our research has several limitations. The first refers to the time of the survey. May 2020 was the end of the first lockdown period in France. The population’s preferences were probably—at least in part—influenced by the context: e.g., mask shortages, without real experimentation on them in a natural setting, could be the origin of the particularly high acceptance we find in our data for wearing a mask. The subjective assessment of the attribute “additional weeks of lockdown” was necessarily biased by the preceding eight weeks of lockdown. Another limitation is the sample size, which is an issue when we must undertake subpopulation studies. Some coefficients are not significant. Indeed, when the sample size is reduced, we cannot see whether this insignificance results from the lack of power of the statistical analysis or “true” nondifference with the null hypothesis. This is why we did not go deeper into multiple stratifications, for example, by regions and age groups, which could interest local policymakers. Another important limitation is that we only elicited respondents’ preferences but not their beliefs about others’ compliance. According to psychological game theory, beliefs about others could affect one’s own utility and therefore the likelihood of taking various actions. However, going in this direction would require first-order beliefs (my beliefs about others’ actions), second-order beliefs (my beliefs about others’ beliefs about my actions), and perhaps higher-order beliefs. Since the questionnaire was already relatively long, we decided to avoid an additional module about beliefs elicitation. However, this could be an interesting future extension by targeting the questionnaire on this issue. Despite these limitations, our study is the first to investigate the preferences of a national population among various sets of COVID-19 policy responses. Knowing how people rank the various COVID-19 prophylactic measures is a logical condition for designing sets of suitable epidemic control programs that could be observed with the highest degree of compliance. The revealed major dissonances of the young people suggest the need for a specific menu of anti-COVID-19 policies. The policymaker should consider this population segment to be targeted for special treatment, maybe using monetary compensation. This could be a way to improve compliance and avoid repeated new waves that may be vectorized through this subgroup.

#### Declaration of competing interest

None.

#### Data availability

Data will be made available on request.

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0041-01), and from the regional program “Défis clés Urgence COVID-19” from the Région Occitanie. The usual caveat applies.

### Appendix 1. Survey methodology

The survey institute, *Viavoice*, recruited respondents by telephone for the online questionnaire. The survey institute had to target a representative sample of the French population (gender, age, and regional characteristics). Of the 7500 persons contacted by *Viavoice* by telephone, 5331 accepted and received a web link. Of those, 1154 responded to the online survey, representing a response rate of 21.6%.

Table A (next page) gives descriptive information about the survey sample compared with the national population (target).

**Table A**  
Sample characteristics

Characteristics	Sample (1154)	France (adults >18 years old) <i>Source: INSEE <a href="https://www.insee.fr/fr/statistiques/fichier/1892086/pop-totale-france.xls">https://www.insee.fr/fr/statistiques/fichier/1892086/pop-totale-france.xls</a></i>	p-value of tests H0 = equality of distribution
Male	51.09%	48.05%	$\chi^2 (1) = 4.110, p\text{-value} = 0.043$
Female	48.91%	51.95%	
18–25	8.25%	10.58%	$\chi^2 (2) = 6.751, p\text{-value} = 0.034$
26–64	66.47%	65.30%	
65 and more	25.28%	24.12%	$\chi^2 (13) = 15.24, p\text{-value} = 0.293$
AUVERGNE RHONE ALPES	12.32%	12.31%	
BOURGOGNE FRANCHE COMTE	5.46%	4.26%	
BRETAGNE	5.02%	5.12%	
CENTRE VAL DE LOIRE	3.70%	3.92%	
CORSE	0.62%	0.53%	
GRAND EST	10.12%	8.45%	
HAUTS DE FRANCE	7.92%	9.14%	
ILE DE FRANCE	17.78%	18.82%	
MARTINIQUE	0.62%	0.55%	
NORMANDIE	4.58%	5.06%	
NOUVELLE AQUITAINE	8.45%	9.19%	
OCCITANIE	10.56%	9.08%	
PAYS DE LA LOIRE	5.19%	5.83%	
PROVENCE ALPES COTE D AZUR	7.66%	7.75%	

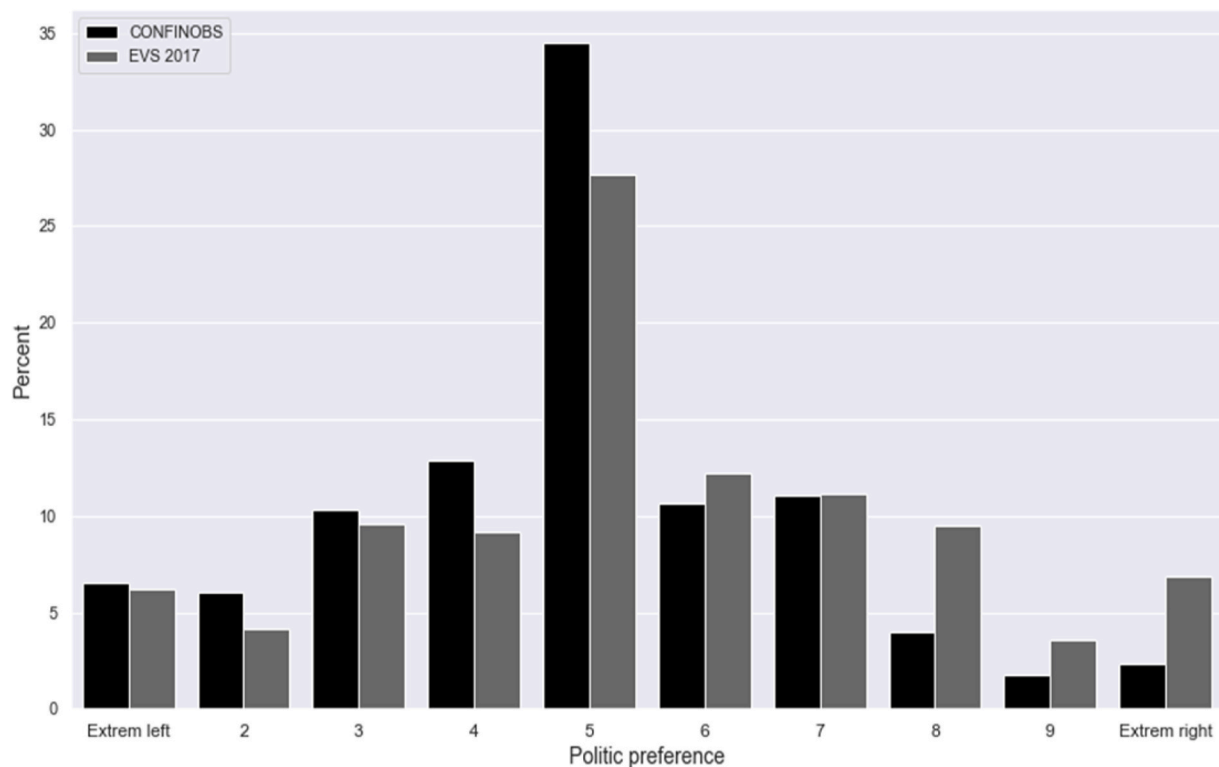


Fig. A. Political distribution: comparison with the European Values Survey.

The political positions of our sample can be compared to the answers to a question extracted from the European Values Study in 2017. *In political matters, people talk of “the left” and “the right.” How would you place your views on this scale, generally speaking?*

## Appendix 2. Theoretical background on choice modeling

To estimate the effects of the attributes on individual choices in a DCE, we start by assuming that individuals maximize their utility (or their satisfaction) based on the following random utility function:  $U_{ijk} = \alpha_j + X'_{jk}\beta + \varepsilon_{ijk}$  where  $U_{ijk}$  is the observed utility level of individual  $i$  related to scenario  $j$  ( $j = 1, 2, \dots, J$ ) presented among the choice set  $k$  ( $k = 1, \dots, K$ ),  $X_{jk}$  is the set of attributes' levels displayed in scenario  $j$  at the choice set  $k$ ,  $\alpha_j$  is the alternative-specific intercept, and  $\varepsilon_{ijk}$  is the regression error. As the latter is assumed to be independently and identically distributed with an extreme value, the probability of choosing option  $j$  has the familiar logit form:

$$Pr(Y_{ik} = j) = \frac{\exp(\alpha_j + X'_{jk}\beta)}{\sum_{j=1}^J \exp(\alpha_j + X'_{jk}\beta)}$$

In our experiment, we have  $K = 3$  choice sets and  $J = 2$  options (or equivalently,  $j = A, B$ ). As there are two options, A and B, only one alternative-specific intercept is identified (here, we assume that it corresponds to option A, i.e.,  $\alpha_A$ ).

## Appendix 3. Marginal effects at the mean

Since we are using an unlabeled DCE, the two options, A and B, have symmetrical roles. To study the marginal effects of attributes on the choice probability, we compute the marginal effects at the mean (MEMs).

First, we determine the mean point of options when individuals choose them. This ‘‘average’’ point has the following characteristics: 1.93 additional weeks for the extended lockdown attribute; Wearing a mask in public places for the mask attribute; Bar, restaurant, and festival venues closed until mid-June 2020; Public transportation adapted to work hours; Leisure travel restricted to mainland France; Implementation of a digital tracking device with free participation; and 1.023 monetary compensation (i.e., 1023 €). At this point, the utility of the chosen option is 1.371.

Second, we consider a reference situation for which all attributes are placed at their reference level, corresponding to a zero utility. The probability that the option corresponding to the mean point is chosen for the reference situation is 0.7976.

Finally, marginal effects are calculated from this mean point by considering one-unit changes in a single attribute level, ceteris paribus. Table B reports the MEMs for the whole sample. Note that for categorical variables, a change to the mean point corresponds to the inclusion of the complementary categories. For example, for the mask attribute, a change to the mean point (mask in public places) implies the situation of no mask and mask everytime. For the leisure travel attribute (the mean point of which is leisure travel restricted to mainland France), it implies no restriction and leisure travel limited to 100 km.

**Table B**  
Marginal effects at the mean, whole sample

Attributes	Marginal effect at the mean
Extension of lockdown	-0.020
Masks	
No mask	-0.173
Mask every time	-0.094
Bar, restaurant, and festival venues closed	-0.092
Public transportation—no restriction	-0.021
Leisure travel	
No restriction	-0.051
Restricted (100 km around)	-0.085
Digital tracking—no	-0.042
Monetary bonus	-0.009

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