

Experiments on risk framing and moral appeal in the context of the coronavirus spread

Pre-Analysis Plan for the fifth survey wave

Björn Bos^a, Moritz A. Drupp^{a,b}, Jasper N. Meya^{c,d}, Martin F. Quaas^{c,d}

^a Department of Economics, University of Hamburg, Germany

^b CESifo, Munich, Germany

^c Department of Economics, Leipzig University, Germany

^d German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany

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1 Introduction

Following up on our survey waves in March 2020, August 2020, December 2020, and June/July 2021, this study continues in aiming at an improved understanding of the private contributions to a public good under uncertainty as well as related questions on compliance. The coronavirus SARS-CoV-2 disease (COVID-19) still dominates life in Germany and all over the world. After a first infections wave in spring 2020, and a second much higher wave in winter 2020/2021, infections have been at a relatively low level in summer 2021. While the number of new infections in Germany started again to increase since autumn 2021, they are now peaking at much higher levels than before. On December 1st, 2021, more than 67.000 new infections have been reported in Germany as well as 446 new deaths due to COVID-19. Recent attention has been put to a new variant called Omikron, the characteristics of which are not fully understood yet. At the beginning of December 2021, 79 percent of the population older than 18 years is fully vaccinated against COVID-19. It turned out that with the delta variant currently prevalent in the German population, those who are vaccinated can still infect others and that infected vaccinated people are more infectious the longer it has been since the vaccination. As a substantial share of the population remains unvaccinated and while it is uncertain how effective the current vaccinations are against new mutations of the coronavirus, we are focusing on public health effects and behavioral adjustments to protect against an infection with the coronavirus. Individuals can contribute to this public good in particular by keeping physical distance to others and by increasing their hygienic efforts. In addition to the focus on physical distancing, we also ask about other contributions to the public good such as wearing a face-mask, and the willingness to get vaccinated for those that have not received a vaccination, yet.

This pre-analysis plan is structured as follows: Section II describes the background and procedures of the fifth survey wave. Section III lists all data that we elicit as part of this wave and section IV reports pre-specified hypotheses in addition to those of our previous survey waves. As this wave includes a medical questionnaire at the end, we have obtained a new ethical approval for the fifth survey wave.

2 Procedures

This survey wave is part of a panel survey experiment. We already conducted four survey waves and will, depending on the pandemic spread, collect further survey waves if necessary.¹ Our survey includes questions on subjects' current health level, past and planned behavior related to the corona pandemic, support for governmental efforts to slow the spread of the virus, stated preferences as well as incentivised experiments on truth-telling and risk-taking.

In the fifth survey wave, we try to reach all previous respondents again that participated in the previous survey waves in March, August and December 2020, as well as in June/July 2021. Those which we cannot reach again, will be replaced with a fresh sample of new respondents such that we end up with a sample size of approximately 3,000. Depending on respondents' willingness to participate in the survey again, we hope to reach between 2,000 and 2,500 of the previous respondents in the fifth survey wave. We will expect to add between 500 to 1,000 new respondents as a fresh sample.

We will start with the data collection on December 3rd, 2021 and plan to collect most responses within 7 days by December 8th, 2021. Nonetheless, we will allow for more time for participants that participated in previous waves such that the whole data collection should be completed by December 17th, 2021 at the latest (i.e. within 2 weeks).

The start of the data collection is scheduled at a time when restrictions on public life are increasing again. For the workplace and public transport, the so-called "3G" rule ("geimpft, genesen, oder getestet" — vaccinated, recovered, or tested) applies. And for many other places such as restaurants, hotels, bars, and theaters, the "2G" rule ("geimpft, genesen" — "vaccinated, recovered") is in force. In addition to travel warnings due to high infections in many countries, additional warnings have been issued for countries in Africa due to the new Omikron variant. It is expected that the (new) government in Germany will introduce additional measures to contain the spread of the coronavirus soon.

In this fifth survey wave, we will not impose experimental treatments, but exploit three natural sources of variation in the risk to get infected with the coronavirus (resulting in different ratios of private and external benefits of behavioural change):

1. spatial heterogeneity,
2. heterogeneity across societal groups (e.g., respondent's age, such as being older than 60, respondents with pre-existing chronic illnesses), and
3. heterogeneity over time in the course of the pandemic dissemination.

The survey will be conducted by an independent research company (responDi, <https://www.responDi.com/EN>) that recruits participants and handles payments. Recruitment of participants follows a stratified random sampling procedure against criteria such as age, gender, income and education. While in the first survey wave quotas were managed actively to guarantee the sample's representativeness regarding these criteria, the sample in this fifth survey wave depends on how the willingness to participate again is distributed among socio-economic groups. The subsample with fresh respondents

¹Our previous pre-analysis plans are pre-registered at the AEA RCT Registry (<https://doi.org/10.1257/rct.5573-1.1>) and we published parts of the data of the first survey wave at the Harvard Dataverse (<https://doi.org/10.7910/DVN/WEIWDK>).

in survey wave 5, in contrast, will be actively managed to ensure representativeness regarding these criteria. The money that respondents earn in our survey experiment will be paid out to them as so-called “mingle points” and one mingle point is worth 1 Euro-Cent.

3 Data and variables

Table 1 provides the variables that we collect as part of the fifth survey wave. Some of the questions are only asked to participants in the fresh sample as they would be redundant for those who participated in a previous survey wave already. Other questions depend on previous answers and might be asked for clarification purposes. We indicate potential filtering options in Table 1 in italic.

Table 1: List of variables (rough translation from German original)

Number	Question
First of all, we have two questions regarding your general life satisfaction	
1	How satisfied are you with your life in general? [0 = completely unsatisfied ,..., 10=completely satisfied]
2	Would you agree with the following statement? “Much of the time during the past week I was happy.”
3	<i>Only for participants in the fresh sample:</i> In which year were you born?
4	<i>Only for participants in the fresh sample:</i> What is your gender?
5	<i>Only for participants in the fresh sample:</i> What is the zip-code of your home?
6	<i>Only for participants in the fresh sample:</i> What is your level of education?
7a	<i>Only for participants in the fresh sample:</i> How many people do you count among your personal circle of family and friends with whom you are in regular contact (i.e. at least once every 3 months)?
7b	<i>Only for participants in the fresh sample:</i> How many of them are over 60 years old?
8a	<i>Only for participants in the fresh sample:</i> How many people live in your household? (please include yourself)
8b	<i>Only for participants in the fresh sample:</i> How many people in your household are children under the age of 18?)
8c	<i>Only for participants in the fresh sample:</i> How many people in your household are older than 60 years?)
9	<i>Only for participants in the fresh sample:</i> What is your monthly net household income (the remuneration of all household members, after deduction of taxes and social securities?)

Table 1: List of variables (continued)

Number	Question
10	How has your annual income changed in the current year 2021 compared to 2019? (in percent)
11	What do you expect approximately how your annual income will change in the year 2022 compared to 2019? (in percent)
12	How high was your monthly net household income in October 2021 compared to February 2020? (in percent)
13	Are you currently employed? Which one of the following applies best to your status? [Employed full-time, Employed part-time, in marginal or irregular employment, not employed]
14	<i>If any employment in Q13:</i> What is your current occupational status? [Self-employed, Blue-collar worker, White-collar worker, Civil servant, Student / Apprentice / Trainee / Intern]
15	<i>If any employment in Q13:</i> What is the minimum share of your working time, that you need to spend at a place that your employer determines (e.g. in his offices or rooms, on his property, at customers)? (in percent)
16	<i>If any employment in Q13:</i> If you can work from home, to which share of your total working time are you using this option? (in percent)
17	Do you belong to a church or religious community?
18	<i>If "yes" in Q17:</i> Which church or religious community do you belong to?
19	To what extent do you experience the emotion "fear" at the moment?
20	Please tell us: How willing are you to take risks with regard to your finances?
21	Please tell us: How willing are you to take risks regarding your health?

Task 1: Investment game based on Gneezy and Potters (1997), following the implementation by Cohn et al. (2015, 2017). We randomize the payoff profile across two groups:

Now we come to a task where you can earn additional money (mingle points). You will receive 100 Euro-Cent from us for this. You can use this money to invest it in a risky asset. Please decide now, which share of it you want to invest in the risky asset. You will receive the amount that you do not invest for sure.

The risky investment works as follows:

- You have a 50% chance of winning 2.5 times your investment.
- You have a 50% chance of losing your investment.

[Investment Group A:] You win if the super number (between 0 and 9) of the Saturday Lotto drawing on December 18, 2021 (www.lotto.de) is one of the numbers 0, 1, 2, 3, or 4. You lose if the super number of this draw is one of the numbers 5, 6, 7, 8, or 9.

Table 1: List of variables (continued)

Number	Question
	<p>[Investment Group B:] You win if the super number (between 0 and 9) of the Saturday Lotto drawing on December 18, 2021 (www.lotto.de) is one of the numbers 5, 6, 7, 8, or 9. You lose if the super number of this draw is one of the numbers 0, 1, 2, 3, or 4.</p> <p>Therefore, the amount you earn by investing in this task is calculated as follows: - If you win: Payout = 100 Euro-Cent minus investment plus (2.5 x investment) - If you lose: Payout = 100 Euro-Cent minus investment</p>
Investment	How many Euro-Cent would you like to invest (0 - 100)?
	We would now like to ask you some questions about your health state and the consequences of an infection with the coronavirus.
22	<i>Only for participants in the fresh sample:</i> Do you have one or more of the following diseases? [Heart disease, Lung disease, Liver disease, Diabetes, Cancer, Weakened immune system]
23	How do you assess your health status? [very good, ... , very bad]
	We would now like to ask you some questions regarding an infection with the coronavirus.
24	If you have the opportunity to get tested for a corona infection, how willing are you to get tested, even if this involves additional effort for you?
25	How often have you been tested on COVID-19 with a PCR-test?
26	How often have you been tested on COVID-19 with a rapid test during the past 4 weeks?
27	Have you been tested positive for COVID-19?
28	Have you already fallen ill with the coronavirus? [Yes, No, Maybe, No answer]
29a	How likely do you think it is that you will become infected with the coronavirus or that you have already been infected? [0 = impossible, ..., 10 = certain]
29b	How likely do you think it is that if you are infected, you will only get sick mildly? [0 = impossible, ..., 10 = certain]
29c	How likely do you think it is that if you are infected, you will be in acute danger of death in case of infection? [0 = impossible, ..., 10 = certain]
30	How certain are you with your reported probability to <u>get sick mildly</u> if you are infected?
31	How certain are you with your reported probability to <u>get in acute danger</u> if you are infected?
32	<i>If "Yes" in Q28:</i> Have you recovered after the corona infection?
33	<i>If "Yes" in Q28:</i> Have you had an infection <u>after</u> being vaccinated against the coronavirus?

Table 1: List of variables (continued)

Number	Question
34	<i>If “Yes” in Q28:</i> How often have you been infected with the coronavirus?
35	How many persons among your family members and friends, with whom you are regularly in contact (i.e., at least once every 3 months), got infected with the coronavirus?
<i>If answers is greater than zero in Q35:</i>	
36a	How many persons among your family members and friends, with whom you are regularly in contact (i.e., at least once every 3 months), have been treated due to the coronavirus in a hospital?
36b	How many persons among your family members and friends, with whom you are regularly in contact (i.e., at least once every 3 months), died due to the coronavirus?
We would now like to know to what extent the following statements apply to you. In the following, “physical, social contact” refers to situations in which you come closer than two metres to other people.	
37	Compared to the same time period in 2019, by what percentage have you reduced or increased your physical, social contacts in the past 7 days?
38	How many people on average came closer than 2 meter to you on a single day? (Please calculate the average number for the past 7 days)
39	Compared to the same time period in 2019, by how many percent have you reduced or increased your intensive hand washing (longer than 20 seconds) in the past 7 days?
40	As far as you reduce physical, social contacts or take protective efforts such as intensive hand washing, in what proportions (in percentage points that sum up to 100%) do you do this in order to - Protect yourself and members of your household [x%] - Protect your family and close friends [y%] - To protect other people [100-x-y%]
We now have a question regarding your future expectations.	
41	What do you expect, when will we be able to live again without substantial restriction due to COVID-19?
We would now like to know what you are planning for the next 7 days:	
42	Compared to the same time period in 2019, by what percentage will you reduce or increase your physical, social contacts in the next 7 days?
43	Compared to the same time period in 2019, by what percentage will you reduce or increase your intensive hand washing (longer than 20 seconds) in the next 7 days?

Table 1: List of variables (continued)

Number	Question
We would now like to know to what extent you agree with the following statements.	
44	The current government measures to contain the COVID-19 pandemic are... [going way too far, ..., are not nearly enough]
45	Relative to the governmental regulations, I will limit my physical, social contacts as follows: [participation in Corona-parties,, complete avoidance of all contacts]
46	Did you had the chance already to get vaccinated against the coronavirus? [yes, no, NA]
47	Did you get already vaccinated against the coronavirus? [yes, no, NA]
48	<i>If “no” in Q47:</i> How likely is it that you will get vaccinated voluntarily? [impossible, ..., for sure]
49	<i>If not “impossible” in Q48:</i> If you would get vaccinated voluntarily, in what proportions (in percentage points that sum up to 100%) do you do this in order to - Protect yourself and members of your household [x%] - Protect your family and close friends [y%] - To protect other people [100-x-y%]
50	<i>If “yes” in Q47:</i> If you already got vaccinated voluntarily, in what proportions (in percentage points that sum up to 100%) did you do this in order to - Protect yourself and members of your household [x%] - Protect your family and close friends [y%] - To protect other people [100-x-y%]
51	<i>If “yes” in Q47:</i> In which month did you got vaccinated in 2021? [Allow for three clicks. Each click represents one vaccination]
52	How many persons among your family members and friends, with whom you are regularly in contact (i.e., at least once every 3 months), got vaccinated against the coronavirus? [in percent]
We would now like to know, by how much you agree to the following statements.	
53	It should be compulsory, to get a vaccination against the coronavirus. [completely disagree, ..., fully agree]
54	Relative to the governmental regulations, I am wearing my face-mask... [never, ..., as requested, ... , always]
55	If somebody is not wearing his face-mask at a place where it is required to do so by regulations, or if somebody is not wearing it correct (e.g., by not covering the nose),... - this bothers me [not at all, ... , a lot] - I will point this out to that person [not at all, ..., energetic]

Table 1: List of variables (continued)

Number	Question
	- I will point this out to other persons [not at all, ..., energetic]
56	If you wear a face-mask, in what proportions (in percentage points that sum up to 100%) do you do this in order to - Protect yourself and members of your household [x%] - Protect your family and close friends [y%] - To protect other people [100-x-y%]
<p><i>The following question is adapted from Falk et al. (2018). It is repeated up to 5 times with varying payoffs for the future time period.</i></p> <p>Imagine, you would have the choice to receive a monetary payoff today or in 12 months. We will present you five situations in which the payoff today is always the same. The payoff in 12 month, however, will differ in each situation. For each situation, we would like to know which payoff you prefer. Please assume that there is no inflation, such that future prices are the same as today.</p>	
57	Please assess the following situation. Would you rather prefer 100 Euro today or 154 Euro in 12 months. [Today, in 12 months, do not know / prefer to not answer]
Please answer the following questions:	
58	How willing would you be to give up something that is beneficial for you today in order to benefit more from that in the future?
59	How much would you be willing to punish someone who treats you unfairly, even if there may be costs for you?
60	How much would you be willing to punish someone who treats others unfairly, even if there may be costs for you?
61	How much would you be willing to give to a good cause without expecting anything in return?
Finally, we would like you to answer the following questions regarding seasonal patterns:	
62	How much do the following factors change for you with the seasons? [Sleep duration, social activities, mood, weight, appetite, energy level]
63	At which month of the year does to following apply to you? [I feel the greatest, I gain most weight, I have the most social activities, I have the shortest sleep, I am eat the most, I have the fewest social activities, I feel the worst]
64	If you realize variations over the seasons, do you perceive them as problematic? [yes, no]
65	<i>If "yes" in Q64:</i> By how much are these changes problematic for you? [Low, Moderate, Substantial, Severe, Disabling]

In addition to the variables collected as part of this survey, we will collect observable data that can be matched to respondents through information about their zip-code. Among those information will be the number of officially confirmed COVID-19 incidents by the Robert Koch Institute (<https://survstat.rki.de/>), the number of deaths from COVID-19, and regulatory stringency. As these types of information might not be available on the zip-code level but on the county level, our matching might be based on a higher spatial aggregation.

COVID_incidence	Number of officially confirmed COVID-19 incidents per county (Source: Robert-Koch-Institute)
COVID_death	Number of officially confirmed COVID-19 deaths (Presumably on the county level by Robert-Koch-Institute)
Reg_string	Regulatory Stringency (Based on regulations by the individual federal states, following classifications - if applicable - by the Oxford COVID-19 Government Response Tracker (OxCGRT))

4 Hypotheses for sub-projects of the fifth survey wave

Following up on our hypotheses from the previous four survey waves, we update them as follows:

A. Risk attitudes, risk exposure and the private provision of a public good under uncertainty

Economic theory predicts that risk-averse individuals may provide more of a public good if they (also) benefit from a (private) risk-reducing effect of providing the public good. For example, Bramoullé and Treich (2009) consider a game with pollution emissions that generate stochastic damage that has a public good character. They show that risk increases individual abatement efforts and thus private provision of the public good. As a consequence, risk may increase welfare. Quaas and Baumgärtner (2008) and Baumgärtner and Quaas (2010) show that individual efforts to conserve biodiversity increase with risk and risk aversion due to the natural insurance function of biodiversity. Also, lab experiments in threshold public good games suggest that risk may lead to improved outcomes (McBride, 2006; Tavoni et al., 2011; Barrett and Dannenberg, 2014). Here we aim to use the data from the survey to test the implications of the theory and the validity of those lab experiments.

Individual protective measures with respect to the coronavirus have exactly the property that they reduce, at the same time, the individual probability of getting infected and the probability to spread the virus. Thus, we expect that risk averse individuals would contribute more to the public good.

We measure individual risk aversion by stated preferences (W1Q10, W1Q11, W2Q17, W2Q18, W3Q20, W3Q21, W4Q19, W4Q20, W5Q20, W5Q21) and revealed preferences (W1Q12, W2Investment, W3Investment, W4Investment, W5Investment). The amount of private provision of the public good is measured by stated past and planned individual defence efforts (W1Q17, W1Q18, W1Q20, W1Q21, W2Q30, W2Q32, W2Q36, W2Q37, W3Q32, W3Q34, W3Q37, W3Q38, W4Q34, W4Q36, W4Q39, W4Q40, W5Q37, W5Q39, W5Q42, W5Q43), the assessment of public policies (W1Q22, W1Q23, W2Q38, W2Q39, W2Q42, W2Q43, W3Q39, W3Q40, W3Q43, W3Q44, W4Q41, W4Q49, W4Q50, W5Q44, W5Q53, W5Q54), the willingness to get vaccinated voluntarily (W2Q40, W3Q41, W4Q45, W5Q47). We further need to control for individual risk exposure with respect to the severity of health damage in case of an infection (age, health); with respect to the (objective or subjective) probability of infection; and with respect to the effect on close relatives (household members, family and friends).

We will test the following hypotheses by means of multivariate regression, using the variables specified in the previous paragraph. All the following hypotheses are *ceteris paribus*, i.e. controlling for the effect of the other variables.

- *A.H1: Private provision of the public good increases with risk aversion.*
- *A.H2: Private provision of the public good increases with individual risk, as measured by*
 - a) probability of getting infected, using prevalence of the pandemic in the county at the time of observation as proxy,
 - b) expected health consequences of an infection, measured by the difference in the answers to questions 29b and 29c,

- c) standard deviation of health consequences of an infection, measured by the square root of (the sum of answers to questions 29b and 29c minus the squared difference in the answers to questions 29b and 29c).

B. Hypotheses on financial investment behavior

Following up upon our previous hypothesis that background health uncertainty increases risk aversion and hence reduces investments in our investment task, we now face a situation in which individuals can insure against parts of this background health risk by getting a vaccination against COVID-19. In light of this insurance device, we expect a weaker effect of the local number of infections on financial risk taking:

- *B_H1: Participants with a higher immunization via vaccination, measured as the time since the last full or the booster vaccination, invest more.*

While there are no systematic studies that examine how risk preferences change over the seasons, there is some limited evidence suggesting seasonality or luminosity effects on economic preferences (e.g., Bassi et al., 2013; Glimcher and Tymula, 2017; Kamstra et al., 2003; Kramer and Weber, 2012). To this end, we use the questions by Kasper (1991), who builds on Rosenthal and Wehr (1987) to elicit how vulnerable participants are to seasonal affective disorder (SAD), also known as the “winter blues”. Given that people are differently affected by SAD and that this only concerns a minority of the population, we expect to be able to reject the following:

- *B_H2: There is no negative relationship between investments and COVID-19 prevalence once we control for the SAD effect or exclude SAD-prone individuals.*

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