

**ECONOMIC PREFERENCES AND  
COMPLIANCE IN THE SOCIAL STRESS  
TEST OF THE CORONA CRISIS**

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# Economic Preferences and Compliance in the Social Stress Test of the Corona Crisis

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## Abstract

We test in a survey the impact of economic preferences on compliance and perception during the Corona pandemic. Results show that economic preferences crucially impact citizens' compliance to policies fighting the crisis. Risk tolerance negatively affects citizens' avoidance of crowds, whereas patience helps to do so and to stay home. Present-biased subjects engage in panic buying. Risk tolerance is negatively related with the Corona threat and trust positively resonates with positive media perception. Exploiting data from before the crisis allows us to infer causality and to deduce valuable insights for crisis management by identifying target groups or regions for the allocation of scarce medical or surveillance resources.

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# 1 Introduction

Many heads of states consider the Corona-virus pandemic as the greatest challenge since World War II. Worldwide, policy measures have been implemented mainly targeting at breaking the chain of transmission. Over time, measures were adjusted from initially soft measures, such as disinfection guidelines over behavioral recommendations to closed borders and curfews. No matter how strongly public administration encourages the right behavior, or how severe the potential punishment in case of civil disobedience, the success of these measures ultimately depends on the ongoing social compliance of the people.

Social compliance constitutes individual adherence to the regulations and recommendations regarding contributions to public health. It is therefore related to the literature on individual contributions to the provision of public goods<sup>1</sup> and to the research on individual compliance, for example, with respect to tax obligations (e.g., Allingham and Sandmo, 1972; Alm et al., 1992; Kirchler, 2007), process standards in firms (e.g., Pierce et al., 2015; Staats et al., 2017; Sheedy et al., 2019), or vaccination (e.g., Bronchetti et al., 2015; Hansen and Schmidtblaicher, 2019). However, only a small share of this literature focuses on individual drivers of compliance in a public-good context. Furthermore, very little is known about the role of individual preferences to achieve compliance in a crisis situation to what most citizens have not been close to experience.

The importance of individual preferences is demonstrated by politicians' requests for social obedience in the crisis. For instance, politicians appeal that citizens should refrain from panic buying to secure the provision of daily goods. Moreover, politicians apply regulations on public gatherings and curfews to increase social distancing, the key instrument to break the chain of transmission. Sticking to the prescribed and recommended behavior reduces the risk of getting infected, but also requires patience and self-discipline. Thus, social compliance constitutes a behavior which is likely to resonate with individual time and risk preferences. This idea is supported by evidence of health-related contexts, highlighting that patience positively affects the adherence to physical activity advice (Van Der Pol et al., 2017), whereas more risk tolerant subjects are less likely to adhere to medications (Simon-Tuval et al., 2018). Compliance also requires from citizens that they trust the appropriateness of the measures and the reliability of the provided information. Since individual compliance generates positive externalities for other members of the society, it might also depend on citizens' general willingness to take over social responsibility.

The main question of this paper analyzes to what extent three key economic preferences (risk, time, trust) predict citizens' social compliance to policy measures in the Corona

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<sup>1</sup>See, for example, Gerber et al. (2008); Bowles and Hwang (2008); Fischbacher and Gächter (2010).

crisis. Therefore we present results of a survey study, where we apply preference measures, which have proven to strongly correlate with incentivized measures and demonstrated their internal and external validity (see, Falk et al., 2016; Falk et al., 2018). Second, we study whether social responsibility is associated with higher social compliance. To account for social responsibility, we asked questions, which assess subjects' free-riding behavior in public contexts before the crisis. Third, we investigate how social responsibility and preferences shape people's perception of the crisis.

In the first block of our survey, without any reference to the Corona crisis, we elicited preferences with respect to risk, time, trust and trustworthiness. To measure social responsibility, we form an index, which comprises three items related to subjects' contributions to the common good, i.e., fare evasion in public transportation, individual turnout, and their agreement to a law on compulsory measles vaccination. The second block is contextual to Covid-19. We captured participants' behavioral compliance to Corona-specific political measures with the help of four items. We asked about citizens' behavior related to: staying at home, avoiding crowds, their willingness to get tested for the Corona virus and their purchasing behavior of food. This block also includes items on the perception of the Corona crisis, the media coverage and the appropriateness political measures.

Regarding our main question, we show that key economic preferences predict individual compliance to the regulations and politicians' public appeal. Our data show that more pronounced risk tolerance is associated with a lower propensity to avoid crowds. At the same time, patient participants are more likely to act in accordance to the behavior prescribed by public authorities. Moreover, we identify present-biased participants to engage in panic buying. Importantly, our design and our data rule out that these relations between preferences and social compliance simply reflect a spurious correlation driven by the Corona crisis. First, the items dealing with social responsibility were presented before any Corona-related item and the content refers to domains different from public health. Second, we have data available on time and risk preferences, which were collected before the crisis. We elicited these data in the same manner and from the same subject pool. The comparison to the current data reveals no difference. Consequently, our correlation analysis allows us to draw causal inference, which is a prerequisite for the derivation of policy implications.

Secondly, we find a positive and significant relation between social responsibility and social compliance. That is, people with higher social responsibility are more likely to behave in accordance to the policy regulations fighting the crisis. We provide evidence for the external validity of our social responsibility index. We exploit additional infor-

mation about the participants, which were collected before the crisis. We use these data to show that reliable subjects who revealed a high attendance rate to past laboratory experiments have a higher index of self-reported responsibility. This allows us to draw causal conclusions. Due to social image concerns, however, our results might overestimate the correlation. We therefore refrain from deducing policy implications for social responsibility. Nevertheless, we consider this to be an interesting finding for Political Science scholars, as it provides evidence for the significant role of social capital (Putnam, 1995; Knack and Keefer, 1997; Bjørnskov, 2006) in overcoming an exceptional threat to society. Regarding subjects' perception of Covid-19, we find that risk tolerance is negatively related with the perceived threat posed by the Corona virus. Whereas, trust positively resonates with the perceived appropriateness of the media coverage.

Our policy implications are twofold. The first set of implications takes a long-run perspective and is concerned with policies affecting individual preferences. For example, the finding that patience increases compliance in the crisis, points to policies affecting the determinants of time preferences. The literature on endogenous time preferences identified causal relations to factors, such as wealth (Becker and Mulligan, 1997), parents' own non-cognitive skills and parental time investments (Delaney and Doyle, 2012), or education (Alan and Ertac, 2018). Thus, we highlight that family, educational or distributional policies, which increase patience may also generate a positive externality for the society.

The second type of implications takes a short-run perspective concerning the identification of target groups for policy measures in the crisis. It builds on research, which reveals information on the distribution of preferences across occupations, space, or socioeconomic classes (e.g., Bonin et al., 2007; Masclet et al., 2009; Fouarge et al., 2014). For example, our finding that risk tolerant participants are less likely to avoid crowds, identifies workers who predominantly encounter financial and social risks and perform professional, managerial, or administrative work (Hill et al., 2019). This suggests that fines should vary with income, or that informational campaigns targeting this group should highlight the individual and social risks to increase social compliance. Our findings also provide insights for the spatial allocation of scarce medical and surveillance resources.

## 2 Data and Study Design

The data of this study were collected in an online survey on March 16 and March 17, 2020. A few days beforehand, politicians began to highly recommend social-distancing measures, such as staying at home and avoiding masses. We conducted our study one

day after the German chancellor Angela Merkel announced the entry into force of policy measures to fight Covid-19. The measures concentrated on the closing of: the German borders,<sup>2</sup> schools, day-care centers, bars, restaurants, discotheques, gyms, and public institutions. The German government restricted the visiting time in hospitals and rest homes. Our study analyzes citizens' direct responses to these drastic measures.

The study focuses on subjects, who have signed in to the data base for experiments at the University of Göttingen. Subjects were sent an invitation e-mail to participate in an online study, which was processed with the "Google-Forms" tool. They were told that the study lasts 10–15 minutes and that they receive a compensation of €5 in the form of an Amazon voucher, if they complete the study. Importantly, we did not mention the study topic. Participants did not receive an indication that the study was about Corona. Our study is divided in two blocks, where we first elicit participants' preferences, followed by contextual questions focusing on the Covid-19 crisis (see the Appendix for the questions). To address measurement error, we applied different packages of questions in each block. We discuss the validity of the measures comprehensively in Section 5 of this paper.

In the first block, we applied a package on general preferences, where we ask verbal questions on: risk tolerance, time preferences, general trust, and trustworthiness. For risk, trust, and trustworthiness, participants had to answer on likert scales (0 = lowest degree; 10 = highest degree). To measure time preferences, participants were asked about the level of immediate compensation in Euros to forego a payment of €1000 in six months. Afterward, they were asked about the required level of compensation in six months to forego a payment of €1000 in twelve months. We calculate patience in the form of discount factors ( $\delta$ ), by dividing the answers by 1000. We use the mean of the two discount factors, as a measure for patience (Meier and Sprenger, 2010), i.e., more (less) patient subjects have a higher (lower) discount factor. Eliciting a discount factor in the near and in the far future allows us to control, whether subjects are present-biased.<sup>3</sup> To study preferences on social responsibility, we designed a second package of questions, asking about participants' behavior in social life and about their attitudes towards social duties. The questions concentrate on three scenarios, which focus on contributions to the common good before the crisis. First, we focus on free-riding behavior in terms of public services, such as, transportation. We ask how often participants committed fare evasion in public transportation (0 = never before; 5 = always). Moreover, we measure subjects'

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<sup>2</sup>From that moment Germany closed its borders to Switzerland, France, Austria, Denmark, and Luxembourg. Within Germany the government blocked the access to all northern German islands for tourists.

<sup>3</sup>This would be the case for subjects who have a higher discount factor in the far future than in the near future.

participation in politics, i.e., we ask for individual turnout. Recently, in Germany, there was a vivid debate on compulsory vaccination. Many citizens showed a resistance on vaccination. To address this, we add a third question. The question accounts for people's willingness to take precautions to protect their health and the health of fellow citizens. We asked about their agreement to a law of compulsory measles vaccination, before children go to the kindergarten/school (0 = lowest degree; 10 = highest degree). Based on the three answers, we form a social-responsibility index.

In the second block, we asked contextual questions on compliance in the Covid-19 time and about subjects' perception of the crisis. To reduce measurement error and to increase the validity of our measures, we included multiple items. We focused on four domains of compliance during the crisis and compute an index on social-compliance during Covid-19. Regarding social-distance behavior, we asked participants, whether they increased the time of staying home, since the Corona crisis started (0 = lowest degree; 3 = highest degree). We address social distancing in a further question, where we asked participants, whether they started to avoid crowds, since the crisis started (0 = lowest degree; 10 = highest degree). We address social compliance in the form of solidarity, in a question, which focuses on panic buying. We asked whether participants increased the purchases of food during the crisis (0 = lowest degree; 4 = highest degree). In a further question of this package, we concentrate on the likelihood that subjects would do a Corona test, when having symptoms (0 = lowest degree; 10 = highest degree). In the contextual block, we had a package, which focused on participants' perception of the Covid-19 crisis. Here, we had two questions, which aim at the perceived threat of Corona. That is, we asked participants about their fear of Corona (0 = lowest degree; 10 = highest degree). Furthermore, we let them guess the likelihood (0-100 percent) that they will be infected by the virus, within the next four weeks. We use these answers to compute an index on subjects' threat of Corona. In two further questions we concentrated on participants' perception of the media and politics during the crisis. We asked whether participants believe that the media reporting on Covid-19 is appropriate (very understated, understated, adequate, exaggerated, very exaggerated). Regarding the perception of politics, we asked participants about their agreement to the policy measures fighting the crisis (0 = lowest degree; 10 = highest degree). We included questions, asking about participants' main source of information (tv news, print media, online newspapers, social media, family/friends/fellow students) and about their party preferences. We had a control question on participants' honesty to account for the accuracy of their responses, in a similar vein

as Falk et al. (2016).<sup>4</sup> Finally, we elicited demographics (age, gender, nationality, field of study/profession, disposable monthly income).

## Computation of the Indexes

We make use of three indexes: (i) *social responsibility*; (ii) *social compliance*; (iii) *Corona threat*. The *social-responsibility* index combines the agreement to compulsory measles vaccination, the participation in political elections, and the frequency to commit fare evasion (which enters negatively). The *social-compliance* index combines four questions of subjects’ behavior during the Covid-19 crisis: staying at home, avoidance of crowds, testing corona, increased purchased of food (which enters negatively). The *Corona-threat* index combines participants’ “fear of Corona” with their self-assessed probability of getting infected. Table 1 overviews the computation of the normalized indexes.

Table 1: Description and computation of the index measures

index	computation
Social Responsibility (SR)	$SR = 1/3 \times (\text{agreem. vaccination}/10 + \text{part. in election}/2 - \text{fare evasion}/4)$
Social Compliance (SC)	$SC = 1/4 \times (\text{stay. home}/3 + \text{avoid. of crowds}/10 + \text{testing corona}/10 - \text{incr. purch.}/4)$
Corona Threat (CT)	$CT = 1/2 \times (\text{fear of Corona}/10 + \text{prob. of getting infected}/100)$

## 3 Behavioral Predictions

We start with the impact of economic preferences on compliance in the crisis. Concerning risk preferences, it is possible that they affect at least three of the four dimensions of social compliance, as these situations are characterized by uncertainty. Thus, risk-tolerant persons may be less likely to stay at home, to avoid crowds, and to do panic buying. We believe that time preferences are an important concept to predict compliant behavior in the Corona stress test. Time preferences reflect subjects’ impatience, i.e., their preference for immediate utility over delayed utility (Frederick et al., 2002). Empirical evidence suggests that more patient subjects are more successful in achievements in social domains, which require a high degree of self-control (Alan and Ertac, 2018). Some of the prescribed measures of the Covid-19 stress test are characterized by trading off immediate utility over delayed utility. This applies to the directions of staying at home and avoiding public events with large crowds. Therefore, we expect that more patient citizens are more likely to stay at home and to avoid crowds. Present-biased subjects face self-control problems, as

<sup>4</sup>We asked them: “How do you assess yourself: Are you an honest person?” (0 = not at all honest; 10 = very honest)

disproportionate preferences for immediate consumption have the effect that subjects have a hard time to delay instantaneous gratification (Meier and Sprenger, 2010). Thus, such citizens may be prone to panic buying during the crisis, as building up stocks ensures that they always have the possibility to consume immediately at home. Trustworthy persons may behave more cooperative and more compliant. Although, trust may increase the acceptance of policy measures, it is unclear whether this may affect civil obedience in decision making. The reason is that social compliance is measured in individual decisions on outgoing habits, which may be affected by preferences, explaining behavior in risky and tempting situations.

Regarding our second question, we believe that socially-responsible participants behave socially compliant. This should be reflected by a high score in the social-compliance index. Subjects achieve a high score in the index, when they increase staying home, avoid crowds, do not engage in panic buying, and do a Corona test, when having the symptoms of the disease. These dimensions reflect civic duties, which should be particularly adhered by citizens with a high social responsibility.

Finally, we turn to participants' perception of various aspects of the Corona crisis. We measure risk preferences based on a verbal question on general risk. Dohmen et al. (2011) use the same question and show that risk tolerance positively correlates across different contexts (car driving, financial matters, sports, career, health). We study how well general risk preferences explain subjects' perceived threat of Corona, which resembles a risky situation in a health context. Thus, we believe that more risk tolerant subjects should also take higher risks in the domain of Corona. As a consequence, they should feel a lower perceived threat of the virus. We do not expect an effect of time preferences on subjects' Covid-19 perception. The literature emphasized that general trust positively correlates with trust in media (Tsfati and Ariely, 2014) and with political trust (Harris et al., 2010). Thus, we believe that citizens with a high level of general trust, trust more in media and perceive the media reporting on Covid-19 as less exaggerated. We expect that those citizens trust more in the government and show a higher agreement to policy measures fighting Covid-19. For trustworthiness we expect a weakened effect on perception of the Covid-19 crisis, as trustworthiness rather arises as a consequence of trust in interpersonal relationships. By contrast, we believe that the social-responsibility index indicates subjects' perception of the appropriateness of the policy measures, as the index reflects subjects' willingness to participate in political life. Thus, we expect that social responsibility positively correlates with the acceptance of policies fighting the virus.

## 4 Results

In this section we give a brief overview on participants' preferences, then we present our findings on the predictive power of economic preferences for social compliance in the Corona stress test. Afterward, we focus on participants' perception of the Corona crisis.

### 4.1 Summary Statistics and Comparison with old Data

Table 2 presents summary statistics of subjects' preferences and the control variables, we use (i.e., demographics, media preferences, and honesty).<sup>5</sup> In total, 197 subjects participated in the survey. We drop seven subjects who entered in the time-preference question a money amount, which exceeded €1000. There are only five non-German subjects in the data base. It is likely that this may bias the data and the social responsibility index, e.g., when those subjects were not entitled to vote in any election. This is indeed the case, i.e., 4 subjects were not allowed to vote. It is possible that non-German subjects made different experiences with the pandemic in their home countries (or watched other media than Germans). This may further affect the data. To control for this, we would have to apply interactions in our regressions, which is however, also problematic as the number of non-German subjects is very low ( $n = 5$ ). Thus, we decided to drop them. This yields a sample of 185 subjects (52% female) with a mean age of 22.86. We find that subjects' field of study was balanced in the subject pool with only 19 percent of econ students. Most of them were students of the University of Göttingen, which reflects in the disposable income (€435).

Regarding risk preferences, we find that our participants have a very similar mean risk tolerance (4.97) as compared to participants of a laboratory experiment, which was ran before the Corona crisis at the University of Göttingen ( $n = 292$ ; mean: 4.91, two-sided t-test,  $p = 0.784$ ). Turning to time preferences, it can be seen that the mean patience ( $\delta = 0.90$ ) of the data set is not significantly different from the mean patience ( $n = 152$ ;  $\delta = 0.89$ ; two-sided t-test,  $p = 0.646$ ), in an experiment at the University Göttingen in December 2019. The similarity of risk and time preferences before and after the Corona crisis confirms the internal validity of the data of our survey. We discuss this in detail in section 5. Overall, participants showed a mediocre level of trust (5.76)<sup>6</sup> and stated to be trustworthy (8.31) and honest persons (7.99). We find that 24% of the participants

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<sup>5</sup>Descriptive statistics of all measured preferences and contextual preferences are presented in Figure 2 and Figure 3 in the appendix.

<sup>6</sup>Unfortunately, we do not have old data on subjects' answers regarding the trust question, which could be compared with their current level of trust in this online study.

Table 2: Preferences and Controls of study participants (n = 185).

	mean	sd	min	max
<b>preferences</b>				
risk	4.97	2.10	1	10
patience ( $\delta$ )	0.90	0.19	0	1
trust	5.76	2.41	0	10
trustworthiness	8.31	1.60	1	10
<b>controls</b>				
age	22.89	4.47	18	67
female	0.52	0.51	–	–
econ	0.19	0.40	–	–
disposable income	435.87	327.82	0	2500
main source: social media	0.13	0.34	–	–
left-wing party voter	0.59	0.49	–	–
no voter preferences indicated	0.23	0.42	–	–
honesty	7.99	1.40	2	10

mainly retrieve their information from social media. Moreover, 59% of them vote for left-wing parties, whereas 23% did not indicate voter preferences.

## 4.2 Main Results: Social Compliance under Covid-19

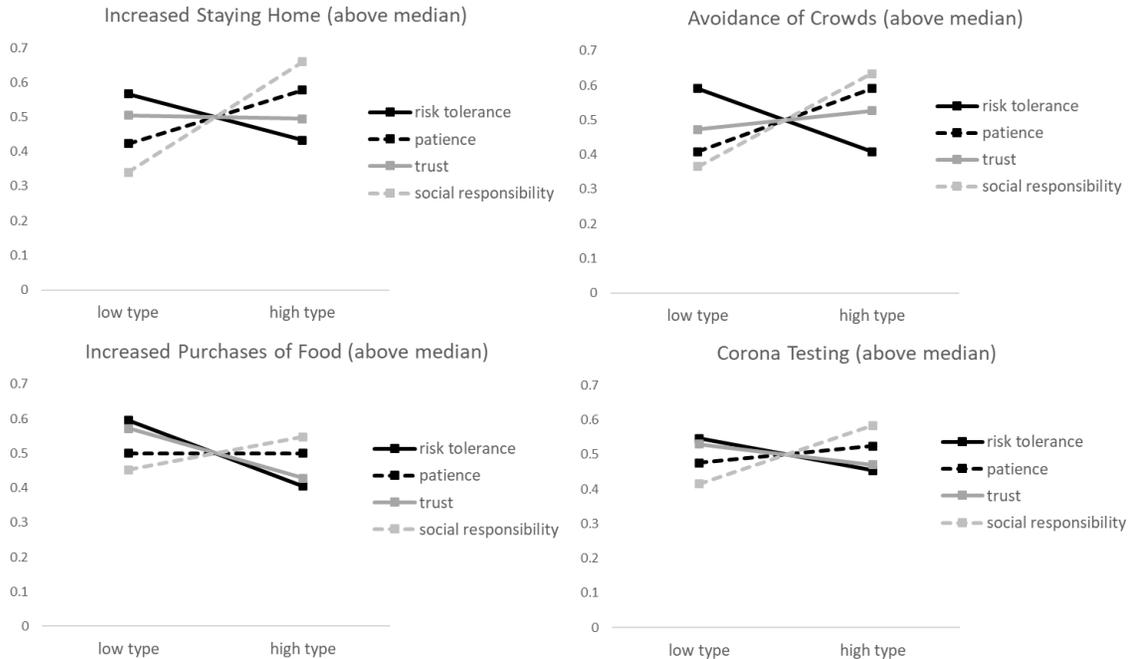
We start by focusing on our main results, regarding the impact of economic preferences on social compliance during the Corona crisis. In this respect, Figure 1 displays participants' answers in the four dimensions of the social-compliance index. The diagram presents the answers, which fall into the above-median categories of the corresponding dimension. The diagram reports the share of above-median answers, which were given by subjects who revealed a low- or high-type preference. This classification is based on a median split.<sup>7</sup>

The diagram, gives a first tendency on the possible relations of the economic preferences and compliance. It suggests that participants with an above-median risk tolerance are less likely to increase staying home and less often avoid crowds. At the same time, they are less likely to engage in panic buying. In the same vein, trusting people are apparently not very susceptible to increase purchases of food during the crisis.

<sup>7</sup>If subjects' preferences were below/equal (above) median, they become a low (high) type.

The diagram reveals a further pattern for time preferences. That is, more patient subjects are obviously more likely to stay at home and to avoid crowds.

Figure 1: Effects of Economic Preferences on Social Compliance (n = 185)



A similar effect can be found for social responsibility. Participants who reveal a high degree of social responsibility tend to behave more compliant with respect to staying at home and avoiding crowds during the crisis. Finally, we observe that social responsibility may also have a positive effect on the probability that subjects do a Corona test. To get deeper insights and to test for statistical significance, we turn to regression analyses.

Table 3 presents regression analyses of the effects of economic preferences and social responsibility on social compliance (models (1)–(2)) and its four dimensions (models (3)–(6)). Models (1) and (2) are OLS regressions, focusing on the social-responsibility index. Models (3)–(6) are Ordered Probit regressions, presenting disaggregated analyses of the index.<sup>8</sup> All regressions are based on the same explanatory variables. That is, we include economic preferences: *risk tolerance*, *patience*, *trust*, and *trustworthiness*. *Patience* is the mean of the individual discount factor when deciding about the near and far future money trade off. *Present bias* is an indicator dummy variable, which is positive for persons who behave time inconsistently, i.e., they indicated a higher discount factor in the far future

<sup>8</sup>In Table 7, we show that all results of models (3)–(6) are robust, when running OLS regressions. The only exception is model (6), where we observe an attenuated effect for *social-responsibility*, which fails significance ( $p = 0.152$ ) when running OLS regressions.

than in the near future. We also include *social responsibility*, which is subjects' score in the social-responsibility index (range: -1-2). Models (2), (4), and (6) always include the same control variables. The variables are: gender, age, subjects' disposable income, their answer in the honesty question, dummies to control whether their main information source is social media, whether they are voters of left-wing parties, whether they stated no voter preferences, and whether they are econ students.

Table 3: OLS and Ordered Probit regressions on social compliance and its four dimensions

	Social Compliance					
	soc. comp. index (1)	soc. comp. index (2)	staying home (3)	avoid. crowds (4)	incr. purchases (5)	Corona testing (6)
<i>risk tolerance</i>	-0.004 (0.004)	-0.003 (0.006)	-0.003 (0.044)	-0.069* (0.041)	-0.129** (0.054)	-0.010 (0.041)
<i>patience</i>	0.116* (0.060)	0.128** (0.061)	1.125** (0.503)	1.203*** (0.439)	0.912 (0.643)	0.210 (0.442)
<i>present bias</i>	0.011 (0.033)	0.016 (0.034)	0.265 (0.258)	0.096 (0.238)	0.664** (0.313)	0.291 (0.245)
<i>trust</i>	0.000 (0.005)	0.000 (0.005)	0.008 (0.036)	-0.020 (0.033)	-0.018 (0.044)	0.008 (0.034)
<i>trustworthiness</i>	0.007 (0.007)	0.004 (0.008)	-0.020 (0.062)	0.030 (0.058)	-0.082 (0.076)	0.005 (0.059)
<i>social responsibility</i>	0.195*** (0.073)	0.203*** (0.075)	1.204** (0.583)	1.452*** (0.539)	0.032 (0.681)	1.034* (0.538)
<i>day two</i>	0.072*** (0.022)	0.078*** (0.023)	0.679*** (0.184)	0.727*** (0.169)	0.037 (0.221)	0.042 (0.167)
controls	no	yes	yes	yes	yes	yes
obs.	185	183	183	183	183	183
R <sup>2</sup> / Pseudo R <sup>2</sup>	0.105	0.128	0.064	0.050	0.072	0.014

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>a</sup> Controls: Gender, age, disposable income, answer in the honesty question, dummies which control whether their main information source is social media, whether they vote for left-wing parties, whether they stated no voter preferences, whether they are econ students.

The regressions focus on 183 subjects, as we lose two observations because of missing information.<sup>9</sup> The survey was conducted within two days (on March 16 and March 17, 2020) in the very dynamic week after Angela Merkel announced the drastic policy measures to fight Covid-19. During these days, the events were overturning and the media was reporting more and more new cases of Corona. At this time, more and more online articles and special broadcasts reported about the crisis and discussed the policy measures. This process may have affected citizens' perception. To control for this, we include

<sup>9</sup>One subject stated to be neither female nor male. Another subjects did not enter the disposable income and argued that he has an unlimited amount of money because his parents pay for him.

a dummy variable (*day two*), which is positive when the survey was completed on day two (March 17, 2020).

Regarding the impact of economic preferences, the regressions clearly show that time preferences are a very important determinant of compliant behavior. Model (1) and (2) highlight that the coefficient of *patience* is positive and significant, i.e., subjects who achieve a higher score in the social-responsibility index show a higher degree of social compliance. We find in models (3) and (4) that this finding is stimulated by the fact, that more patient citizens are also more likely to stay at home and to avoid the masses during the Corona-stress test. This confirms our behavioral predictions. Time preferences have a further effect on consumption behavior. In model (5), it can be seen that present-biased citizens are more likely to engage in panic buying in the stress test. This confirms the view of the literature that those subjects are more prone to self-control problems and undisciplined behavior.

We also find that risk tolerance is predictive for some behaviors under the Covid-19 stress test. The significantly negative coefficients of *risk tolerance* emphasize in models (4) and (5), that risk-tolerant citizens are less likely to avoid crowds and are less likely to do panic buying during the crisis. The results are in line with the behavioral predictions on risk preferences, although the data do not entirely support all conjectures. It turns out that neither trust, nor trustworthiness are predictive for social compliance. Finally, we observe time dynamics in the social compliance of our subjects. That is the positive significant coefficients of *day two* demonstrate in models (1) and (2), that subjects' showed a higher degree of social compliance on the second day after Merkel announced the Covid-19 measures. This is also reflected by models (3)–(4), where we find that on the second day of our questionnaire, subjects were significantly more likely to state that they increased staying at home and avoiding crowds.

Next, we focus on the “social responsibility” index and analyze whether persons who score high in it also show a high degree of social compliance in the Covid-19 crisis. Recall, that we measure subjects' social compliance based on an index, which encompasses four dimensions. Focusing on the relation between social responsibility and social compliance, we indeed find a significant positive correlation between the two indexes. Models (1) and (2) emphasize this by the positive and highly significant coefficients of *social responsibility*. Models (3), (4), and (6) show that our finding is confirmed in three of the four dimensions of social compliance. That is, subjects with a higher social involvement are more likely to stay at home, to avoid crowds and to do a Corona test. The only exception is citizens' tendency to increase the purchases of food during the crisis. In a robustness

check, we computed the social-responsibility index without the data on subjects' attitudes towards vaccination. We find that the results hold ,i.e., *social responsibility* is positive and significant in model (1) ( $\beta = 0.112$ ;  $p = 0.067$ ) and in model (2) ( $\beta = 0.126$ ;  $p = 0.045$ ).

## External Validity of Social Responsibility

Members of the subject pool of the Göttingen Laboratory of Behavioral Economics were informed at the time of their registration that no-shows of registered participants might lead to a cancellation of the experiment. This information intends to make them aware of the responsibility they take when they register for an experiment. Thus, we believe that the revealed attendance rate at least partially reflects participants' social responsibility. Hence, it should correlate with our survey index on social responsibility. For subjects who participated in laboratory experiments before, we have data on the their revealed reliability before the crisis, i.e., on their number of registrations ( $n$ ) and show ups ( $k$ ).<sup>10</sup> For these participants we can test the external validity of our survey measure on social responsibility. In this analysis, we have to exclude participants, who never participated in experiments before.<sup>11</sup>

Note that someone who registered and showed up for five experiments sends a less noisy signal than someone who registered and showed up only once. Put differently, any pattern of reliability can be generated by any unobserved true reliability rate  $\theta \in (0, 1)$ . However, the different levels of the true reliability  $\theta$  have different probabilities to generate a given pattern of reliability. For example, for  $n = 10$  and  $k = 9$ , low  $\theta$ s are very unlikely to generate this pattern. To estimate the true reliability rate, we weighted each of the potentially true  $\theta$ s with the probability to generate the observed reliability pattern.<sup>12</sup>

Based on the estimated reliability, we generate a dummy variable *reliable*, which equals one, if the estimated reliability is above the median and zero if not. Using a dummy has the advantage that this reduces measurement error and the dependency on the metric scale, or the form of the relationship (e.g., linearity). We classify participants with an estimated reliability above 75% as reliable. For the 105 participants who registered in a laboratory experiment before the crisis, we find that reliable participants show a significantly higher

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<sup>10</sup>Cases of excused absence count as shown up.

<sup>11</sup>First, we wanted a measure of taking responsibility before the crisis. Second, registration for a laboratory experiment in advance and showing up at the laboratory at the date of the experiment is not comparable to a situation where registration allows an immediate online participation via a link to the survey included in the invitation.

<sup>12</sup>That is, we applied the following formula:  $\hat{\theta}(n, k) = \int_0^1 \theta \cdot \frac{\theta^k (1 - \theta)^{n-k} \binom{n}{k}}{\int_0^1 \theta^k (1 - \theta)^{n-k} \binom{n}{k} d\theta} d\theta$ .

index of social responsibility (t-test:  $p = 0.086$ ). This is confirmed by an OLS regression on social responsibility. Controlling for socioeconomics (gender, field of study, age, income) we find a positive and significant coefficient for *reliable* ( $\beta = 0.063$ ;  $p = 0.048$ , see Table 5 in the Appendix). The significant correlation between revealed past reliability and our social-responsibility index emphasizes the external validity of this measure.

### 4.3 Perception of Covid-19

Next, we turn to the predictive power of economic preferences on citizens' perception of Covid-19. Table 4 presents OLS regressions (models (1)–(2)) and Ordered probit regressions (models (3)–(6)).<sup>13</sup>

Table 4: OLS and Ordered Probit regressions on Covid-19 perception

	Covid-19 Perception					
	Corona threat		media exaggeration		policy acceptance	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>risk tolerance</i>	-0.016*** (0.005)	-0.015** (0.006)	-0.025 (0.041)	-0.009 (0.045)	0.042 (0.039)	0.069 (0.043)
<i>patience</i>	0.007 (0.062)	0.008 (0.063)	-0.367 (0.461)	-0.365 (0.471)	0.491 (0.434)	0.518 (0.443)
<i>present bias</i>	-0.002 (0.034)	-0.007 (0.035)	0.115 (0.253)	0.260 (0.260)	-0.066 (0.241)	-0.072 (0.246)
<i>trust</i>	0.004 (0.005)	0.005 (0.005)	-0.065* (0.036)	-0.083** (0.037)	0.038 (0.034)	0.034 (0.035)
<i>trustworthiness</i>	-0.008 (0.007)	-0.008 (0.008)	0.050 (0.054)	0.022 (0.065)	-0.031 (0.052)	-0.028 (0.061)
<i>social responsibility</i>	0.078 (0.076)	0.080 (0.078)	-0.334 (0.575)	-0.463 (0.590)	1.318** (0.549)	1.507*** (0.560)
<i>day two</i>	0.010 (0.023)	0.011 (0.024)	0.119 (0.176)	0.201 (0.183)	0.271 (0.165)	0.328* (0.171)
controls	no	yes	no	yes	no	yes
obs.	185	183	185	183	185	183
R <sup>2</sup> / Pseudo R <sup>2</sup>	0.065	0.101	0.016	0.043	0.017	0.035

Standard errors in parentheses  
\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

<sup>a</sup> Controls: Gender, age, disposable income, answer in the honesty question, dummies which control whether their main information source is social media, whether they vote for left-wing parties, whether they stated no voter preferences, whether they are econ students.

<sup>13</sup>In Table 6 we show that all results of models (3)–(6) are robust, when running OLS regressions.

All regressions are based on the same explanatory variables and controls, as in Table 3. Regressions (1)–(2) focus on subjects’ perceived threat of Corona (range: 0–1). In models (3)–(4), we analyze citizens’ perception of the media, i.e., whether they think that the reporting is exaggerated during the Covid-19 crisis. Finally, models (4)–(5) focus on the role of preferences for the acceptance of policy measures to fight the Corona virus. Models (2), (4), and (6) additionally include the same control variables as in Table 3.

In line with the behavioral predictions, models (1) and (2) highlight a significant relation between citizens’ risk tolerance and their perceived threat of Corona. In model (1) the highly significant coefficient of *risk tolerance* demonstrates that less risk-tolerant citizens are prone to a higher threat of Corona than more risk-tolerant subjects. Model (2) shows that this result is robust when including control variables.<sup>14</sup>

Turning to media perception (models (3)–(4)), we find that *trust* is correlated with subjects’ view of media during the crisis. As predicted, citizens with a high level of trust, are less likely to perceive that the media exaggerate their reporting on the Covid-19 crisis. Finally, we focus on citizens’ perception of the recently implemented policy measures of the German government. We find a significantly positive relation between the social-responsibility index and subjects’ acceptance of the Covid-19 policy measures. This supports our behavioral predictions. Focusing on trust, we find no significant effects for the policy acceptance, i.e., this does not support the idea that trust positively affects trust in politics (Tsfati and Ariely, 2014). Model (6) also shows that *day two* is positive and weakly significant. It follows that, in the course of the Corona crisis, citizens increased their acceptance of the policy measures. The regressions also show that time preferences and trustworthiness do not affect citizens’ perception of the Covid-19 crisis.

## 5 Discussion

We first discuss the internal and external validity of our survey measures of time preferences, risk preferences and trust. We elicit these preferences verbally and non-incentivized (Falk et al., 2016, 2018) and test how well they translate to participants’ behavior during the pandemic. Several studies demonstrated that these non-incentivized measures correlate with incentivized measures. This holds for risk tolerance (Dohmen et al., 2011; Falk et al., 2016; Grosch et al., 2018) and for trust (Falk et al., 2016). We validated the verbal time-preference measure in an experiment (Rau, 2020) at the University of Göttingen and

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<sup>14</sup>To control whether subjects’ threat of Corona is influenced by own experiences, we asked a control question, whether they know somebody who was infected by the virus. The regressions do not change, if we include this dummy. The coefficient of *risk tolerance* is still -0.015 and it is significant at  $p < 0.05$ .

showed that it significantly correlates with the incentivized multiple-price list measure of Andreoni and Sprenger (2012). These preference measures have proven to predict individual behavior and many important economic outcomes across countries (Dohmen et al., 2012; Falk et al., 2018). For example, patience strongly correlates with per capita income (Falk et al., 2018) and is associated with achievements in social domains, which require a high degree of self-control (Alan and Ertac, 2018).

Second, demonstrating internal and external validity of our preference measures is not sufficient to draw causal conclusions from the correlation with social compliance. Regarding the truthfulness of participants' answers, one could argue that untruthful participants may tend to over-report their compliance to behave in line with the obvious social norm. However, we do not see how untruthfulness should systematically bias our preference measures. We make use of our honesty measure, as a robustness check. In another data set (Grosch et al., 2018), we show that this unincentivized measure strongly correlates with the incentivized measure of lying preferences based on the paradigm of Fischbacher and Föllmi-Heusi (2013), which in turn has been predictive for economic behavior outside the laboratory (e.g., Potters and Stoop, 2016; Hanna and Wang, 2017; Dai et al., 2018). First, we find no correlation in our data when testing honesty with social compliance (Spearman's  $\rho = 0.025$ ,  $p = 0.733$ ), with time preferences (Spearman's  $\rho = -0.020$ ,  $p = 0.783$ ), and risk preferences (Spearman's  $\rho = -0.009$ ,  $p = 0.907$ ). Second, we excluded participants, who self-reported a value below five (on a 0–10 likert scale) for their honesty preferences. The exclusion does not change the qualitative results of our regression analysis.

We consider the concern of potential reverse causality as more relevant. For example, if a participant behaves compliant for a reason different than time preferences, it maybe that she/he becomes more patient by staying at home and avoiding crowds. This in turn might influence this subject to indicate an increased degree of patience in our questions on time preferences as well. One would expect that this systematically biases our measurement of time preferences. However, we find no differences in time and risk preferences between our survey and data which was collected before the crisis. This allows us to rule out reverse causation. This argument also rules out that some Corona related variable causes a spurious correlation between reported compliance and preferences. Thus, the only remaining possibility is that such a variable does not influence our preference measure, but at the same time causes a variation in social compliance, which correlates with the preference measure. We do not see a plausible explanation for such an interaction effect.

We now discuss the correlation between social responsibility and social compliance.

In section 4.2 we showed that participants who demonstrated a high attendance rate at laboratory experiments reported a high level of social responsibility. This allows us to draw causal inference. We acknowledge that one should be cautious about the strength of this correlation, as social image concerns may be at play. Participants who are concerned about their social image might overstate their social responsibility and their social compliance at the same time. Thus, our results might overestimate the correlation between the two variables. Nevertheless, such forces alone cannot explain the correlation we find, because in this case we would expect no relation between reported social responsibility and revealed reliability. We therefore refrain from deducing policy implications for this finding.

## 6 Conclusion

The success of the policy measures to fight the Corona pandemic and therefore the social and economic severity of the crisis and its aftermath depend to a large extent on citizens' compliance. This study provides insights into the individual drivers of citizens' compliance with the public regulations and behavioral recommendations. Concerning these drivers we focus, on the one hand, on standard measures of economic preferences with respect to time, risk, and trust as potential explanations of participants' compliance in a highly uncertain and dynamic situation in times of diminishing trust to media and politics. On the other hand, we focus on participants' social responsibility taken before the crisis. Our main findings on compliance are that patience and social responsibility increase social compliance, whereas risk tolerant and present-biased participants show lower compliance in the form of avoidance of crowds and panic buying, respectively. We argue that we can infer causality from these correlations and deduce the following policy implications.

In view of the findings on the determinants of individual time and risk preferences, our results inform politics from a behavioral perspective how to strengthen the immune system of the society in the long run. For example, Alan and Ertac (2018), conducted a randomized educational intervention on children's intertemporal choices. The intervention was implemented through a set of education materials that were conveyed by student's own trained teachers. The treated children became more patient in incentivized experimental tasks, the results persisted almost three years after the intervention and students were less likely to receive a low "behavior grade." Our results show that such intervention might not only generate private benefits for the students, but also positive externalities in times of a crisis. Our findings also offer insights for short run crisis management. There is plenty of research, which informs us on the distribution of social responsibility and preferences

across different dimensions, such as occupations, space or socioeconomic classes (e.g., Bonin et al., 2007; Masclet et al., 2009; Fouarge et al., 2014). This offers insights for the distribution of scarce medical or surveillance resources along these dimensions, or for the design and targeting of informational campaigns.

Finally, our results generate predictions for future studies on differences in compliance across nations. For example, Falk et al. (2016) find that “all of the 10 most patient countries in the world are either located in the neo-European, English-speaking world, or else in Western Europe, with the Scandinavian countries exhibiting particularly high levels of patience.” Consequently, we would expect that citizens in these countries *ceteris paribus* show a higher social compliance.

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## Appendix A: Tables and Figures

Table 5: External validity of the social responsibility index

<b>Social Responsibility</b>	
<i>reliable</i>	0.063** (0.031)
<i>female</i>	0.016 (0.031)
<i>econ</i>	-0.048 (0.036)
<i>age</i>	0.010*** (0.004)
<i>income</i>	-0.0002*** (0.00005)
obs.	104
R <sup>2</sup>	0.120
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

<sup>a</sup> We had to drop the observation of one participant who stated to be neither female nor male.

Table 6: Robustness checks: OLS regressions on Covid-19 perception

	<b>Covid-19 Perception</b>			
	media exaggeration		policy acceptance	
	(1)	(2)	(3)	(4)
<i>social responsibility</i>	-0.247 (0.360)	-0.304 (0.363)	2.953*** (0.992)	3.026*** (0.982)
<i>risk tolerance</i>	-0.018 (0.026)	-0.008 (0.028)	0.064 (0.071)	0.103 (0.074)
<i>patience</i>	-0.199 (0.293)	-0.184 (0.294)	0.579 (0.806)	0.583 (0.795)
<i>present bias</i>	0.083 (0.161)	0.158 (0.162)	-0.296 (0.443)	-0.269 (0.438)
<i>trust</i>	-0.038* (0.022)	-0.047** (0.023)	0.079 (0.062)	0.073 (0.061)
<i>trustworthiness</i>	0.031 (0.034)	0.014 (0.039)	-0.020 (0.093)	-0.005 (0.107)
<i>day two</i>	0.063 (0.110)	0.102 (0.112)	0.404 (0.304)	0.497 (0.303)
controls	no	yes	no	yes
obs.	185	183	185	183
R <sup>2</sup>	0.031	0.078	0.070	0.124

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>a</sup> Controls: Gender, age, disposable income, answer in the honesty question, dummies which control whether their main information source is social media, whether they vote for left-wing parties, whether they stated no voter preferences, whether they are econ students.

Table 7: Robustness checks: OLS regressions on Social Compliance

	<b>Social Compliance</b>			
	staying home	avoid. crowds	incr. buys	Corona testing
	(1)	(2)	(3)	(4)
<i>social responsibility</i>	0.956** (0.434)	2.860** (1.231)	-0.041 (0.236)	1.955 (1.358)
<i>risk tolerance</i>	0.008 (0.033)	-0.222** (0.093)	-0.041** (0.018)	-0.042 (0.103)
<i>patience</i>	0.758** (0.351)	2.558** (0.997)	0.223 (0.191)	0.590 (1.099)
<i>present bias</i>	0.128 (0.194)	0.216 (0.550)	0.205* (0.105)	0.505 (0.607)
<i>trust</i>	0.001 (0.027)	-0.046 (0.078)	-0.008 (0.015)	0.004 (0.085)
<i>trustworthiness</i>	-0.010 (0.047)	0.098 (0.134)	-0.026 (0.026)	0.046 (0.148)
<i>day two</i>	0.492*** (0.134)	1.453*** (0.380)	0.022 (0.073)	0.092 (0.419)
controls	yes	yes	yes	yes
obs.	183	183	183	183
R <sup>2</sup>	0.142	0.188	0.086	0.038
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

<sup>a</sup> Controls: Gender, age, disposable income, honesty, media preferences, whether subjects are German, whether subjects' study economics/business economics.

Figure 2: Summary statistics of preference questions in the survey

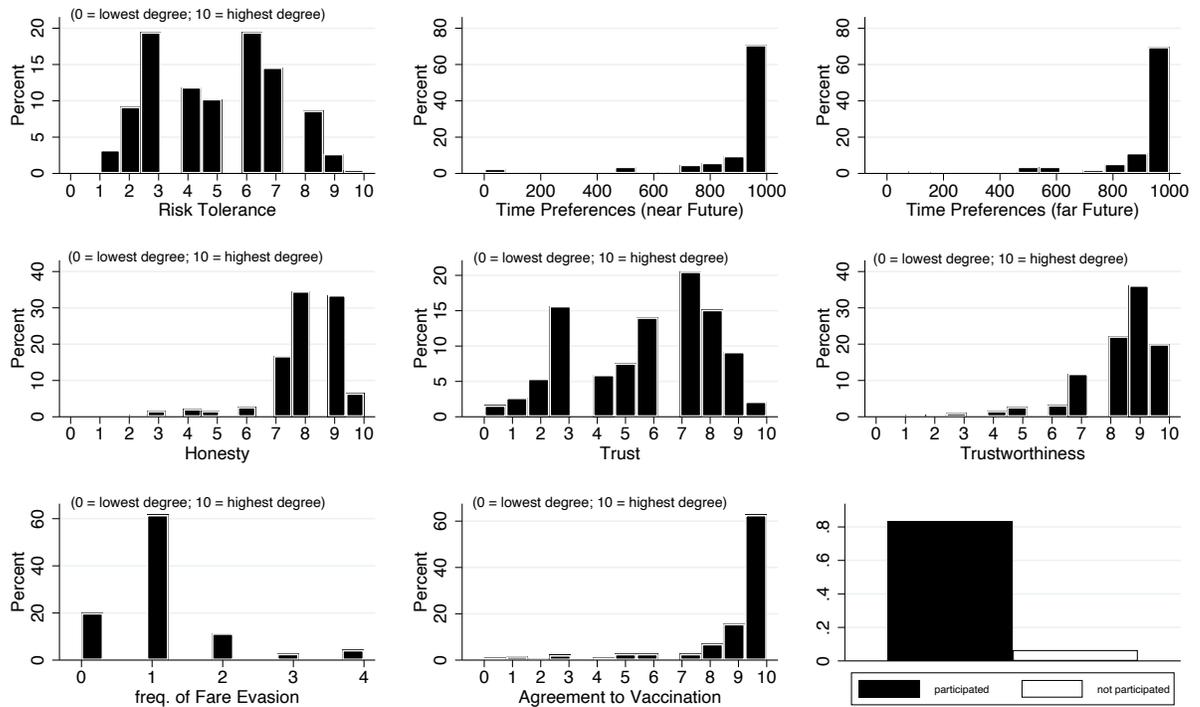
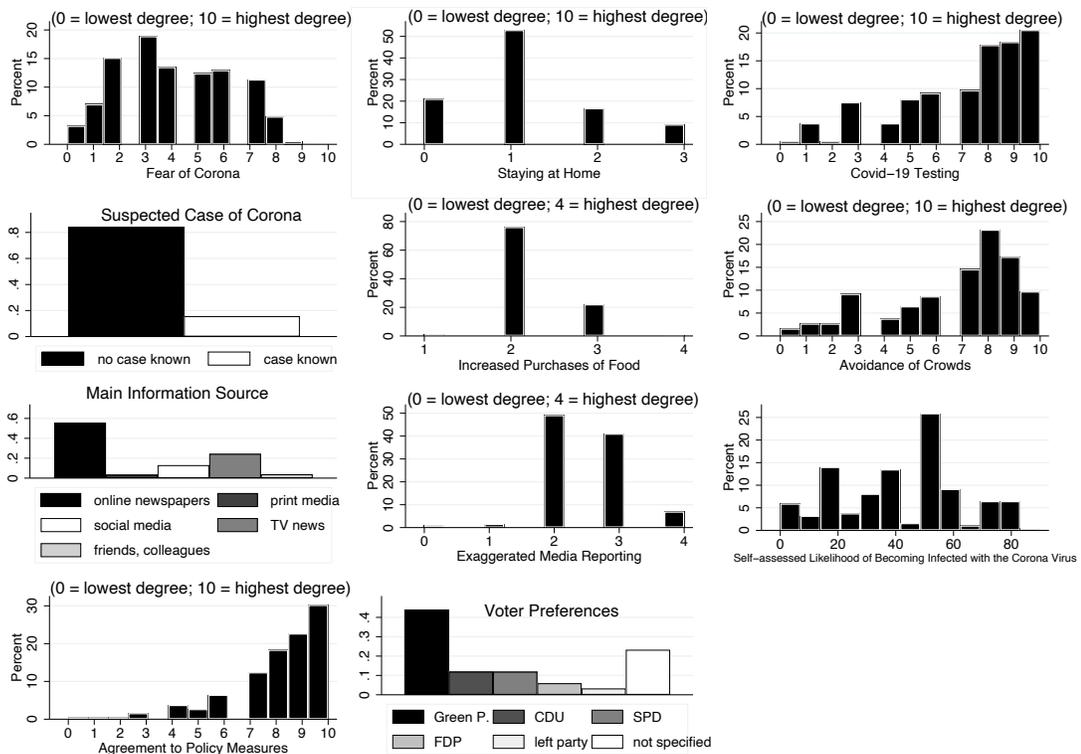


Figure 3: Summary statistics of contextual Corona questions in the survey



# Appendix B: Questions of the Online Survey

## Preferences Part

### [Risk Tolerance]

- *How do you assess yourself: Are you a person who is prepared to take risks in general, or do you avoid taking risks?*  
(0 = not at all prepared to take risks; 10 = very prepared to take risks)

### [Time Preferences]

- *How much money do you want to receive today, such that you give up a sure payment of €1000 in 6 months?*  
(Please enter a money amount between €0 and €1000)
- *How much money do you want to receive in 6 months, such that you give up a sure payment of €1000 in 12 months?*  
(Please enter a money amount between €0 and €1000)

### [Honesty]

- *How do you assess yourself: Are you an honest person?*  
(0 = not at all honest; 10 = very honest)

### [Trust and Trustworthiness]

- *How well does the following statement describe you as a person?*  
(0 = does not describe me at all; 10 = describes me perfectly)  
*As long as I am not convinced otherwise, I assume that people have only the best intentions.*
- *How well does the following statement describe you as a person?*  
(0 = does not describe me at all; 10 = describes me perfectly)  
*I consider myself to be a trustworthy person.*

### [Fare Evasion]

- *How often did you use public transportation services without having a valid ticket?*  
(never before; rarely; occasionally; frequently; very frequently; always)

### [Agreement to Vaccination]

- *How much do you agree to the law of compulsory measles vaccination, which came into effect on March 1, 2020. Under this law all kids have to do exhibit all recommended measles vaccinations before they go to the kindergarten or to school.*  
(0 = no at all agree; 10 = completely agree)

[Participation in Election]

- *Have you participated in the last parliamentary/state election?*  
(yes/no)

## Contextual Covid-19 Part

[Fear of Covid-19]

- *How much are you afraid of the Corona virus?*  
(0 = no at all afraid; 10 = very much afraid)

[Staying at Home]

- *Have you reduced going outside because of the Corona virus?*  
(no; yes, I go out less often; yes, I go out much less often; yes, I go out very much less often)

[Covid-19 testing]

- *Imagine that you experience symptoms, which are typical for the Covid-19 virus, how likely is it that you contact by phone your family doctor/public health department?*  
(0 = unlikely; 10 = very likely)

[Suspected Case of Corona]

- *Do you know any suspected case of Corona in your personal environment?*  
(yes; no)

[Purchases of Food]

- *Did you change your purchases of durable food (such as noodles, rice, or pesto) because of the Corona virus?*  
(I buy much less of it; I buy less of it; no change in consumption; I buy more of it; I buy much more of it)

[Avoidance of Crowds]

- *How strongly do you avoid large crowds in public (public-transportation services, bars, restaurants, etc.)?* (0 = no at all; 10 = completely)

[Main Information Source]

- *What is your main source of information?* (TV news; print media; online newspapers; social media (Twitter, Facebook/Instagram); family, friends, fellow students/colleagues)

[Media Reporting]

- *How do you perceive the general media reporting of the Corona virus?* (very understated; understated; adequate; exaggerated; very exaggerated)

[Self-assessed Likelihood of Becoming Infected with the Corona virus]

- *What do you think is the probability that you will be infected with the virus within the next four weeks?* (Please enter a value between 0 and 100)

[Agreement to Policy Measures]

- *How appropriate are the policy measures (Educational work, school closures, travel bans, etc.) in the context of the Corona virus, which were decided by the federal government?* (0 = not appropriate; 10 = fully appropriate)

## Socio Demographics

- *What is your age?*
- *What is your gender?*
- *What is your nationality?*
- *What is your field of study/job (if not a student)?*
- *What is your monthly free disposable income (after the deduction of all regular payments, such as rent)?*

## Politics

- *What is the party that you sympathize most with? (CDU, SPD, green party, FDP the left, AfD, NPD, no information)*