The robustness of preferences during a crisis: The case of COVID-19

Maastricht University

Paul Bokern, Jona Linde, Arno Riedl, Peter Werner

The Robustness of Preferences During a Crisis: The case of COVID-19

RM/23/012

ISSN: 2666-8807

GSBE

Maastricht University School of Business and Economics
Graduate School of Business and Economics

P.O Box 616
NL- 6200 MD Maastricht
The Netherlands

The Robustness of Preferences During a Crisis: The case of COVID-19*

Paul Bokern Jona Linde Arno Riedl Peter Werner

July 2023

Abstract

We investigate how preferences have been affected by exposure to the COVID-19 crisis. Our main contributions are: first, our participant pool consists of a large general population sample; second, we elicited a wide range of preferences (risk, time, ambiguity, and social preferences) using different incentivized experimental tasks; third, we elicited preferences before the onset of the crises and in three additional waves during the crises over a time period of more than a year, allowing us to investigate both short-term and medium-term preference responses; fourth, besides the measurement of causal effects of the crisis, we also analyze within each wave during the crisis, how differential exposure to the crisis in the health and financial domain affects preferences. We find that preferences remain remarkably stable during the crisis. Comparing them before the start and during the crisis, we do not observe robust differences in any of the elicited preferences. Moreover, individual differences in the exposure to the crisis at best show only weak effects in the financial domain.

Keywords: preference robustness, crisis, risk-, time-, ambiguity- and social preferences, COVID-19

JEL codes: C90, D01

*Paul Bokern: Maastricht University, Department of Microeconomics and Public Economics; Jona Linde: Maastricht University, Department of Microeconomics and Public Economics; Arno Riedl (corresponding author): CESifo, IZA, and Maastricht University, Department of Microeconomics and Public Economics, P.O. Box 616, 6200 MD Maastricht, the Netherlands, a.riedl@maastrichtuniversity.nl; Peter Werner: Maastricht University, Department of Microeconomics and Public Economics. Financial support from Netspar through the grant "Understanding and improving pension savings by combining incentivized experiments, surveys, and administrative big data – A general employed population sample with a focus on the self-employed" and from the Limburg University Fund/SWOL is gratefully acknowledged. An earlier version of this paper, targeted at Dutch financial institutions, is published as a Netspar Academic Paper (Bokern et al., 2021).

1 Introduction

The COVID-19 pandemic had a large impact on people's lives all over the world. In addition to the substantial health risks, the pandemic and related policy measures severely impacted the economy and society in many domains. Negative economic consequences of the crisis emerged, for instance, through the reduction of consumer demand, increases in unemployment rates, changes in labor conditions, and shocks on financial markets. In the societal domain, individual and social well-being and mental health, among others, have been adversely affected (Brodeur et al., 2021 provide an extensive review). During the pandemic also changes in behavior have been observed, not all of which were exogenously enforced. This raises the natural question whether such changes were just a response to changed rules and incentives or—at least in part—the consequence of an adjustment of preferences during the crises.

Preferences, next to beliefs, are the fundamentals of human economic and social behavior. Therefore, it is important to understand if and how exogenous shocks, such as the COVID-19 pandemic or the war in Ukraine, affect these fundamentals. A possible shift in preferences might affect economic behavior in a wide range of domains, including longer term economic and social developments. For example, changes in risk, ambiguity or time preferences may affect the way people save and invest with both micro- and macroeconomic consequences for wealth accumulation and productivity. Changes in social preferences might shift support for welfare programs and redistribution policies.[1] Moreover, knowledge about a change in preferences is of vital importance for the design of effective policies, as it may necessitate an adjustment of rules and incentives. Ignoring it may lead to ill-advised policy reforms and unintended adverse outcomes Allcott et al., 2020; Barrios and Hochberg, 2020; Van Bavel et al., 2020; Fan et al., 2020). Importantly, in case preferences are indeed affected by exogenous shocks, this would imply that they need to be continuously monitored to design well-informed policies.

We exploit the COVID-19 crisis to investigate the effect of a longer-lasting adverse event on risk, time, ambiguity, and social preferences.[2] To elicit preferences and explore preference change,

[1]Theoretical arguments and empirical evidence suggest that risk preferences are correlated with investment and occupational decisions, such as becoming self-employed (Beauchamp et al., 2017; Menkhoff and Sakha, 2017), time preferences with savings decisions (Sutter et al., 2013; Falk et al., 2018), wealth (Huffman et al., 2019), and saving and planning for retirement (Clark et al., 2019), and ambiguity preferences with stock market participation (Dimmock et al., 2016) as well as portfolio choices (Bianchi and Tallon, 2019). Social preferences have been found to influence attitudes towards re-distributive policies and the willingness to donate money or to volunteer (Falk et al., 2018; Almas et al., 2020).

[2]There is evidence suggesting that exposure to a natural disaster can lead to increased risk aversion and more impatience (see, e.g., Beine et al., 2020, for the case of earthquakes). See also Chuang and Schechter (2015), for a review of the impact of exogenous shocks on economic preferences more generally. Importantly, these disasters

we implemented incentivized economic tasks in a large population sample from the Netherlands in four waves before and during the crisis. The first wave was conducted right before the onset of the crisis; the second, third and fourth wave took place during the first and the second lockdown phase in the Netherlands. Altogether, this waves cover a period of more than a year during the crisis. Comparing preferences measured in the waves during the crisis with those elicited before the start of the pandemic allows us to identify causal effects of exposure to the crisis. In addition, we elicited data which make it possible to analyze if and how differences in individual exposure to COVID-19 are correlated with differences in the elicited preferences.

Traditional economics assumes that preferences are stable and do not respond to external events, at least not in the short-run. However, lately theoretical arguments have been put forward stating that preferences are state-dependent and may respond to external circumstances, such as economic incentives and the environment a decision-maker is immersed in (Bowles and Polania-Reyes, 2012). Additionally, laboratory experiments show that previous exposure to specific environments may have spillover effects on behavior, preferences, and beliefs (see, e.g., Brandts and Riedl, 2020; Engl et al., 2021, and the references therein).

A number of studies report on the effect of the COVID-19 crisis on preferences but the existing findings are mixed and difficult to compare, due to differences in samples and preferences elicitation methods (Umer, 2023 provides an extensive review).[3] Concerning risk preferences, it has been found that people became more risk averse (Li et al., 2020), less risk averse (Adema et al., 2022; Gassmann et al., 2022; Shachat et al., 2021), did not change (Angrisani et al., 2020; Drichoutis and Nayga, 2022; Harrison et al., 2022; Lohmann et al., 2023), or that the results depend on the elicitation method (Aksoy et al., 2021; Zhang and Palma, 2021). Ambiguity aversion has been observed to increase (Shachat et al., 2021) and decrease (Gassmann et al., 2022). Time preferences have mostly been found to remain stable (Drichoutis and Nayga, 2022; Gassmann et al., 2022; Harrison et al., 2022; Lohmann et al., 2023), although Li et al. (2020) found that participants became less patient. Finally, social preferences, specifically altruism, have been found to increase (Aksoy et al., 2021; Shachat et al., 2021 or remain stable (Lohmann et al., 2023).[4]

---

have been short one-time events, whereas the COVID-19 pandemic was longer-lasting with much uncertainty about its duration.

[3] We discuss the related literature in some detail in the next section.

[4] Umer (2023) also discusses results based on unincentivized elicitation methods and concludes that those show even higher variability.

Importantly, most of the previous studies use student samples that are relatively homogeneous in their socio-economic characteristics and exposure to the crisis.[5] However, in order to understand heterogeneous responses and to develop effective policy measures it is important to explore potential shifts in important preference domains of a broader range of population groups. Moreover, to our knowledge, none of the existing studies simultaneously considered a general population sample, using incentivized tasks for a broad set of preferences, elicited before and after the crisis.

Our main contributions are: first, our participant pool consists of a large general population sample; second, we elicited a wide range of preferences (risk, time, ambiguity, and social preferences) using different incentivized experimental tasks, also within preference domains; third, we elicited preferences in four waves, before and during the crisis, over a time period of more than a year, allowing us to investigate both short-term and medium-term preference responses in a causal way; fourth, besides the measurement of direct effects of the crisis on preferences across waves, we also observe within each experimental wave how various measures of self-stated individual exposure to the crisis affect preferences.

We find that, despite some indications for short-term fluctuations in some of the measures, elicited preferences are remarkably stable over the whole measurement period. We do not observe robust significant differences in any preference domain when comparing preferences of participants directly before the start of the crisis with those elicited at three different points in time up to more than a year after the start of the crises. We do find suggestive evidence for a small shift in risk, ambiguity, and social preferences, due to adverse individual exposure in the financial and career domain during the pandemic. At the same time, there is no evidence that individual exposure to the crisis in the health domain and beliefs concerning the duration of the crisis affects preferences.

The rest of the paper is organized as follows. In Section 2, we briefly review related experimental economics literature that investigates the effect of the COVID-19 crisis on preferences. In Section 3 we describe the decision tasks and experimental implementation in detail. The results are presented in Section 4. Section 5 discusses the results and concludes.

[5] With the exception of Angrisani et al. (2020), who have a small number of traders in their sample, and Aksoy et al. (2021) and Zhang and Palma (2021) who both consider a sample from Amazon Mechanical Turk (AMT).

2 Related Literature

The studies that have investigated the effect of COVID-19 on preferences use a multiplicity of approaches, including both hypothetical and incentivized decision tasks as well as surveys that are elicited pre- and post-pandemic or are based solely on post-pandemic data. We briefly review those studies which, similar to ours, used incentivized economic experiments to investigate the effect on risk, ambiguity, time, or social preferences (see Umer, 2023, for a more comprehensive recent overview).

Gassmann et al. (2022), Lohmann et al. (2023), and Shachat et al. (2021) are closest to our study in terms of the variety of preferences they collect, but they all use students samples. Gassmann et al. (2022) implemented incentivized multiple price lists (as in Holt and Laury, 2002) to measure risk, time and ambiguity preferences in a sample of French students. They collected data over a three months period during and after the end of the first lockdown in France and compared them to data elicited in a comparable sample several years before the crisis. The authors find that risk and ambiguity aversion as well as patience decrease during the lockdown relative to their base levels and increase again after the lockdown (but do not reach the original base level). Lohmann et al. (2023) elicit risk, time, and social preferences pre- and post-pandemic in a sample of Chinese students. Risk preferences are measured with a lottery choice task (Eckel and Grossman, 2002) and an investment task (Gneezy and Potters, 1997), time preferences with Convex Time Budgets (Andreoni and Sprenger, 2012), and social preferences with dictator games. On the aggregate, exposure to COVID-19 does not significantly affect preferences, but there is some evidence for heterogeneous responses of men and women.[6] Shachat et al. (2021) elicit risk, ambiguity, and social preferences also in sample of Chinese students, both pre-pandemic and in multiple waves over a six-weeks period during the crisis. Risk and ambiguity preferences are elicited with multiple price lists and social preferences with dictator games. The authors observe an increase in risk-tolerance, ambiguity aversion, and altruism in the early waves of their study.

Several studies elicit risk and time preferences and others elicit risk and social preferences. Drichoutis and Nayga (2022) elicit risk and time preferences among Greek students using multiple price lists both before and in two waves during the crisis and report that the preferences remain stable across all three waves. Li et al. (2020) use multiple price lists in a sample of Chinese students and find that participants were more risk averse and less patient after the start of the pandemic. Harrison et al. (2022) measure atemporal risk preferences, time preferences and in-

[6]Men decrease risk-taking in the Gneezy and Potters task and become less likely to be present-biased with more exposure.

tertemporal risk preferences among US students in several waves during the crisis with unordered incentivized lottery choices. The authors find that the atemporal risk premium increases during the crisis whereas time preferences and intertemporal risk preferences remain stable. Aksoy et al. (2021) elicit both risk and social preferences in a sample of Amazon Mechanical Turk (AMT) workers in the US. Risk preferences are measured with a multiple price list and the investment task of Gneezy and Potters (1997). They find that after the start of the pandemic risk aversion decreases in the investment task, whereas it increases in the multiple price lists. Social preferences were elicited with a dictator game and they find that participants became more altruistic after the start of the pandemic.

Another set of studies collect only one type of preferences. Angrisani et al. (2020) elicit risk preferences of students and professional traders with the Bomb Risk Elicitation Task (Crosetto and Filippin, 2013) before and at the beginning of the crisis and report no preference change.[7] Adema et al. (2022) elicit risk preferences with a lottery choice and find that participants were less risk averse after the start of the pandemic. Zhang and Palma (2021) elicit risk preferences with a lottery choice task (Eckel and Grossman, 2002) and the balloon analogue risk task (Lejuez et al., 2002). They find no changes in risk aversion when measured with the lottery choice task, but do observe that an increase in risk aversion when measured with the balloon analogue risk task. Brañas-Garza et al. (2022) investigate charitable donations in a sample of Spanish citizens during the initial phase of the crisis and find it decreases with the degree of exposure to the crisis.

3 Experimental Design and Procedures

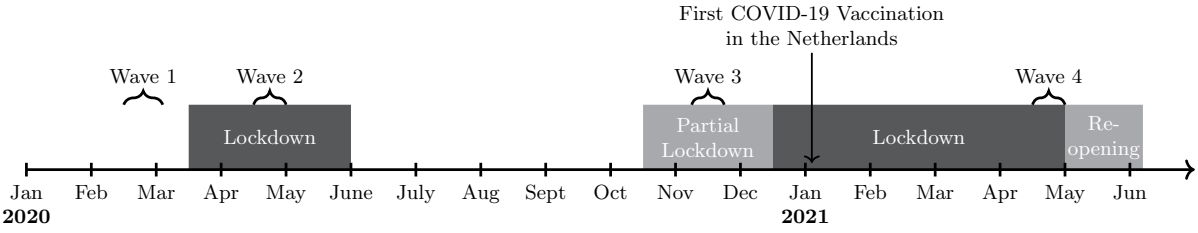
In this section, we first explain the implementation and timing of the study. Thereafter, we elaborate on the different tasks used to elicit risk, ambiguity, time and social preferences. Finally, we describe our survey questions used to capture the extent to which individuals were exposed to the COVID-19 crisis.

3.1 Timing and Implementation

Our study consisted of four waves implemented at multiple points in time before and during the COVID-19 crisis in the Netherlands (see Figure 1 for the timeline). The field time of the first

[7] At the same time, the authors find heterogeneous effects of personal experiences with COVID-19 (i.e. infection of oneself or of a close friend or family member) on risk preferences.

wave was from February, 20 to March 2, 2020, and thus shortly before the crisis was recognized as such in the Netherlands (and most parts of Europe, except for Italy).[8] Shortly thereafter, the first lockdown was introduced in the Netherlands. In order to test the short-run impact of the uncertainty around COVID-19 and the initial lockdown on preferences, we implemented a second wave between April 22 and April 29, 2020. After a quiet period, with little restrictions, COVID-19 became more prevalent again towards the end of 2020 and a "partial" lockdown started on October 13. In order to gauge a potential longer-run impact of COVID-19 and the restrictions, we implemented a third wave between November 11, 2020 and November 18, 2020. The restrictions tightened further on December 15 and the term lockdown was used again. Around the same time, however, the first positive signs concerning vaccination popped up and in January 2021 the first vaccination was administered in the Netherlands. Nevertheless, the end of this lockdown would only be announced at the end of April, 2021. Throughout May, the restrictions were lifted one-by-one by means of a re-opening plan and the lockdown officially ended on June 5. To test the impact of this long, very strict, lockdown, we decided to implement a final wave between April 21 and April 29, 2021, right before the first restrictions were lifted.



Notes: The first lockdown started on March 15, 2020, with the closing of schools, restaurants and sports clubs and was extended on March 23, 2020, with further restrictions on public gatherings. Plans to relax the general lockdown measures were published on May 6, 2020. Already before this date, on April 21, 2020, it was announced by the Dutch government that schools would be opened again by May 11, 2020. A second lockdown with less restrictions (a "partial" lockdown) started on October 13, 2020. However, during November and December, the government increased the restrictions step-by-step and as of December 15, 2020 the term lockdown was used again. On January 23, 2021, restrictions were tightened even further with the introduction of an evening curfew. On April 20, 2021 the government announced the start of its reopening plan that would become active on April 28, 2021. As part of the reopening plan, the evening curfew would be lifted and shops and outdoor areas of restaurants and cafes would partially reopen. The lockdown officially ended on June 5, 2021. For a detailed timeline, see https://www.rijksoverheid.nl/onderwerpen/coronavirus-tijdlijn (last retrieved May 2023).

Figure 1: Timeline COVID-19 in the Netherlands and Study Implementation

[8]The initial wave was originally planned as a pilot session for a large scale study among a representative sample of the Dutch population. The study served as a test run of the parameters and presentation of the elicitation tasks. Therefore, we have two versions for some of the preference measures with slight differences in the parameters used (see Section 3.2 for details).

In all four waves, we implemented an identical set of preference elicitation tasks to measure risk, ambiguity, time, and social preferences. Waves 2 to 4 additionally included an extensive questionnaire on participants' exposure to the crisis, the effects of the crisis in various domains (e.g., health and economic), as well as their beliefs concerning the crisis and the future development of the economy. The experiments were programmed and implemented online by the research agency Flycatcher. Flycatcher operates a panel of about 10,000 members recruited from the Dutch general population who are regularly invited for participation in online studies. Participants were recruited through e-mail.

Altogether 1035 individuals in the age range of 18 to 67 years took part in our study (125 in wave 1, 290 in wave 2, 314 in wave 3 and 306 in wave 4).[9] All waves were conducted between-subjects, thus no one participated in multiple waves. Our sample covers a wide range of population groups of the Netherlands in terms of age, sex, education, and income. A comparison of the samples across waves shows that there are no significant differences in the composition of the waves concerning the background variables of participants, except for education levels (see Appendix A.1). We control for participants' demographic and socioeconomic background characteristics in the analyses.

Participants were informed that one out of ten participants would be randomly selected to receive payments dependent on their decisions.[10] One choice of these participants was then randomly picked and paid out. The median participation time in our study was 36, 45, 46 and 44 minutes in waves 1 to 4, respectively.Participants earned on average €7.66 in wave 1, €8.06 in wave 2, €6.61 in wave 3 and €6.58 in wave 4.[11] These amounts were paid out via bank transfers with the help of Flycatcher in a way that guaranteed anonymity of the participants towards the research team.

[9]We used different versions of the tasks that differed slightly in parameter values (for details see below, Section 3.2). The number of participants that received version 1 (2) of the tasks was 51 (74), 146 (144), 151 (163) and 154 (152), respectively for waves 1 to 4. We conducted a third version of the tasks with an additional 145 participants in wave 2 as a further test of parameters for our large-scale study. Because version 3 was elicited only in wave 2, we do not use this data for further analyses.

[10]Participants could choose at the end of the study whether they wanted to be contacted for payments. Across all waves, 92.6% of the participants selected to be contacted for payments (between 92.0% and 93.8%, depending on the wave). The random draw to determine which participants received payment was done on the subset of participants who wanted to be paid.

[11]In wave 2 to 4 participants spend more time becasue of the additional survey questions related to COVID-19 that were included at the end of the study. The average earnings are close to working 45 minutes at the Dutch minimum wage in 2020 (which was €9,70 per hour for a 40 hour workweek, see https://www.rijksoverheid.nl/onderwerpen/minimumloon/bedragen-minimumloon/bedragen-minimumloon-2020, last retrieved May 2023)

3.2 Preference Elicitation Tasks

We elicited risk, time, ambiguity, and social preferences with several complimentary experimental tasks. Risk and time preferences were elicited jointly with the convex time budget (CTB; Andreoni and Sprenger, 2012) and separately with several multiple price lists (MPLs) in the spirit of Holt and Laury (2002) and Coller and Williams (1999), respectively. To infer risk preferences from participants' decisions in these tasks, we rely on simple count measures because they do not require any restrictive modeling assumptions for decision-making under risk. Higher-order risk preferences were elicited with five binary choices for prudence and five binary choices for temperance, following Noussair et al. (2014) Ambiguity aversion was elicited with MPLs, in the spirit of Cettolin and Riedl (2019). Social preferences were elicited with a modified version of the solidarity game by Selten and Ockenfels (1998). We discuss the tasks in detail below.

To facilitate understanding of the decision tasks we used graphical elements for the display of the tasks. Moreover, they were explained through short video clips that participants watched prior to each task. These videos explained the decision tasks step by step, successively highlighting the relevant parts of the decision screens. In addition to the video clips, written instructions were available for online reading and download.[12] More information on the experimental design, including instructions and screenshots, can be found in Appendix B.

Convex Time Budget (CTB). We implemented an adapted version of the CTB (Andreoni and Sprenger, 2012; Potters et al., 2016), which jointly elicits risk and time preferences. In our implementation, participants received two sets of 12 decision tasks sequentially (see Table B1 in the Appendix). In each decision task, participants allocated money between an earlier date, which was 8 weeks from the day of participation, and a later date, which was 12, 16, or 24 weeks from the day of participation depending on the task and version.[13] Payments allocated to the early date were always certain, whereas payments to later dates were paid with a 50%, 70%, 90% or 100% chance, depending on the decision task. These probabilities were known to participants. Depending on the decision task, the amounts allocated to the later date paid an interest rate of 0%, 4% or 16% over the period by which the payment was delayed. The budget to be allocated by the decision-maker was always €75. When the chance of future payments

[12]Importantly, the perceived clarity of the instructions was very high, generally ranging between values of 8 and 9 on a scale from 0 (completely unclear) to 10 (very clear), for all tasks and irrespective of the format (video or written instructions) (see Tables A6 and A7 in Appendix A.2 for details).

[13]In version 1 (2), the late date was 12 (16) weeks from the day of participation in the first set of decision tasks and 16 (24) weeks from the day of participation in the second set of decision tasks.

was below 100% the amount to be paid was increased such that the expected value of the future payment matched the certain payment in the 100% payout case. To simplify the decisions, each choice set was discretized into 13 predefined allocations. Two of the predefined allocations constituted dominated choices, which serve as a comprehension and attention check.[14]

To infer risk preferences from the CTB, we compare allocations in decision tasks with risk (that is, the decision situations where the later payoff was obtained with a 90%, 70%, or 50% chance) to allocations in their risk-less counterpart (i.e., the decision situation where the later payoff was obtained with a 100% chance). If an individual allocates less (more) money to the later date in the task with risk, compared to its risk-less counterpart, then we categorize the allocation as risk averse (seeking). If the individual allocates the same in both, then we categorize the allocation as risk neutral.[15] As a measure of risk preference on the individual level, we simply count the number of decisions that are classified as risk seeking (RS) with weight=-1, risk neutral (RN) with weight=0, and risk neutral (RA) with weight=1 for both sets and take the average. Larger values of this variable are thus associated with a stronger tendency of the participant to avoid risk. To infer time preferences, we simply take the average euro amount a participant allocates to the late date in risk-less decision situations (i.e., the decision situation where the later payoff was obtained with a 100% chance). Larger values for this variable are thus associated with higher patience of the decision-maker.

Multiple Price Lists (MPL). Risk preferences were elicited using two rMPLs (see Tables B4 and B5 in the Appendix). In each rMPL, participants made nine choices between a certain payoff and a lottery that paid a lower and a higher payoff with a given probability. The probability for the low (high) payoff was either 0.50 (0.50) or 0.33 (0.67). The outcomes and probabilities remained the same within each MPL, whereas the value for certain payoffs increased across rows. We take the average number of safe choices across both rMPLs as a simple measure for participants' risk aversion, with a higher number of safe choices indicating higher aversion towards risk. Time preferences were elicited with two tMPLs (see Tables B2 and B3 in the Appendix). In each tMPL, participants made nine choices between €75 at an early date (8 weeks from the day of participation, just as in the CTB) and varying amounts to be paid at a later date (in 12 or 16 weeks and in 16 or 24 weeks, depending on the task version). Moving

[14]The majority of participants (827, 80% of the entire sample) never makes a dominated choice in this task. We control for whether a participant makes at least one dominated choice in the analysis.

[15]If an individual makes a corner choice in both the decision with risk and their risk-less counterpart, then we categorize the pairs of corner choices at the early (late) date as risk averse (seeking).

down the list, the amount to be paid at the later date increased, yielding interest rates between 0% and 21.3% over the delay period. The decision situation where participants switched from the early to the late option defined an interval for their individual time preferences. We take the average number of patient choices (favoring the later option) across both tMPLs as a simple measure for participants' time preference, with higher values indicating more patience.

Higher-order risk preferences were elicited using tasks introduced by Noussair et al. (2014) (see Tables B6 and B7 in the Appendix). To elicit prudence, participants faced a series of five binary decision situations. In each decision situation, participants received a lottery that would yield a high or a low outcome with equal probability. They were then asked to choose whether they wanted to add a zero-mean lottery to the state of high wealth or to the state of low wealth. Prudent decision-makers would add the lottery to the state of high wealth. As a measure of prudence, we simply count the number of prudent choices. Temperance was also elicited with five binary decision situations. In each decision situation, participants received a fixed payment and had to decide whether they wanted to aggregate or disaggregate two identical zero-mean lotteries. Temperate participants would prefer disaggregation of the lotteries. As a measure of temperance, we simply count the number of temperate choices.

Ambiguity preferences were elicited with two aMPLs in which participants had to choose between risky lotteries with known probabilities of winning and an ambiguous lottery where the probability of winning was unknown (see Table B8 in the Appendix). Participants also had the option to state indifference, in which case a fair random device chose between the options for them (Cettolin and Riedl, 2019). The winning probabilities in the lotteries were displayed with red and blue balls in urns. The left urn contained 10 red or blue balls in a known and displayed proportion. The right urn also contained 10 red or blue balls, but the urn was made opaque so that the proportion of red and blue balls was unknown to the participant. Participants were informed that the proportion of red and blue balls in the ambiguous urn stayed the same within each and between both aMPLs. The proportion of red and blue balls in the risky urn varied from all red in the first row of an aMPL to all blue in the last row. The two aMPLs differed only with respect to the color associated with winning the lottery. To control whether a participant fully understood the task, we added a dominated option to each aMPL consisting of an urn with a displayed proportion of 10 balls of the losing color.[16] We look at two measures for ambiguity. First, we count the number of times the risky lottery is chosen in both aMPLs and take the

[16]The majority of participants (984, 83% of the entire sample) never makes a dominated choice in this task. We control for dominated choices in the analysis.

average, where a higher number can be interpreted as more ambiguity aversion. Second, we count the number of consecutive indifference choices. If an individual chooses more than one indifference choice in the aMPLs, this can be interpreted as incomplete preferences or preference for randomization (Cettolin and Riedl, 2019). Thus, a higher number of this measure, can be interpreted as less complete preferences or a stronger preference for randomization.

In all MPLs, we did not enforce consistency in participants' choices. That is, we allowed participants to switch multiple times and in the direction of the option that is becoming less attractive. The number of participants who make at least one inconsistent choice in the tMPLs, rMPLs, and aMPLs, are 72 (6%), 109 (9%), and 306 (26%), respectively.[17]

Solidarity Game. Social preferences were elicited with a modified version of the solidarity game introduced by Selten and Ockenfels (1998). Participants were anonymously matched with another participant in the study and were confronted with one of the following four possible situations: (i) both participants win an amount of €80 (with 50% probability), (ii,iii) one participant wins an amount of €80 and the matched other wins nothing or vice versa (both with 20% probability), (iv) both receive nothing (with 10% probability).

Applying the strategy method (Selten, 1967), we elicited social preferences towards different age groups, similarly to Riedl et al. (2019). Specifically, for the case where they would be the sole winner, participants had to decide on the amount of money they were willing to transfer to (a) a young participant (between 16 and 34 years), (b) a middle-aged participant (between 35 and 64 years), and (c) an old participant (65 years and older). We take the average amount sent to others as a measure of social preference. We also asked participants (non-incentivized) what they expected to receive from another participant (in each age group) in case the other person would be the sole winner, measuring participants' beliefs about the solidarity of others. Here, we also take the average over all age groups as a measure of expected solidarity.

3.3 Survey Questions COVID-19

To measure individual exposure to the COVID-19 crisis, we implemented a battery of survey questions in waves 2 to 4. First, we asked participants whether they or a close friend or rela-

[17]Multiple switches in MPLs may be considered as errors (Yu et al., 2021) but may also reflect a preference for randomization (Agranov and Ortoleva, 2017; Cettolin and Riedl, 2019; Agranov and Ortoleva, 2022). In the analysis we do not treat them as errors.

tive had contracted COVID-19 (health exposure).[18] We create a binary variable that captures whether the participant responded "yes" to either question. Second, we asked participants how they perceived the impact of COVID-19 on their financial situation and career perspective.[19] We create two variables that capture whether the participant's financial situation or career perspective worsened, stayed the same, or improved. Third, we asked participants about their belief when everything would be back to normal. For the latter, we create a binary variable that captures whether the participant either beliefs that the situation will be back to normal within one year or that it will take longer.[20]

Table 1 shows descriptive statistics of these survey questions. As expected, the frequency that participants had COVID-19 or knew anyone who had it was lowest in wave 2, at the start of the pandemic, and became more common in later waves. Interestingly, in terms of impact of COVID-19 on the financial situation, the majority of participants in all waves indicated that they did not experience any change. For those who did experience changes, it worsened for the majority in wave 2, whereas it improved for the majority in wave 4. Similarly, for the impact of COVID-19 on the career perspective, the majority of participants in all waves indicated that they did not experience any change. For those who did experience change, the majority in all waves indicated that it worsened, although the proportion becomes more equal in later waves. Participant's beliefs about the end of the crisis are roughly equally split between less than a year or more in wave 2, at the start of the pandemic. In wave 3, at the beginning of the second lockdown, participants became slightly more pessimistic and in wave 4, at the end of the second lockdown, participants became more optimistic.

[18]The exact wording was (translated from Dutch): (i) "Were or are you infected with the so-called coronavirus (COVID-19)?", (ii) "Was or is one of your family members or close friends infected with the so-called coronavirus (COVID-19)?" [answer options for both questions: yes, no, not sure, prefer not to answer]

[19]The exact wording was (translated from Dutch): (i) "In your opinion, to what extent did your financial situation change as a result of the so-called coronavirus (COVID-19)?", (ii) "In your opinion, to what extent did your career perspective change as a result of the so-called coronavirus (COVID-19)?" [answer options for both questions: scale 1-5, where 1 = clearly worsened, ..., 5 = clearly improved, prefer not to answer, not applicable]. In the analysis the latter two options are treated as missing.

[20]The exact wording was (translated from Dutch): "When do you expect that all restrictions regarding the so-called coronavirus (COVID-19) will be lifted so that the situation in the Netherlands will return back to the pre-crisis situation?" [in one month, in three months, in six months, in nine months, in one year, in one and a half years, in more than one and a half years, never]. We use a binary variable for the ease of interpretation because the categories cannot be considered as linear.

Table 1: Self-reported Exposure to COVID-19

	Wave 2		Wave 3		Wave 4	
	N	%	N	%	N	%
Health Exposure						
No infection	255	87.9	191	60.8	143	46.7
Infection	35	12.1	123	39.2	163	53.3
Total	290	100.0	314	100.0	306	100.0
Financial Situation						
No change	212	73.4	211	69.4	192	64.6
Worsened	58	20.1	44	14.5	34	11.4
Improved	19	6.6	49	16.1	71	23.9
Total	289	100.0	304	100.0	297	100.0
Career Perspective						
No change	193	73.1	201	69.8	212	73.6
Worsened	58	22.0	57	19.8	41	14.2
Improved	13	4.9	30	10.4	35	12.2
Total	264	100.0	288	100.0	288	100.0
Situation back to normal						
Within 1 year	147	50.7	139	44.3	185	60.5
More than 1 year	143	49.3	175	55.7	121	39.5
Total	290	100.0	314	100.0	306	100.0

Notes: the responses "not applicable" and "prefer not to answer" are treated as missing. The total number of participants is 125 in wave 1, 290 in wave 2, 314 in wave 3 and 306 in wave 4.

4 Results

In the first part of our analysis, we report results concerning the causal impact of the crisis on the elicited preferences, by comparing behavior across waves. Thereafter, we conduct an in depth analysis among the participants of waves 2 to 4 to test to what extent heterogeneous exposure to the crisis affected preferences.

4.1 The Causal Effect of the Crisis on Preferences

We investigate the causal effect of the crisis on preferences by comparing our measures across waves at the aggregate level. The analysis follows the same structure in each subsection. We first discuss the results descriptively by reporting average responses across waves and the p-value of a non-parametric Kruskal Wallis test analysing differences across waves.[21] We then turn to parametric Ordinary Least Squares (OLS) regression analyses with the constructed measures for each participant in each task as the dependent variable. The first specification is a regression,

[21]Figures A1–A10 in Appendix A.3 show histograms for each measure in every wave.

where we only include dummy variables for the experimental waves, capturing changes in the preference measures in the course of the crisis relative to the situation before the crisis. In the second specification, we additionally include controls for the decision-makers' demographic characteristics (age and sex) and socioeconomic background (education level, being a tenant or a homeowner and income). In this specification we also control for dominated choices.

Risk Preferences

Table 2 reports the average of our risk preference measures for each wave. In all waves participants are risk averse in both the rMPLs and the CTB. In the rMPLs, participants make between 6 and 7 safe choices on average, whereas risk-neutral participants should make only 2 to 3 safe choices. In the CTB, the weighted score is on average between 3 and 4, whereas a score of 0 indicates risk neutrality and 9 the strongest possible form of risk aversion.[22] For higher-order risk preferences, we find that participants make around 4 prudent choices on average. Participants behave slightly less temperate, with the average number of temperate choices between 3 and 4.

Table 2: Risk Preferences Across Waves - Descriptive Statistics

			Wave 1		**Wave 2**		**Wave 3**		**Wave 4**		**KW**
	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-value
Risk (rMPL)	0	9	6.6	2.6	6.5	2.7	6.3	2.7	6.1	2.9	0.354
Risk (CTB)	-9	9	3.7	4.7	3.7	4.6	3.3	4.6	3.9	4.4	0.456
Prudence	0	5	3.9	1.6	4.2	1.4	3.9	1.6	4.0	1.6	0.376
Temperance	0	5	3.7	1.7	3.5	1.8	3.6	1.8	3.3	1.9	0.363

Notes: the table reports means, standard deviations, and the p-values of Kruskal-Wallis tests.

Across waves, the average number of safe choices in the rMPLs decreases slightly. For the CTB, there is no clear trend, however. Prudence and temperance remain roughly the same across waves, although individuals appear to be slightly more prudent in wave 2 and slightly less temperate in wave 4. None of the observed differences are statistically significant according to non-parametric Kruskall-Wallis tests. This is by and large corroborated by the parametric regression analyses reported in Table 3. For rMPLs (Models 1 and 2) and the CTB (Models 3 and 4), the coefficients for the variables reflecting waves 2 to 4 are all small and statistically insignificant. There is some weak indication that participants behave more prudent in wave 2 ($p = 0.052$ and $p = 0.065$, in models 5 and 6, respectively) and less temperate in wave 4

[22] In the rMPLs around 40 percent of participants chooses the safe option in every decision (see Figure A1). In the CTB, for 25 to 30 percent of participants all choices are classified as risk averse (Figure A2).

Table 3: First and Higher Order Risk Preferences

	Risk (rMPL)		**Risk (CTB)**		**Prudence**		**Temperance**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wave 2	-0.04	-0.03	0.05	-0.02	0.32*	0.31*	-0.18	-0.16
	(0.30)	(0.29)	(0.49)	(0.49)	(0.17)	(0.17)	(0.19)	(0.19)
Wave 3	-0.29	-0.29	-0.37	-0.41	0.06	0.05	-0.15	-0.12
	(0.29)	(0.28)	(0.48)	(0.48)	(0.17)	(0.16)	(0.19)	(0.19)
Wave 4	-0.46	-0.44	0.21	0.20	0.11	0.09	-0.36*	-0.33*
	(0.29)	(0.28)	(0.48)	(0.48)	(0.17)	(0.16)	(0.19)	(0.19)
Female		0.62***		0.65**		-0.02		0.44***
		(0.18)		(0.30)		(0.10)		(0.12)
Age		0.04***		0.00		-0.00		0.00
		(0.01)		(0.01)		(0.00)		(0.00)
Middle Educated		0.57**		0.41		0.21		-0.09
		(0.25)		(0.43)		(0.15)		(0.17)
High Educated		-0.33		-0.23		0.13		-0.33*
		(0.27)		(0.46)		(0.16)		(0.18)
Tenant		-0.23		-0.39		0.07		-0.08
		(0.19)		(0.32)		(0.11)		(0.13)
36.500 euro or more		-0.09		-0.48		0.10		-0.06
		(0.23)		(0.39)		(0.13)		(0.16)
Prefer not to state income		-0.09		-0.52		0.15		-0.07
		(0.27)		(0.45)		(0.15)		(0.18)
Dominated Choice		0.18		-1.58***		-0.53***		-0.06
		(0.18)		(0.31)		(0.11)		(0.12)
Constant	6.58***	4.68***	3.69***	4.10***	3.87***	3.97***	3.70***	3.61***
	(0.25)	(0.56)	(0.41)	(0.94)	(0.14)	(0.32)	(0.16)	(0.38)
Observations	1035	1035	1035	1035	1035	1035	1035	1035

Notes: standard errors in parentheses. Risk (rMPL): average number of safe choices. Risk (CTB): average weighted count of risk seeking (weight=-1), risk neutral (weight=0), and risk averse (weight=1) choices. Prudence: number of prudent choices. Temperance: number of temperate choices. Baselevels: Wave 1, Male, Low Educated, Homeowner, Yearly income 36.500 euro or less, did not make dominated choices. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

($p = 0.061$ and $p = 0.091$, in models 7 and 8, respectively), but there is no effect in the other waves. Overall, the crisis does not seem to robustly affect first- and higher-order risk preferences.

We find several effects with respect to the demographic and socioeconomic background of participants. In line with most previous literature (e.g., Croson and Gneezy, 2009), female participants make significantly more safe choices in our study, both in rMPLs ($p = 0.001$) and the CTB ($p = 0.031$). Moreover, women tend to make more temperate choices ($p < 0.001$), in line with Noussair et al. (2014). We find effects of age depending on the task. Older participants behave in a more risk-averse manner in the rMPLs ($p < 0.001$), in line with Dohmen et al. (2011) and von Gaudecker et al. (2011), but not in the CTB ($p = 0.669$). Dummy variables for

education are statistically significant in some of the models, but not in a robust and systematic manner.

Ambiguity Preferences

The descriptive results in Table 4 show that participants choose the risky urn about five times on average in every wave, implying little ambiguity aversion. The average number of consecutive indifference choices is around two in all waves.[23]

Table 4: Ambiguity Preferences Across Waves - Descriptive Statistics

			Wave 1		**Wave 2**		**Wave 3**		**Wave 4**		**KW**
	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-value
Ambiguity Aversion	0	11	5.0	1.3	5.2	1.6	5.0	1.6	4.9	1.5	0.158
Consecutive Indiff.	0	11	1.8	2.0	1.9	2.0	1.7	2.1	1.8	2.3	0.441

Notes: the table reports means, standard deviations, and the p-values of Kruskal-Wallis tests.

Looking at the measures across waves, we observe very small differences and none of the observed differences are statistically significant in non-parametric Kruskall-Wallis tests. Table 5 reports the regression results. In concordance with the descriptive statistics, there is no evidence that the crisis affected ambiguity preferences. In particular, the dummy variables for all three waves are close to zero and statistically insignificant in all models. We also do not find a robust impact of any of the background variables.

Time Preferences

Table 6 reports the descriptive statistics for time preferences for each wave. In the tMPLS participants made between 5 and 6 patient choices in each wave and in the CTB they allocated between €38 and €40 (about 52% of the budget) to the later date.[24]

We observe only small differences across waves and none of the these are statistically significant using non-parametric Kruskall-Wallis tests. This result is confirmed in the regression analyses (Table 7), where the dummy variables for the waves are insignificant in all specifications. Concerning demographics, we find that older participants tend to behave in a less patient way in the CTB ($p = 0.004$), but not the tMPLs ($p = 0.120$). In addition, participants with middle

[23]About half of the participants makes between zero and one consecutive indifference choices, while the other half makes more than one (see Figure A6).

[24]In the tMPLs, between 30 and 40 percent of participants always chose the patient choice when there is a positive interest rate (Figure A7). In the CTB, there is more heterogeneity across participants (Figure A8).

Table 5: Ambiguity Preferences

	Ambiguity Aversion		**Consecutive Indiff.**	
	(1)	(2)	(3)	(4)
Wave 2	0.19	0.16	0.06	0.10
	(0.16)	(0.16)	(0.23)	(0.22)
Wave 3	-0.01	-0.03	-0.08	-0.06
	(0.16)	(0.16)	(0.23)	(0.21)
Wave 4	-0.06	-0.07	0.02	0.04
	(0.16)	(0.16)	(0.23)	(0.21)
Female		-0.09		0.00
		(0.10)		(0.13)
Age		-0.01		0.01
		(0.00)		(0.01)
Middle Educated		-0.06		0.07
		(0.14)		(0.19)
High Educated		0.01		-0.17
		(0.16)		(0.21)
Tenant		0.03		-0.01
		(0.11)		(0.14)
36.500 euro or more		0.02		-0.10
		(0.13)		(0.17)
Prefer not to state income		0.01		0.06
		(0.15)		(0.20)
Dominated Choice		-0.65***		1.45***
		(0.10)		(0.14)
Constant	5.00***	5.51***	1.80***	1.14***
	(0.14)	(0.32)	(0.19)	(0.42)
Observations	1035	1035	1035	1035

Notes: standard errors in parentheses. Ambiguity Aversion: average number of risky urn choices. Consecutive Indiff.: average number of consecutive indifference choices. Baselevels: Wave 1, Male, Low Educated, Homeowner, Yearly income 36.500 euro or less, did not make dominated choices. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

and high education levels make somewhat more patient choices in the tMPLs ($p = 0.021$ and $p = 0.001$, respectively), but not in the CTB ($p = 0.423$ and $p = 0.810$, respectively). Finally, tenants are less patient in the tMPLs ($p = 0.009$), but this effect is not found for the CTB ($p = 0.960$).

Table 6: Time Preferences Across Waves - Descriptive Statistics

			Wave 1		**Wave 2**		**Wave 3**		**Wave 4**		**KW**
	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-value
Time (tMPL)	0	9	5.7	2.8	5.5	2.7	5.3	2.7	5.8	2.6	0.152
Time (CTB)	0	75	39.6	19.1	40.1	18.3	38.1	18.8	39.4	19.4	0.470

Notes: the table reports means, standard deviations, and the p-values of Kruskal-Wallis tests.

Table 7: Time Preferences

	Time (tMPL)		**Time (CTB)**	
	(1)	(2)	(3)	(4)
Wave 2	-0.24	-0.25	0.56	0.18
	(0.29)	(0.28)	(2.02)	(2.00)
Wave 3	-0.39	-0.42	-1.43	-1.66
	(0.28)	(0.28)	(2.00)	(1.98)
Wave 4	0.01	-0.05	-0.16	-0.36
	(0.28)	(0.28)	(2.00)	(1.98)
Female		0.05		-0.47
		(0.17)		(1.23)
Age		-0.01		-0.14***
		(0.01)		(0.05)
Middle Educated		0.58**		-1.41
		(0.25)		(1.76)
High Educated		0.92***		-0.46
		(0.27)		(1.90)
Tenant		-0.49***		0.07
		(0.19)		(1.32)
36.500 euro or more		-0.06		1.48
		(0.23)		(1.60)
Prefer not to state income		-0.10		0.72
		(0.26)		(1.85)
Dominated Choice		-0.72***		-6.72***
		(0.18)		(1.27)
Constant	5.74***	6.01***	39.57***	47.82***
	(0.24)	(0.55)	(1.69)	(3.88)
Observations	1035	1035	1035	1035

Notes: standard errors in parentheses. Time (tMPL): average number of patient choices. Time (CTB): average amount allocated to the late period in decisions without risk. Baselevels: Wave 1, Male, Low Educated, Homeowner, Yearly income 36.500 euro or less, did not make dominated choices. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Social Preferences

Here we first look at the average amount that participants' sent to others, averaged over all target groups (Table 8). We find that participants exhibit clear prosocial behavior by sending

on average between €23 and €25, and thus between 29% and 32% of their endowment of €80. Interestingly, participants on average show substantial pessimism about the solidarity of other participants: expected transfers are substantially lower than the amounts sent in all waves.[25] Similar pessimistic expectations about solidarity have been found before in a large population sample (see Riedl et al., 2019).

Table 8: Social Preferences Across Waves - Descriptive Statistics

			Wave 1		**Wave 2**		**Wave 3**		**Wave 4**		**KW**
	Min	Max	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-value
Solidarity Sent	0	80	23.5	18.6	24.7	16.2	24.7	17.3	24.9	17.3	0.927
Solidarity Expect	0	80	17.3	15.3	18.1	14.7	20.1	16.4	19.6	16.4	0.361

Notes: the table reports means, standard deviations, and the p-values of Kruskal-Wallis tests.

Looking at the average transfers and expectations across waves, we find little differences and none are statistically significant using non-parametric Kruskall-Wallis tests.[26] The descriptive results are confirmed by the regression analyses reported in Table 9. In Models 1 and 2, where the dependent variable is the average amount transferred to others, we find that none of the dummy variables reflecting the different waves is statistically significant. The same holds for the average expected solidarity transfers (Models 3 and 4).[27] Concerning the effect of demographic background, we observe that women, older and highly educated participants expect lower solidarity from others ($p = 0.041$, $p = 0.045$, $p = 0.060$, respectively). In addition, tenants tend to transfer less compared to homeowners ($p = 0.050$).

[25] If we compare average transfers and average expected transfers on the level of the individual participant (and separately for each wave) using two-sided Wilcoxon Matched Pairs Signed Ranks tests, all tests yield $p < 0.001$.

[26] The shares of fully selfish choices, i.e. average transfers of €0, also do not fluctuate strongly across waves, with 26.4%, 20.0%, 18.8% and 22.2% for waves 1 to 4, respectively.

[27] The dummy variable for wave 3 is marginally significant in Model 3 ($p = 0.098$), but this effect vanishes when we control for the backgrounds of participants in Model 4.

Table 9: Solidarity Preferences

	Solidarity Sent		**Solidarity Expected**	
	(1)	(2)	(3)	(4)
Wave 2	1.19	0.91	0.81	0.06
	(1.84)	(1.85)	(1.69)	(1.70)
Wave 3	1.17	0.93	2.77*	2.09
	(1.82)	(1.83)	(1.67)	(1.68)
Wave 4	1.37	1.34	2.29	1.93
	(1.82)	(1.83)	(1.68)	(1.68)
Female		0.45		-2.14**
		(1.14)		(1.05)
Age		0.06		-0.08**
		(0.04)		(0.04)
Middle Educated		-1.34		-1.23
		(1.63)		(1.50)
High Educated		-2.12		-3.04*
		(1.76)		(1.62)
Tenant		-2.40*		-1.82
		(1.22)		(1.12)
36.500 euro or more		0.12		-1.18
		(1.48)		(1.36)
Prefer not to state income		-0.87		-1.85
		(1.71)		(1.57)
Dominated Choice		-0.21		1.38
		(1.18)		(1.08)
Constant	23.53***	23.36***	17.29***	25.35***
	(1.54)	(3.59)	(1.41)	(3.30)
Observations	1035	1035	1035	1035

Notes: standard errors in parentheses. Solidarity Sent: average amount sent to others. Solidarity Expected: average amount expected from others. Base-levels: Wave 1, Male, Low Educated, Homeowner, Yearly income 36.500 euro or less, did not make dominated choices. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Taken all results together, we observe a remarkable stability of preferences. There are no systematic and robust differences between preferences elicited shortly before the crises and preferences elicited over a one-year period during the crises including two lockdown phases in the Netherlands.

4.2 Heterogeneous Effects of Exposure to COVID-19

The lack of changes in preferences between the different waves may mask individual heterogeneity in preference adjustments of participants, as those may depend on individual exposure to COVID-19. Specifically, we hypothesize that participants with a stronger health related exposure and

participants who economically were hit severely will show a stronger response in preferences than other participants. In this section we test for this possibility.[28]

To investigate the impact of personal exposure to the crisis, we conducted regression analyses similar to those reported in the previous subsection. We summarize the results of all regression models in Table 10 by reporting the coefficients and standard errors of the variable capturing individual exposure to the crisis. The full table with all regression results can be found in Appendix A.4. Models 1 to 4 concern first- and higher-order risk preferences (rMPL, CTB, prudence and temperance), Models 5 and 6 time preferences (tMPL, CTB), Model 7 and 8 ambiguity preferences, and Models 8 and 9 solidarity preferences. All models control for demographic and socioeconomic backgrounds of the decision-maker, dominated choices, and the version of the experimental tasks where applicable.

Table 10 shows that most of the variables capturing exposure to the crisis have little impact on preferences. In particular, none of the coefficients for exposure to the crisis in the health domain

Table 10: Heterogenous Exposure to the COVID-19 crisis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(i) Health exposure										
Infection	-0.08	0.22	-0.03	0.09	0.01	0.39	-0.11	-0.09	1.15	-0.30
	(0.20)	(0.33)	(0.11)	(0.13)	(0.19)	(1.36)	(0.11)	(0.15)	(1.25)	(1.17)
(ii) Financial Situation										
Worsened	0.41	1.22**	0.36**	-0.20	-0.28	-3.23	0.17	-0.49**	0.12	-1.39
	(0.29)	(0.48)	(0.17)	(0.20)	(0.28)	(1.99)	(0.16)	(0.21)	(1.84)	(1.72)
Improved	-0.48*	-0.51	-0.10	0.17	-0.19	-0.54	0.19	-0.32	-1.62	-1.64
	(0.27)	(0.45)	(0.16)	(0.18)	(0.26)	(1.86)	(0.15)	(0.20)	(1.72)	(1.61)
(iii) Career Perspective										
Worsened	-0.44*	-1.08**	0.09	0.13	-0.08	2.90	-0.06	-0.09	2.78*	1.87
	(0.26)	(0.43)	(0.15)	(0.18)	(0.25)	(1.78)	(0.15)	(0.19)	(1.64)	(1.53)
Improved	-0.27	-0.28	-0.13	-0.05	-0.23	3.11	0.04	-0.13	2.94	3.12
	(0.34)	(0.57)	(0.20)	(0.23)	(0.33)	(2.37)	(0.20)	(0.26)	(2.19)	(2.04)
(iv) Belief Back to Normal										
More than 1 year	0.05	0.18	0.06	0.02	0.22	-0.99	-0.02	-0.01	-0.29	-0.50
	(0.19)	(0.31)	(0.11)	(0.13)	(0.18)	(1.28)	(0.11)	(0.14)	(1.18)	(1.11)

Notes: (1) Risk (rMPL), (2) Risk (CTB), (3) Prudence, (4) Temperance, (5) Time (tMPL), (6) Time (CTB), (7) Ambiguity Aversion, (8) Consecutive Indifference, (9) Solidarity Sent, (10) Solidarity Expected. The table reports coefficients and standard errors in parenthesis of the impact variables from an OLS regression. All models include control variables for sex, age, education level, homeownership, income, and whether the individual made at least one dominated choice. A table with all regression results can be found in Appendix A.4. Participants from wave 1 and participants that answered 'prefer not to answer' or 'not applicable' in any of the survey questions are excluded, leaving a total of 831 participants. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[28]For definitions and an overview of the variables capturing health and economic exposure, recall Section 3.3 and Table 1.

and beliefs about the further duration of the crisis are statistically significant. We do find a few, albeit small, effects for exposure to the crisis in the financial and career domain. Specifically, participants who state that the financial situation has improved during the crisis tend to make less safe choices, thus behave less risk-averse, in the rMPLs ($p = 0.076$). However, such an effect is not found in the CTB ($p = 0.252$). Rather, participants who experienced a worsening of their financial situation tend to make more risk averse choices in the CTB ($p = 0.011$), but not in the rMPLs ($p = 0.150$). They also make more prudent choices ($p = 0.032$) and less consecutive indifference choices in the aMPLs ($p = 0.023$). Participants who indicated that their career perspective worsened make less safe choices, thus behave less risk-averse, in both the rMPLs ($p = 0.089$) and the CTB ($p = 0.011$). At the same time, they tend to sent slightly more money to others in the solidarity game ($p = 0.090$).

In sum, we find that individual exposure to the crisis in the financial and career domain appeared to have some small effect on risk, ambiguity, and social preferences. Beliefs about the duration of the crisis and exposure to the crisis in the health domain had no effect. All in all, there is only weak evidence that exposure to the crisis affected preferences.

5 Discussion and Conclusion

We test the robustness of preferences in a heterogeneous sample of the Dutch population during a long lasting crisis. We measure risk, time, ambiguity and social preferences before and during the COVID-19 pandemic in four waves over a period of over one year. Our findings provide evidence for that preferences are largely stable over the investigated period. Comparing preferences before the crisis with preferences during the first and second lockdown in the Netherlands, we do not observe robust and significant shifts in the elicited preferences. In addition, we find that individual exposure to the COVID-19 crisis in the domain of health has little impact on preferences. Participants' beliefs about the further duration of the crisis also do not affect preferences. There is some weak evidence that individual exposure in the financial and career domain affects risk, ambiguity, and social preferences. By and large, however, the effects of individual exposure to the crisis on preferences are limited.

That preferences remain relatively stable on the population level as well as individually is encouraging from both a theoretical and a practical perspective. If preferences could be assumed to remain stable throughout a crisis, policy measures can be developed on the basis of existing knowledge about how preferences are distributed in the population. Moreover, stability

of preferences would increase the predictive value of theoretical models that try to forecast the dynamics of economic interaction during a crisis.

Our results only allow for conclusions concerning medium-term effects, and we acknowledge that our study is only one step in understanding the dynamics of preference development throughout a crisis. For the understanding of possible impacts of any crisis (e.g., the war in Ukraine, climate change) on preferences and for the formulation of adequate policies to respond to them, it is of crucial importance to measure preferences on an ongoing basis. This is important because economic and other consequences of a crisis might become visible for many people only in the longer term, and effects may diverge among various population groups. In addition, potential preference adjustments might interact with societal and political responses to the crisis, such as the degree to which the government supports those who are most adversely affected.

In conclusion, we find remarkable stability of a large set of preferences during the COVID-19 crisis. Our results are complementary to a literature on that topic that finds mixed results. Future result could investigate the roots of these discrepancies in order to achieve a better understanding of the nature of preferences and their stability in the case of exogenous shocks.

References

Adema, J., Nikolka, T., Poutvaara, P., and Sunde, U. (2022). On the stability of risk preferences: Measurement matters. *Economics Letters*, 210:110172.

Agranov, M. and Ortoleva, P. (2017). Stochastic choice and preferences for randomization. *Journal of Political Economy*, 125(1):40–68.

Agranov, M. and Ortoleva, P. (2022). Revealed preferences for randomization: An overview. *AEA Papers and Proceedings*, 112:426–30.

Aksoy, B., Chadd, I., Osun, E., and Ozbay, E. (2021). Behavioral changes of MTurkers during the COVID-19 pandemic (SSRN Working Paper). `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3920502`.

Allcott, H., Boxell, L., Conway, J., Gentzkow, M., Thaler, M., and Yang, D. (2020). Polarization and public health: Partisan differences in social distancing during the coronavirus pandemic. *Journal of Public Economics*, 191:104254.

Almas, I., Cappelen, A. W., and Tungodden, B. (2020). Cutthroat capitalism versus cuddly socialism: Are Americans more meritocratic and efficiency-seeking than Scandinavians? *Journal of Political Economy*, 128(5):1753–1788.

Andreoni, J. and Sprenger, C. (2012). Estimating time preferences from convex budgets. *American Economic Review*, 102(7):3333–56.

Angrisani, M., Cipriani, M., Guarino, A., Kendall, R., and de Zarate Pina, J. O. (2020). Risk preferences at the time of COVID-19: An experiment with professional traders and students (Federal Reserve Bank of New York Staff Report No. 927). `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3609586`.

Barrios, J. M. and Hochberg, Y. (2020). Risk perception through the lens of politics in the time of the COVID-19 pandemic (National Bureau of Economic Research Working Paper No. 27008). `https://www.nber.org/papers/w27008`.

Beauchamp, J. P., Cesarini, D., and Johannesson, M. (2017). The psychometric and empirical properties of measures of risk preferences. *Journal of Risk and Uncertainty*, 54(3):203–237.

Beine, M., Charness, G., Dupuy, A., and Joxhe, M. (2020). Shaking things up: On the stability of risk and time preferences (CESifo Working Paper No. 8187). `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3570289`.

Bianchi, M. and Tallon, J.-M. (2019). Ambiguity Preferences and Portfolio Choices: Evidence from the Field. *Management Science*, 65(4):1486–1501.

Bokern, P., Linde, J., Riedl, A., Schmeets, H., and Werner, P. (2021). The effect of the COVID-19 crisis on economic and social preferences. *Netspar Design Paper*, DP 12/2021-031.

Bowles, S. and Polania-Reyes, S. (2012). Economic incentives and social preferences: substitutes or complements? *Journal of Economic Literature*, 50(2):368–425.

Brañas-Garza, P., Jorrat, D., Alfonso, A., Espín, A. M., Muñoz, T. G., and Kovářík, J. (2022). Exposure to the COVID-19 pandemic environment and generosity. *Royal Society Open Science*, 9(1).

Brandts, J. and Riedl, A. (2020). Market interaction and efficient cooperation. *European Economic Review*, 121:103318.

Brodeur, A., Gray, D., Islam, A., and Bhuiyan, S. (2021). A literature review of the economics of COVID-19. *Journal of Economic Surveys*, 35(4):1007–1044.

Cettolin, E. and Riedl, A. (2019). Revealed preferences under uncertainty: Incomplete preferences and preferences for randomization. *Journal of Economic Theory*, 181:547–585.

Chuang, Y. and Schechter, L. (2015). Stability of experimental and survey measures of risk, time, and social preferences: A review and some new results. *Journal of Development Economics*, 117:151–170.

Clark, R. L., Hammond, R. G., and Khalaf, C. (2019). Planning for Retirement? The Importance of Time Preferences. *Journal of Labor Research*, 40(2):127–150.

Coller, M. and Williams, M. B. (1999). Eliciting individual discount rates. *Experimental Economics*, 2(2):107–127.

Crosetto, P. and Filippin, A. (2013). The "bomb" risk elicitation task. *Journal of Risk and Uncertainty*, 47(1):31–65.

Croson, R. and Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature*, 47(2):448–74.

Dimmock, S. G., Kouwenberg, R., Mitchell, O. S., and Peijnenburg, K. (2016). Ambiguity aversion and household portfolio choice puzzles: Empirical evidence. *Journal of Financial Economics*, 119(3):559–577.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., and Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3):522–550.

Drichoutis, A. C. and Nayga, R. M. (2022). On the stability of risk and time preferences amid the COVID-19 pandemic. *Experimental Economics*, 25(3):759–794.

Eckel, C. C. and Grossman, P. J. (2002). Sex differences and statistical stereotyping in attitudes

toward financial risk. *Evolution and Human Behavior*, 23(4):281–295.

Engl, F., Riedl, A., and Weber, R. (2021). Spillover effects of institutions on cooperative behavior, preferences, and beliefs. *American Economic Journal: Microeconomics*, 13(4):261–299.

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., and Sunde, U. (2018). Global evidence on economic preferences. *The Quarterly Journal of Economics*, 133(4):1645–1692.

Fan, Y., Orhun, A. Y., and Turjeman, D. (2020). Heterogeneous actions, beliefs, constraints and risk tolerance during the COVID-19 pandemic (National Bureau of Economic Research Working Paper No. 27211). `https://www.nber.org/papers/w27211`.

Gassmann, X., Malézieux, A., Spiegelman, E., and Tisserand, J.-C. (2022). Preferences after pan(dem)ics: Time and risk in the shadow of COVID-19. *Judgment and Decision Making*, 17(4):745–767.

Gneezy, U. and Potters, J. (1997). An experiment on risk taking and evaluation periods. *Quarterly Journal of Economics*, 112(2):631–645.

Harrison, G. W., Hofmeyr, A., Kincaid, H., Monroe, B., Ross, D., Schneider, M., and Swarthout, J. T. (2022). Subjective beliefs and economic preferences during the COVID-19 pandemic. *Experimental Economics*, 25(3):795–823.

Holt, C. and Laury, S. (2002). Risk aversion and incentive effects. *American Economic Review*, 92(5):1644–1655.

Huffman, D., Maurer, R., and Mitchell, O. S. (2019). Time discounting and economic decision-making in the older population. *The Journal of the Economics of Ageing*, 14:100121.

Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., Strong, D. R., and Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: the balloon analogue risk task (BART). *Journal of Experimental Psychology: Applied*, 8(2):75.

Li, K. K., Huang, B., Tam, T., and Hong, Y. (2020). Does the COVID-19 pandemic affect people's social and economic preferences? Evidence from China (SSRN Working Paper). `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3690072`.

Lohmann, P. M., Gsottbauer, E., You, J., and Kontoleon, A. (2023). Anti-social behaviour and economic decision-making: Panel experimental evidence in the wake of COVID-19. *Journal of Economic Behavior & Organization*, 206:136–171.

Menkhoff, L. and Sakha, S. (2017). Estimating risky behavior with multiple-item risk measures. *Journal of Economic Psychology*, 59(C):59–86.

Noussair, C., Trautmann, S., and Van den Kuilen, G. (2014). Higher order risk attitudes, demographics, and financial decisions. *Review of Economic Studies*, 81(1):325–355.

Potters, J., Riedl, A., and Smeets, P. (2016). Towards a practical and scientifically sound tool for measuring time and risk preferences in pension savings decisions. *Netspar Design Paper*, 59.

Riedl, A., Schmeets, H., and Werner, P. (2019). Preferences for solidarity and attitudes towards the Dutch pension system: Evidence from a representative sample. *Netspar Design Paper*, 128.

Selten, R. (1967). Die Strategiemethode zur Erforschung des eingeschränkt rationalen Verhaltens im Rahmen eines Oligopolexperiments. *Beiträge zur experimentellen Wirtschaftsforschung. Tübingen: JCB Mohr*, pages 136–168.

Selten, R. and Ockenfels, A. (1998). An experimental solidarity game. *Journal of Economic Behavior and Organization*, 34(4):517–539.

Shachat, J., Walker, M. J., and Wei, L. (2021). How the onset of the Covid-19 pandemic impacted pro-social behaviour and individual preferences: Experimental evidence from china. *Journal of Economic Behavior & Organization*, 190:480–494.

Sutter, M., Kocher, M. G., Glätzle-Rützler, D., and Trautmann, S. T. (2013). Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior. *American Economic Review*, 103(1):510–531.

Umer, H. (2023). A selected literature review of the effect of Covid-19 on preferences. *Journal of the Economic Science Association*, 9:147–156.

Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M. J., Crum, A. J., Douglas, K. M., Druckman, J. N., et al. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, pages 1–12.

von Gaudecker, H.-M., van Soest, A., and Wengstrom, E. (2011). Heterogeneity in risky choice behavior in a broad population. *American Economic Review*, 101(2):664–94.

Yu, C. W., Zhang, Y. J., and Zuo, S. X. (2021). Multiple switching and data quality in the multiple price list. *The Review of Economics and Statistics*, 103:136–150.

Zhang, P. and Palma, M. A. (2021). Do risk preferences change during COVID-19? Comparisons between pre and on-pandemic parallel experiments (SSRN Working Paper). `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3849536`.

*** For Online Publication ***

Appendix A Additional Results

A.1 Comparison of Samples

Table A1: Age groups across waves

	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
	Prop.	Prop.	Prop.	Prop.
Age Category				
15 to 19 years	0.008	0.031	0.010	0.016
20 to 24 years	0.056	0.107	0.115	0.088
25 to 29 years	0.104	0.117	0.115	0.124
30 to 34 years	0.128	0.103	0.115	0.108
35 to 39 years	0.112	0.076	0.102	0.095
40 to 44 years	0.088	0.059	0.073	0.078
45 to 49 years	0.096	0.097	0.102	0.111
50 to 54 years	0.160	0.141	0.096	0.131
55 to 59 years	0.136	0.131	0.115	0.105
60 to 64 years	0.048	0.107	0.092	0.105
65 years and older	0.064	0.031	0.067	0.039
Obs	125	290	314	306

Pearson: Uncorrected chi2(30) = 26.932
Design-based F(30.00, 31020.00) = 0.897
P-value = 0.628

Table A2: Income levels across waves

	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
	Prop.	Prop.	Prop.	Prop.
Gross Yearly Income				
$<$ €14.100	0.048	0.045	0.057	0.052
$\geq$ €14.100 - $<$ €36.500	0.152	0.172	0.140	0.134
$\geq$ €36.500 - $<$ €43.500	0.208	0.210	0.220	0.193
$\geq$ €43.500 - $<$ €73.000	0.224	0.203	0.242	0.268
$\geq$ €73.000	0.104	0.159	0.134	0.147
Prefer not to state income	0.264	0.210	0.207	0.206
Obs	125	290	314	306

Pearson: Uncorrected chi2(15) = 9.182
Design-based F(15.00, 15510.00) = 0.612
P-value = 0.868

Table A3: Distribution of participants' sex across waves

	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
	Prop.	Prop.	Prop.	Prop.
Sex				
Male	0.392	0.510	0.510	0.484
Female	0.608	0.490	0.490	0.516
Obs	125	290	314	306

Pearson: Uncorrected chi2(3) = 5.797
Design-based F(3.00, 3102.00) = 1.931
P-value = 0.122

Table A4: Education levels across waves

	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
	Prop.	Prop.	Prop.	Prop.
Education Level				
Low Educated	0.160	0.197	0.156	0.105
Middle Educated	0.392	0.472	0.487	0.480
High Educated	0.448	0.331	0.357	0.415
Obs	125	290	314	306

Pearson: Uncorrected chi2(6) = 15.057
Design-based F(6.00, 6204.00) = 2.507
P-value = 0.020

Table A5: House ownership across waves

	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
	Prop.	Prop.	Prop.	Prop.
Type of Residence				
Homeowner	0.608	0.686	0.701	0.657
Tenant	0.392	0.314	0.299	0.343
Total	1.000	1.000	1.000	1.000
Obs	125	290	314	306

Pearson: Uncorrected chi2(3) = 4.077
Design-based F(3.00, 3102.00) = 1.358
P-value = 0.254

A.2 Understanding

Table A6: Self-reported understanding of video instructions

	N	Mean	Median	Min	Max
Video Instructions					
Video CTB	949	8.8	9.0	0.0	10.0
Video MPL Risk	928	8.9	10.0	0.0	10.0
Video MPL Prudence	924	8.4	9.0	0.0	10.0
Video MPL Temperance	922	8.5	9.0	0.0	10.0
Video MPL Ambiguity	924	8.4	9.0	0.0	10.0
Video MPL Time	935	8.8	10.0	0.0	10.0

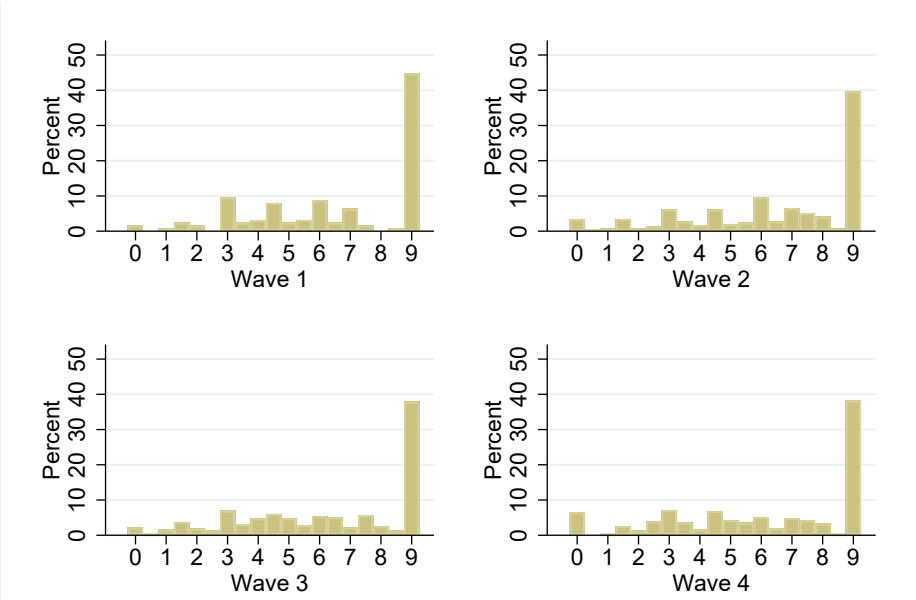
Notes: summary of responses to the question: "To what extent did you find the video instruction at the start of this section clear?" (0 = completely unclear, 10 = very clear). Missing observations are participants who indicated "Not Applicable".

Table A7: Self-reported understanding of written instructions

	N	Mean	Median	Min	Max
Written Instructions					
Text CTB	873	8.3	9.0	0.0	10.0
Text MPL Risk	819	8.6	9.0	0.0	10.0
Text MPL Prudence	815	7.9	8.0	0.0	10.0
Text MPL Temperance	809	8.1	8.0	0.0	10.0
Text MPL Ambiguity	813	8.1	8.0	0.0	10.0
Text MPL Time	818	8.5	9.0	0.0	10.0
Text Solidarity Game	1,035	8.1	8.0	0.0	10.0

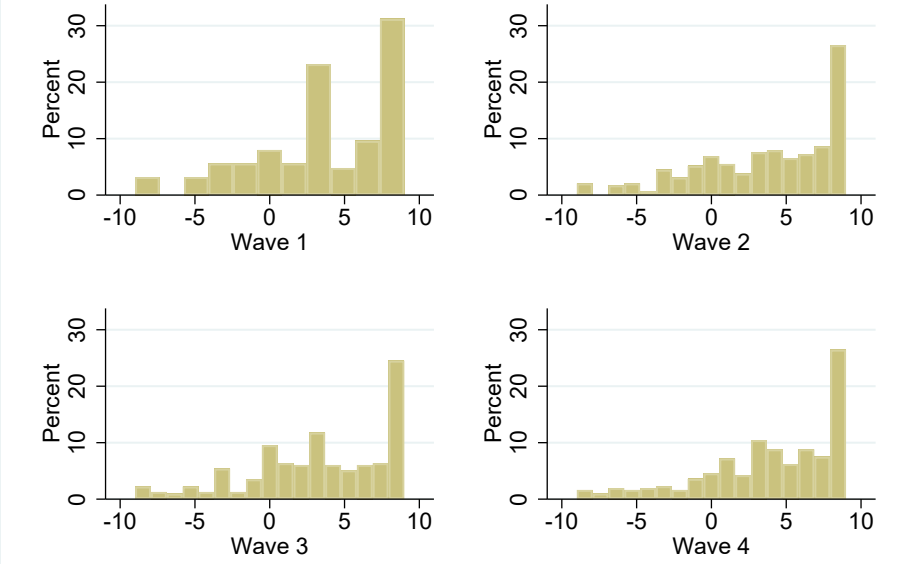
Notes: summary of responses to the question: "To what extent did you find the written instruction at the start of this section clear?" (0 = completely unclear, 10 = very clear). Original: "In hoeverre vond u de geschreven instructie aan het begin van dit deel duidelijk?" (0 = totaal niet duidelijk, 10 = zeer duidelijk). Missing observations are participants who indicated "Not Applicable".

A.3 Descriptive Statistics - Histograms



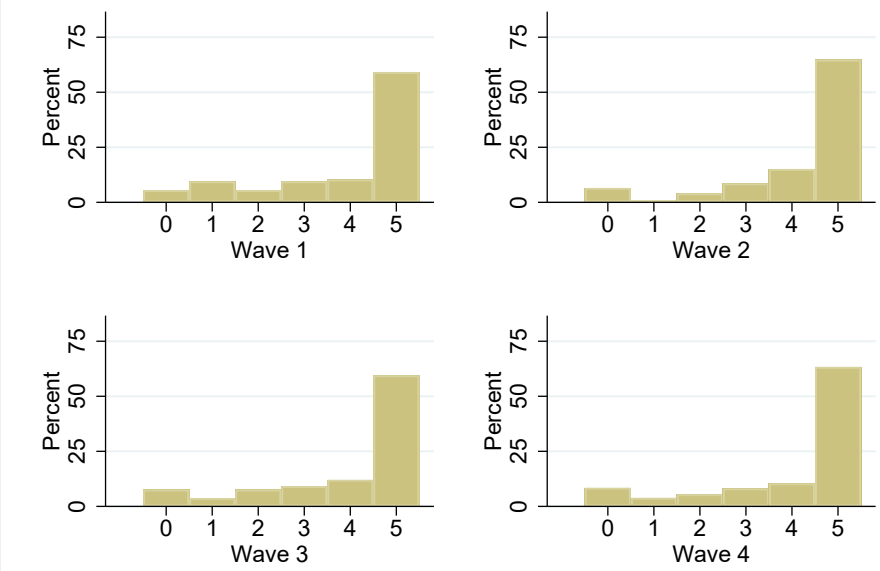
Average number of safe choices.

Figure A1: Histograms MPL Risk



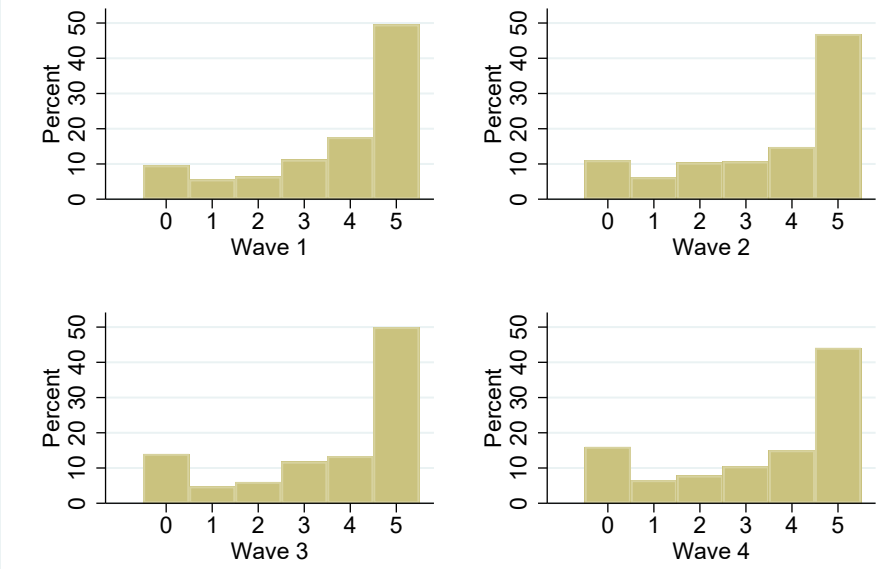
Weighted count of risk averse (weight=1), risk neutral (weight=0), and risk seeking (weight=-1) choices.

Figure A2: Histograms CTB Risk



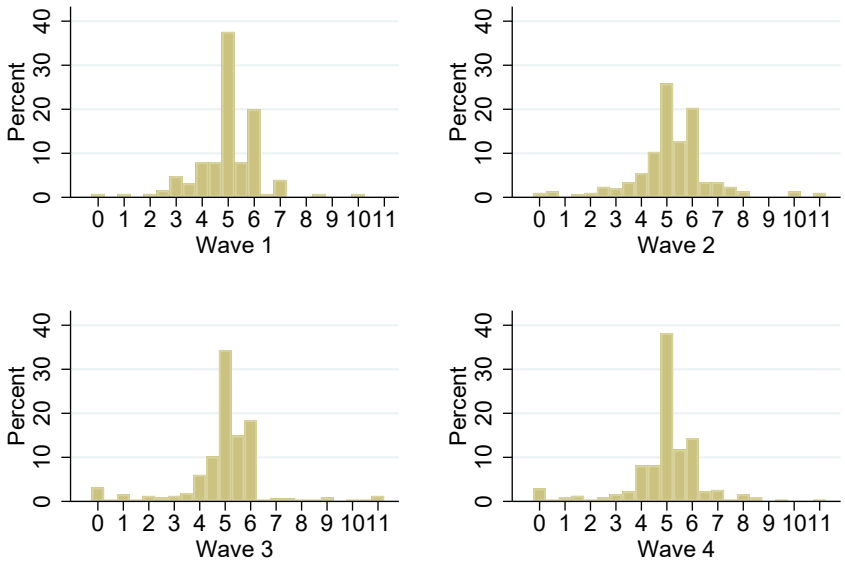
Average number of prudent choices.

Figure A3: Histograms MPL Prudence



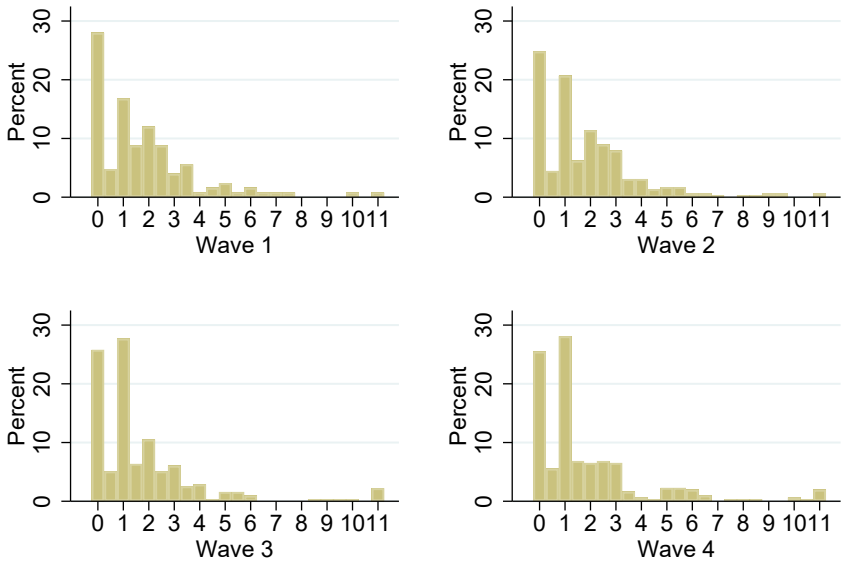
Average number of temperate choices.

Figure A4: Histograms MPL Temperance



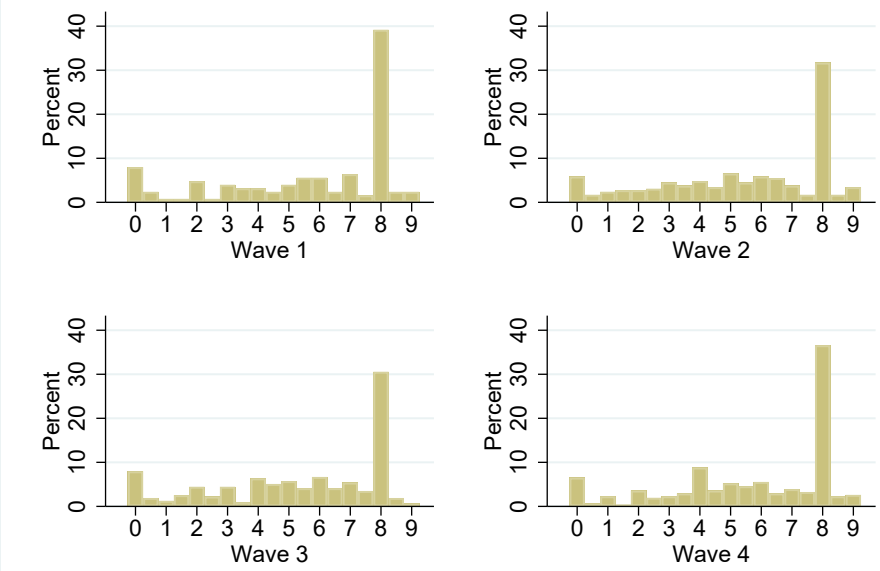
Average number of risky urn choices.

Figure A5: Histograms MPL Ambiguity I



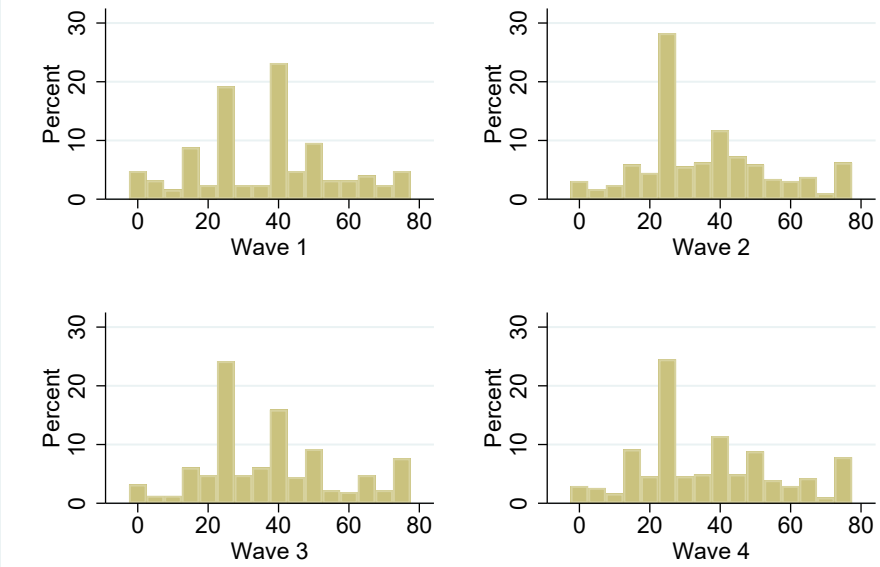
Average number of consecutive indifference choices.

Figure A6: Histograms MPL Ambiguity II



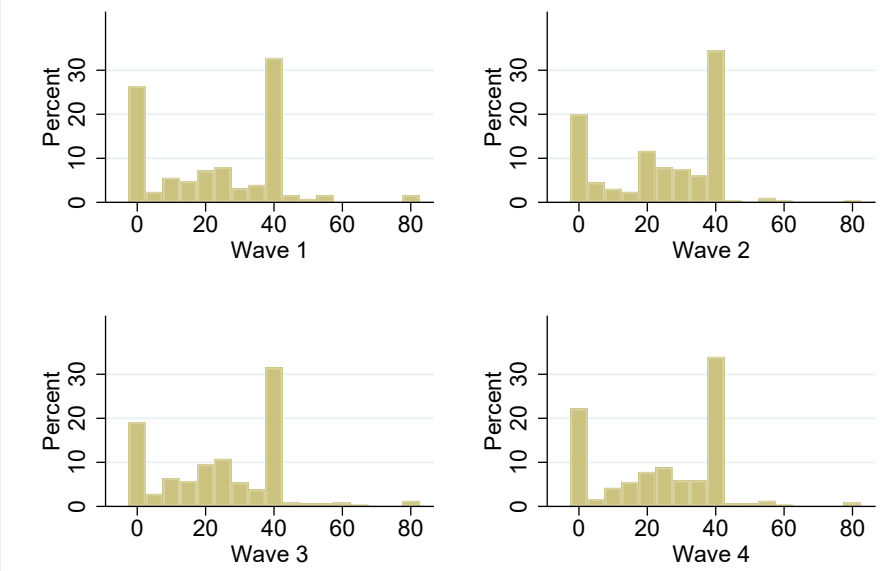
Average number of patient choices.

Figure A7: Histograms MPL Time



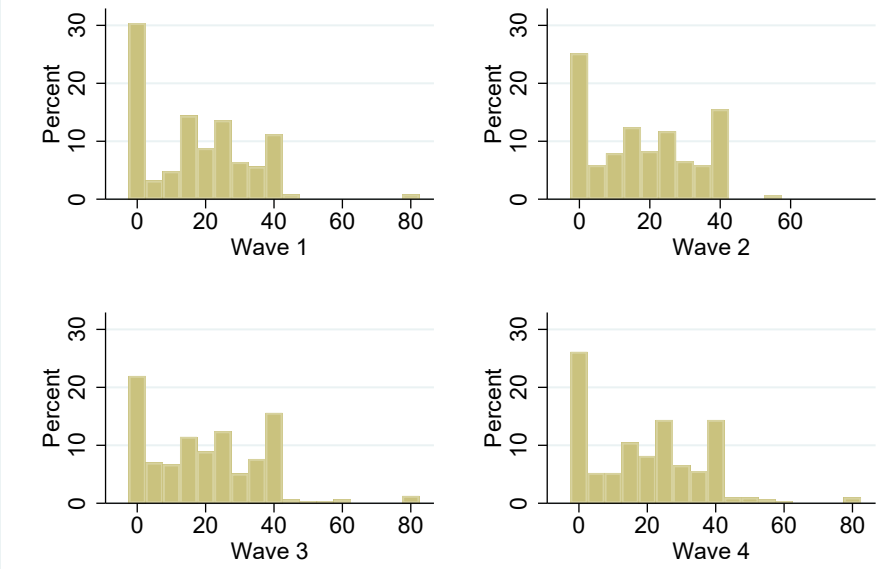
Average amount allocated to the early period in decisions without risk.

Figure A8: Histograms CTB Time



Average amount sent to others.

Figure A9: Histograms Solidarity Game Sent



Average amount expected from others.

Figure A10: Histograms Solidarity Game Expect

A.4 Heterogeneous Impact

Table A8: Heterogenous Exposure to the COVID-19 crisis - Full Regression

	Risk and Higher-Order Risk				Time		Ambiguity		Social	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(i) Health exposure										
Infection	-0.08	0.22	-0.03	0.09	0.01	0.39	-0.11	-0.09	1.15	-0.30
	(0.20)	(0.33)	(0.11)	(0.13)	(0.19)	(1.36)	(0.11)	(0.15)	(1.25)	(1.17)
(ii) Financial Situation										
Worsened	0.41	1.22**	0.36**	-0.20	-0.28	-3.23	0.17	-0.49**	0.12	-1.39
	(0.29)	(0.48)	(0.17)	(0.20)	(0.28)	(1.99)	(0.16)	(0.21)	(1.84)	(1.72)
Improved	-0.48*	-0.51	-0.10	0.17	-0.19	-0.54	0.19	-0.32	-1.62	-1.64
	(0.27)	(0.45)	(0.16)	(0.18)	(0.26)	(1.86)	(0.15)	(0.20)	(1.72)	(1.61)
(iii) Career Perspective										
Worsened	-0.44*	-1.08**	0.09	0.13	-0.08	2.90	-0.06	-0.09	2.78*	1.87
	(0.26)	(0.43)	(0.15)	(0.18)	(0.25)	(1.78)	(0.15)	(0.19)	(1.64)	(1.53)
Improved	-0.27	-0.28	-0.13	-0.05	-0.23	3.11	0.04	-0.13	2.94	3.12
	(0.34)	(0.57)	(0.20)	(0.23)	(0.33)	(2.37)	(0.20)	(0.26)	(2.19)	(2.04)
(iv) Belief Back to Normal										
More than 1 year	0.05	0.18	0.06	0.02	0.22	-0.99	-0.02	-0.01	-0.29	-0.50
	(0.19)	(0.31)	(0.11)	(0.13)	(0.18)	(1.28)	(0.11)	(0.14)	(1.18)	(1.11)
Control Variables										
Female	0.71***	0.59*	-0.03	0.49***	-0.10	-0.33	-0.11	-0.00	0.90	-1.87
	(0.20)	(0.33)	(0.11)	(0.14)	(0.19)	(1.38)	(0.11)	(0.15)	(1.27)	(1.19)
Age	0.04***	0.01	-0.00	0.01	-0.01*	-0.15***	-0.01*	0.01	0.04	-0.10**
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.05)	(0.00)	(0.01)	(0.05)	(0.05)
Middle Educated	0.58**	0.48	0.34**	-0.12	0.62**	-2.80	-0.26	0.25	-2.28	-2.17
	(0.29)	(0.48)	(0.17)	(0.20)	(0.28)	(2.00)	(0.17)	(0.22)	(1.85)	(1.73)
High Educated	-0.21	0.09	0.30*	-0.36*	0.88***	-1.51	-0.13	-0.00	-3.03	-3.65**
	(0.31)	(0.52)	(0.18)	(0.21)	(0.30)	(2.16)	(0.18)	(0.23)	(1.99)	(1.86)
Tenant	-0.28	-0.08	0.16	-0.03	-0.42**	0.82	0.06	-0.03	-2.14	-1.55
	(0.21)	(0.35)	(0.12)	(0.14)	(0.21)	(1.46)	(0.12)	(0.16)	(1.34)	(1.25)
36.500 euro or more	-0.01	-0.22	0.33**	-0.11	0.08	2.56	0.10	-0.05	0.91	-1.57
	(0.26)	(0.43)	(0.15)	(0.18)	(0.25)	(1.79)	(0.15)	(0.19)	(1.65)	(1.54)
Prefer not to state income	-0.00	-0.16	0.32*	-0.10	0.09	1.23	0.13	-0.01	-0.31	-1.48
	(0.30)	(0.51)	(0.18)	(0.21)	(0.30)	(2.11)	(0.17)	(0.23)	(1.95)	(1.82)
Dominated Choice	0.12	-1.70***	-0.51***	0.03	-0.69***	-6.60***	-0.70***	1.55***	-0.47	1.23
	(0.21)	(0.34)	(0.12)	(0.14)	(0.20)	(1.43)	(0.12)	(0.15)	(1.32)	(1.23)
Constant	4.21***	3.22***	3.73***	3.21***	5.88***	47.86***	5.69***	1.18***	24.02***	28.26***
	(0.59)	(0.97)	(0.34)	(0.40)	(0.57)	(4.05)	(0.33)	(0.44)	(3.74)	(3.49)
Observations	831	831	831	831	831	831	831	831	831	831

Notes: Standard errors in parentheses. (1) Risk (rMPL), (2) Risk (CTB), (3) Prudence, (4) Temperance, (5) Time (tMPL), (6) Time (CTB), (7) Ambiguity Aversion, (8) Consecutive Indiff. (9) Solidarity Sent, (10) Solidarity Expected. Baselevels: Wave 1, Male, Low Educated, Homeowner, Yearly income 36.500 euro or less, did not make dominated choices. Participants from wave 1 and participants that answered 'prefer not to answer' or 'not applicable' in any of the survey questions are excluded. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B Additional Information Experimental Design

Convex Time Budget. We implemented two versions of the CTB. Except for the late payout, which was either after 12/16 or 16/24 weeks, the parameters were identical in both versions. Participants made a total of 24 decisions. Table B1 summarizes the parameters that were used.

Table B1: CTB Parameters

Set 1								
Task	t	k	a_t	a_{t+k}	p_{t+k}	EV(a_{t+k})	1+r	1+r'
#1	8	12 (16)	€75	€75.00	1	€75.00	1.00	1.00
#2	8	12 (16)	€75	€78.00	1	€78.00	1.04	1.04
#3	8	12 (16)	€75	€87.00	1	€87.00	1.16	1.16
#4	8	12 (16)	€75	€83.40	0.9	€75.00	1.11	1.00
#5	8	12 (16)	€75	€86.70	0.9	€78.00	1.16	1.04
#6	8	12 (16)	€75	€96.60	0.9	€87.00	1.29	1.16
#7	8	12 (16)	€75	€107.10	0.7	€75.00	1.43	1.00
#8	8	12 (16)	€75	€111.45	0.7	€78.00	1.49	1.04
#9	8	12 (16)	€75	€124.35	0.7	€87.00	1.66	1.16
#10	8	12 (16)	€75	€150.00	0.5	€75.00	2.00	1.00
#11	8	12 (16)	€75	€156.00	0.5	€78.00	2.08	1.04
#12	8	12 (16)	€75	€174.00	0.5	€87.00	2.32	1.16

Notes: Set 2 is identical, except that k=16 (24). t=delay period early date in weeks, k=delay period late date in weeks (weeks in parenthesis correspond to version 2), a_t=amount available at the early date, a_{t+k}= amount available at the late date, p_{t+k}=probability that the payment at the late date is actually paid out, EV(a_{t+k})=expected value of the amount available at the late date, 1+r=interest rate over the delay period not adjusted for risk, 1+r'= interest rate over the delay period adjusted for risk.

The decision tasks were presented with information on the dates, probabilities, and possible allocations on one screen, using colors for clarity. Figure B1 shows an example of such a decision screen. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B2 shows the screen with instructions and Figure B3 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

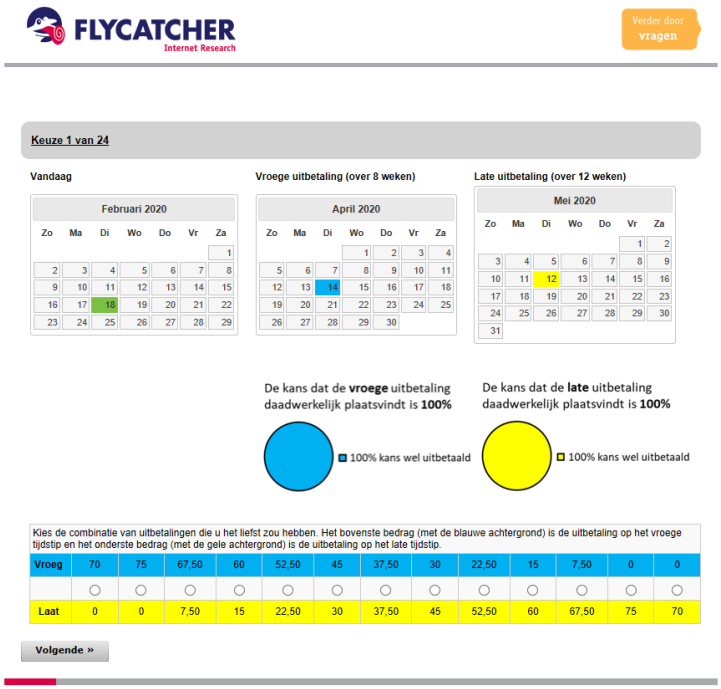


Figure B1: Example Decision Screen CTB #1, Version 1

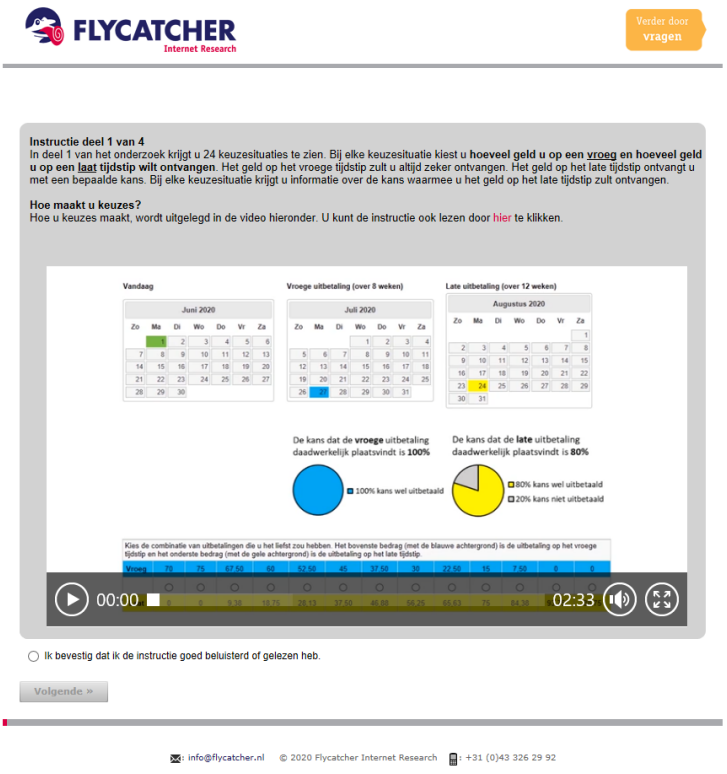


Figure B2: Instructions Screen CTB

Instructions Part [1/4]

In part 1 of the study, you will be presented with 24 decision situations. In each decision situation, you choose **how much money you want to receive at an "early" and how much money you want to receive at a "late" time**. You will always receive the money at the early time with certainty. You will receive the money at the late time with a certain probability. In each decision situation, you will get information about the probability with which you will receive the money at the late time.

How do you make choices?

How you make choices is explained using the example below. The example shows a decision situation in which you are asked to divide a sum of money between an amount of money at an early time (in this example July 27) and an amount of money at a late time (in this example August 24). The times will be different in the choices you make later.

The calendars indicate times relevant to your choice. Today (June 1 in this example) is highlighted in green. The time of the early payout in each decision situation is exactly 8 weeks from today and is marked in blue. The time of the late payout in this example is 12 weeks from today and is highlighted in yellow. **The time of the late payment may differ between decision situations.**

Below the calendars you will see the probability of actually receiving the money at the late time. In this example, this probability is 80% (i.e. a probability of 8 in 10). **This probability can differ between decision situations.**

At the bottom of the page you can see the possible divisions of the amount of money in this example. The top amount (with the blue background) shows the amount of money you will receive at the early time. The bottom amount (with the yellow background) shows the amount of money you will receive at the late time with a certain probability.

Explanation of payments in this example. Do you choose:

70 ◉ 0 then you would receive **€70** at the early time (27 July) and receive **€0** at the late time (24 August)

30 ◉ 56,63 then you would receive **€30** at the early time (27 July) and receive **€56,63** at the late time (24 August) and is the probability that you receive the money at the late time 80%.

0 ◉ 93,75 then you would receive **€0** at the early time (27 July) and receive **€93,75** at the late time (24 August) and is the probability that you receive the money at the late time 80%.

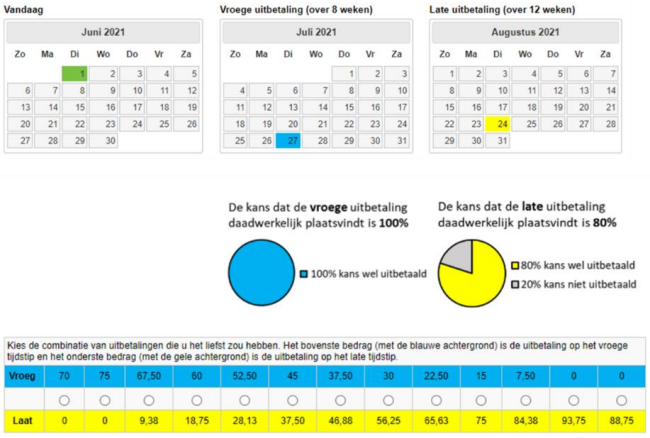


Figure B3: Written Instructions CTB

Multiple Price List Time Preferences. We implemented two versions of the tMPLs. Except for the late payout, which was either after 12/16 or 16/24 weeks, the parameters were identical in both versions. Tables B2 and B3 show the parameters that were used.

Table B2: MPL-Time List 1

	Option A		Option B	
	€	Delay Period	€	Delay Period
#1	75	8 weeks	75	12 (16) weeks
#2	75	8 weeks	77	12 (16) weeks
#3	75	8 weeks	79	12 (16) weeks
#4	75	8 weeks	81	12 (16) weeks
#5	75	8 weeks	83	12 (16) weeks
#6	75	8 weeks	85	12 (16) weeks
#7	75	8 weeks	87	12 (16) weeks
#8	75	8 weeks	89	12 (16) weeks
#9	75	8 weeks	91	12 (16) weeks

Notes: Weeks in parenthesis correspond to version 2.

Table B3: MPL-Time List 2

	Option A		Option B	
	€	Delay Period	€	Delay Period
#1	75	8 weeks	75	16 (24) weeks
#2	75	8 weeks	77	16 (24) weeks
#3	75	8 weeks	79	16 (24) weeks
#4	75	8 weeks	81	16 (24) weeks
#5	75	8 weeks	83	16 (24) weeks
#6	75	8 weeks	85	16 (24) weeks
#7	75	8 weeks	87	16 (24) weeks
#8	75	8 weeks	89	16 (24) weeks
#9	75	8 weeks	91	16 (24) weeks

Notes: Weeks in parenthesis correspond to version 2.

The decision tasks were presented in a list of binary choices with information about the delay period and outcomes. Figure B4 shows an example of a tMPL as presented to participants. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B5 shows the screen with instructions and Figure B6 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

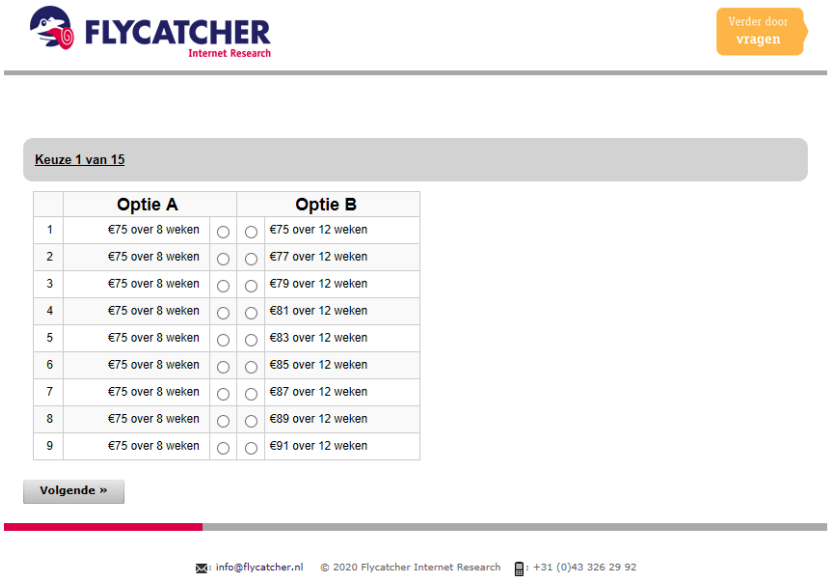


Figure B4: Example Decision Screen tMPL, Version 1

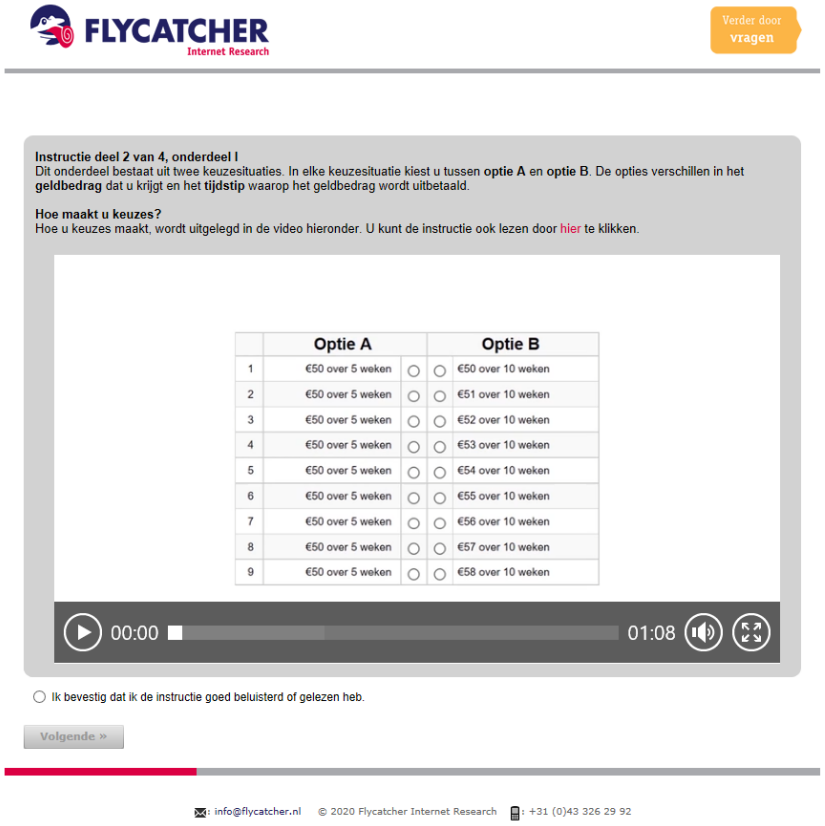


Figure B5: Instructions Screen tMPL

Instructions part [1.1/2]

This part consists of two decision situations. In each decision situation you choose between **option A** and **option B**. The options **differ** in the **amount of money** you receive and the **time** when the amount of money is paid out.

How do you make choices?

How you make choices is explained using the example below. The example shows a choice situation in which you are asked to make **9 choices** between option A and option B.

Option A is the same in every row. If you choose option A in this example, you will receive **€50**. This amount will be paid **in 5 weeks**.

Option B differs in each row. If you choose option B in this example, you will receive **€50 or more**. This amount will be paid **in 10 weeks**.

You make your choices by clicking on one of the radio buttons. **Note: you must make a choice in each row.**

	Optie A			Optie B
1	€50 over 5 weken	○	○	€50 over 10 weken
2	€50 over 5 weken	○	○	€51 over 10 weken
3	€50 over 5 weken	○	○	€52 over 10 weken
4	€50 over 5 weken	○	○	€53 over 10 weken
5	€50 over 5 weken	○	○	€54 over 10 weken
6	€50 over 5 weken	○	○	€55 over 10 weken
7	€50 over 5 weken	○	○	€56 over 10 weken
8	€50 over 5 weken	○	○	€57 over 10 weken
9	€50 over 5 weken	○	○	€58 over 10 weken

Figure B6: Written Instructions tMPL

Multiple Price List Risk Preferences. Tables B4 and B5 show the parameters used for the rMPLs.

Table B4: MPL-Risk List 1

	Option A			Option B				
	p	€	EV(A)	p	€	p	€	EV(B)
#1	1	74	€74	0.5	40	0.5	120	€80
#2	1	75	€75	0.5	40	0.5	120	€80
#3	1	76	€76	0.5	40	0.5	120	€80
#4	1	77	€77	0.5	40	0.5	120	€80
#5	1	78	€78	0.5	40	0.5	120	€80
#6	1	79	€79	0.5	40	0.5	120	€80
#7	1	80	€80	0.5	40	0.5	120	€80
#8	1	81	€87	0.5	40	0.5	120	€80
#9	1	82	€82	0.5	40	0.5	120	€80

Notes: EV(A) and EV(B) list the expected value of the related lottery.

Table B5: MPL-Risk List 2

	Option A			Option B				
	p	€	EV(A)	p	€	p	€	EV(B)
#1	1	71	€71	0.33	20	0.67	110	€80
#2	1	72.50	€72.50	0.33	20	0.67	110	€80
#3	1	74	€74	0.33	20	0.67	110	€80
#4	1	75.50	€75.50	0.33	20	0.67	110	€80
#5	1	77	€77	0.33	20	0.67	110	€80
#6	1	78.50	€78.50	0.33	20	0.67	110	€80
#7	1	80	€80	0.33	20	0.67	110	€80
#8	1	81.50	€81.50	0.33	20	0.67	110	€80
#9	1	83	€83	0.33	20	0.67	110	€80

Notes: EV(A) and EV(B) list the expected value of the related lottery.

The decision tasks were presented in a list of binary choices with information about the probabilities and outcomes. Figure B7 shows an example of a rMPL as presented to participants. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B8 shows the screen with instructions and Figure B9 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

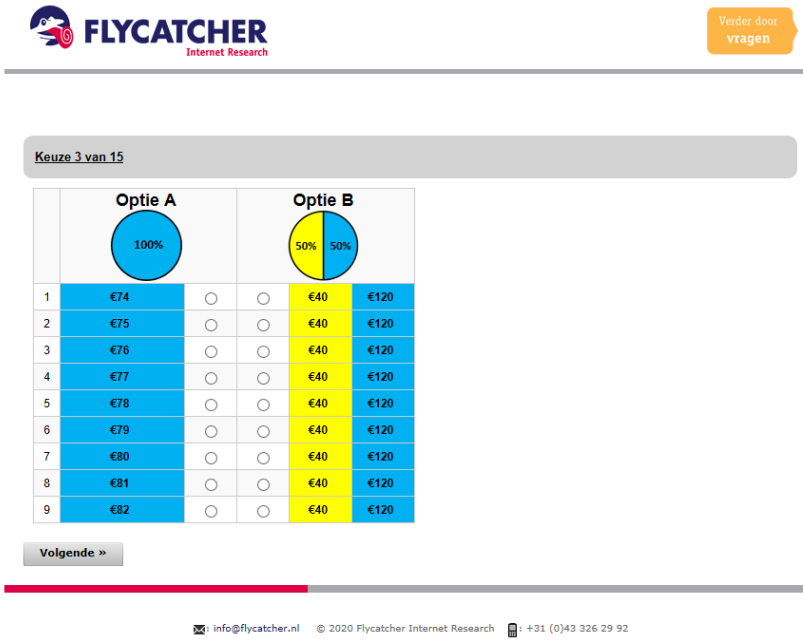


Figure B7: Example Decision Screen rMPL

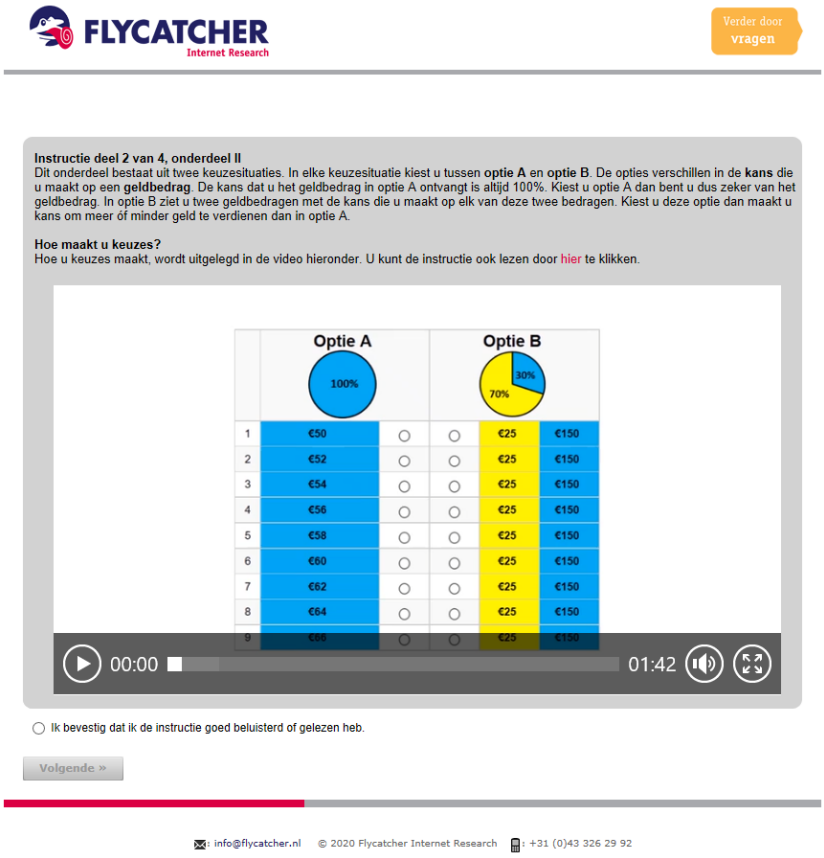


Figure B8: Instructions Screen rMPL

Instructions part [2.2/4]

This part consists of two decision situations. In each decision situation you choose between **option A** and **option B**. The options differ in the **probability** of receiving an **amount of money**. The probability that you will receive the amount of money in option A is always 100%. If you choose option A, you are therefore certain of the amount of money. In option B you will see two amounts of money with the probabilities of winning each of these two amounts. If you choose this option, you have a chance to earn more or less money than in option A.

How do you make choices?

How you make choices is explained using the example below. The screen shows a decision situation in which you are asked to make **9 choices** between option A and option B.

Option A differs in each row. If you choose option A in this example, you will receive **€50** or more. The chance that this amount will be paid out is shown at the top and is **always 100%**

Option B is the same in every row. In this option you always see two amounts, in this example **€25** and **€150**. If you choose option B, you will receive one of these amounts with a certain probability. This probability is stated above the amounts. In this example, **the probability of receiving $25 is 70%** (i.e. a 7 in 10 chance) and **the probability of receiving $150 is 30%** (i.e. a 3 in 10 chance).

You make your choices by clicking on one of the radio buttons. **Note: you must make a choice in each row.**

	OPTIE A 			OPTIE B 	
1	€50	○	○	€25	€150
2	€52	○	○	€25	€150
3	€54	○	○	€25	€150
4	€56	○	○	€25	€150
5	€58	○	○	€25	€150
6	€60	○	○	€25	€150
7	€62	○	○	€25	€150
8	€64	○	○	€25	€150
9	€66	○	○	€25	€150

Figure B9: Written Instructions rMPL

Multiple Price List Prudence. Table B6 shows the parameters used for the prudence MPLs.

Table B6: MPL-Prudence

	Option A				Option B			
	p	€	p	€	p	€	p	€
#1	0.5	€90 + [0.5∗€20;0.5∗−€20]	0.5	€60	0.5	€90	0.5	€60 + [0.5∗€20;0.5∗−€20]
#2	0.5	€90 + [0.5∗€10;0.5∗−€10]	0.5	€60	0.5	€90	0.5	€60 + [0.5∗€10;0.5∗−€10]
#3	0.5	€90 + [0.5∗€40;0.5∗−€40]	0.5	€60	0.5	€90	0.5	€60 + [0.5∗€40;0.5∗−€40]
#4	0.5	€135 + [0.5∗€30;0.5∗−€30]	0.5	€90	0.5	€135	0.5	€90 + [0.5∗€30;0.5∗−€30]
#5	0.5	€65 + [0.5∗€20;0.5∗−€20]	0.5	€35	0.5	€65	0.5	€35 + [0.5∗€20;0.5∗−€20]

The decision tasks were presented one by one with information about the probabilities and outcomes. Figure B10 shows an example of a prudence MPL as presented to participants. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B11 shows the screen with instructions and Figure B12 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

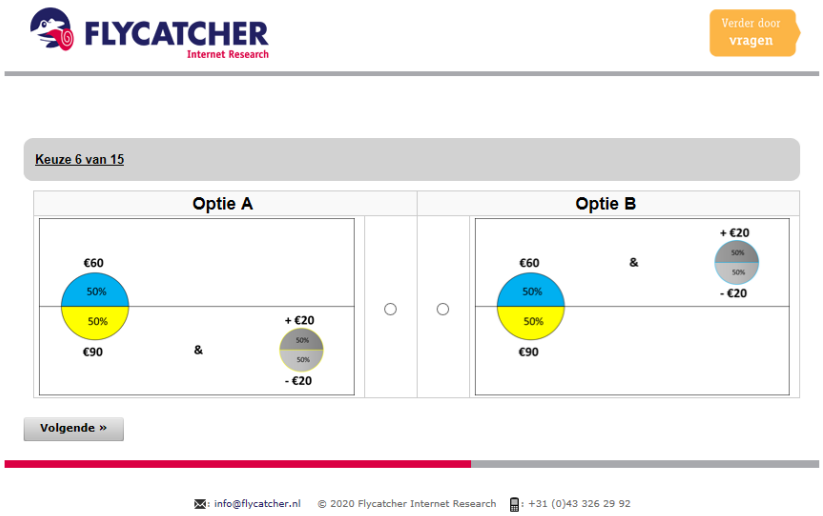


Figure B10: Example Decision Screen Prudence MPL

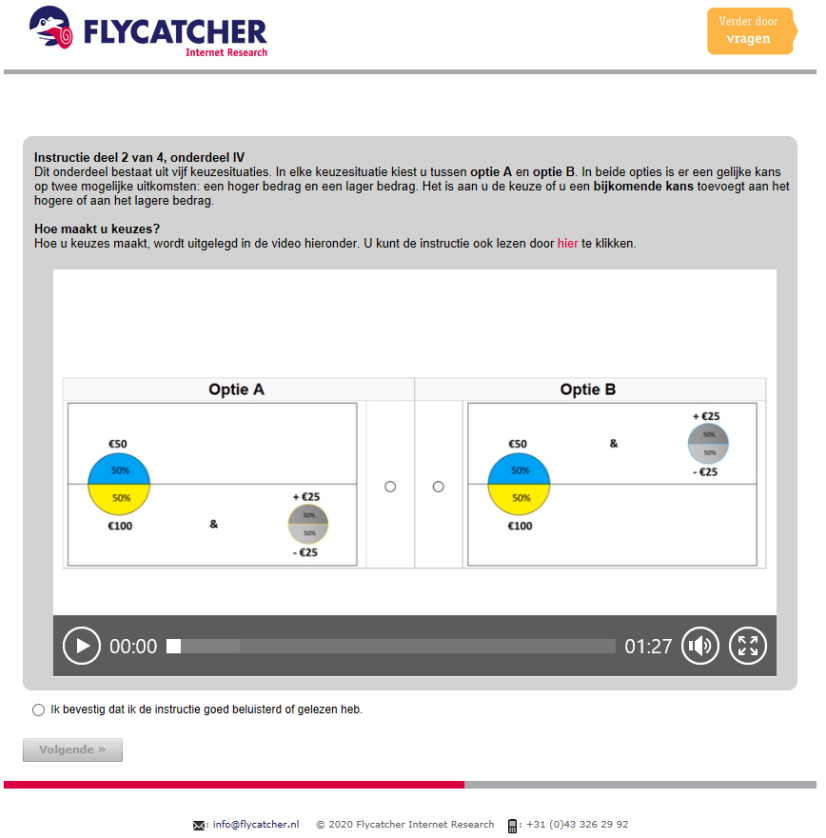


Figure B11: Instructions Screen Prudence MPL

Instructions part [1.4/2]

This part consists of five decision situations. In each decision situation you choose between **option A** and **option B**. In both options there is an equal chance of two possible outcomes: a higher and a lower amount. In addition, in both options there is an **additional** equal chance that one of the amounts will be higher or lower. In option A, this additional chance is added to the higher amount. In option B, this additional chance is added to the lower amount.

How do you make choices?

How you make choices is explained using the example below. The example shows a decision situation in which you are asked to choose between option A and option B.

In both option A and option B you have an equal chance of receiving a higher or lower amount, in this example €50 or €100.

In both option A and option B there is an **additional** equal chance that one outcome will be higher or lower, in this example €25 higher or €25 lower. The difference is that option A has the **additional** chance added to the higher amount, while option B has the **additional** chance added to the lower amount.

You can make your choice by clicking on one of the radio buttons.

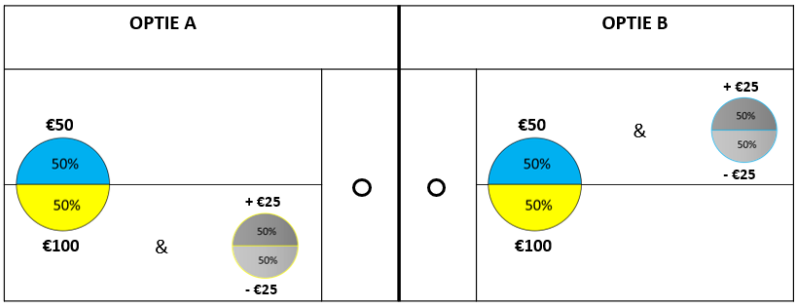


Figure B12: Written Instructions Prudence MPL

Multiple Price List Temperance. Table B7 shows the parameters used for the temperance MPLs.

Table B7: MPL-Temperance

	Option A				Option B			
	p	€	p	€	p	€	p	€
#1	0.5	€90 + [0.5∗€30;0.5∗−€30]	0.5	€90 + [0.5∗€30;0.5∗−€30]	0.5	€90	0.5	€90 + [0.5∗€30;0.5∗−€30] + [0.5∗€30;0.5∗−€30]
#2	0.5	€90 + [0.5∗€30;0.5∗−€30]	0.5	€90 [0.5∗€10;0.5∗−€10]	0.5	€90	0.5	€90 + [0.5∗€30;0.5∗−€30] + [0.5∗€10;0.5∗−€10]
#3	0.5	€90 + [0.5∗€30;0.5∗−€30]	0.5	€90 [0.5∗€50;0.5∗−€50]	0.5	€90	0.5	€90 + [0.5∗€30;0.5∗−€30] + [0.5∗€50;0.5∗−€50]
#4	0.5	€30 + [0.5∗€10;0.5∗−€10]	0.5	€30 [0.5∗€10;0.5∗−€10]	0.5	€30	0.5	€30 + [0.5∗€10;0.5∗−€10] + [0.5∗€10;0.5∗−€10]
#5	0.5	€70 + [0.5∗€30;0.5∗−€30]	0.5	€70 [0.5∗€30;0.5∗−€30]	0.5	€70	0.5	€70 + [0.5∗€30;0.5∗−€30] + [0.5∗€30;0.5∗−€30]

The decision tasks were presented one by one with information about the probabilities and outcomes. Figure B13 shows an example of a prudence MPL as presented to participants. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B14 shows the screen with instructions and Figure B15 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

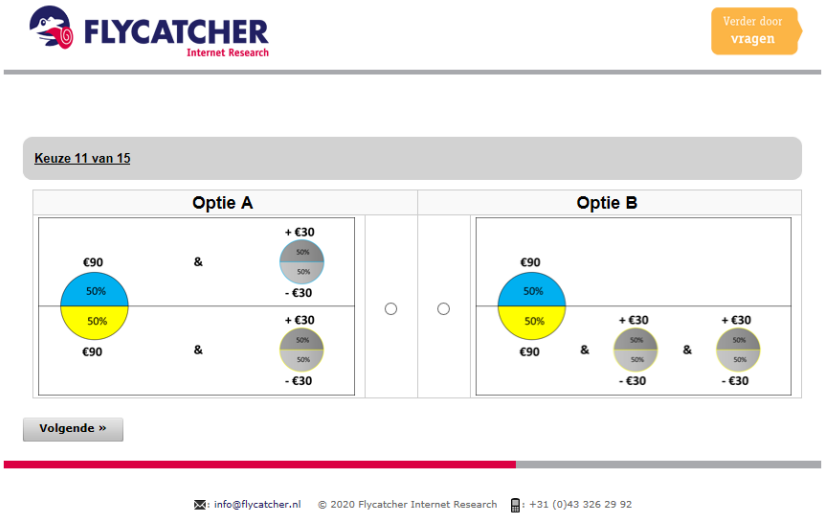


Figure B13: Example Decision Screen Temperance MPL

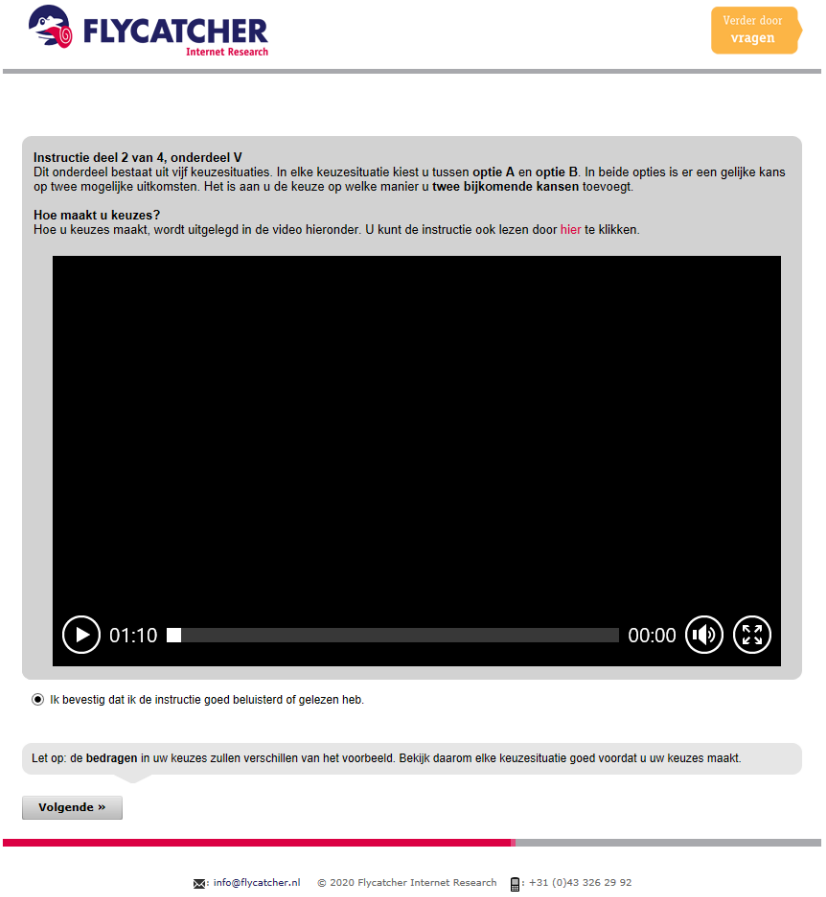


Figure B14: Instructions Screen Temperance MPL

Instructions part [1.5/2]

This part consists of five decision situations. In each decision situation you choose between **option A** and **option B**. In both options there is an equal chance of two possible outcomes. In addition, there is **twice** an **additional** equal chance that an outcome will be higher or lower. In option A, these additional probabilities are split. In option B, these additional chances are added to the same amount.

How do you make choices?

How you make choices is explained using the example below. The example shows a decision situation in which you are asked to make a choice between option A and option B.

In both option A and option B you have an equal chance of winning an amount, in this example €100.

In both option A and option B there is **twice** an **additional** equal chance that one outcome will be higher or lower, in this example €25 higher or €25 lower. The difference is that with option A the **additional** odds are split, while with option B the **additional** odds are added to the same amount.

You can make your choice by clicking on one of the radio buttons.

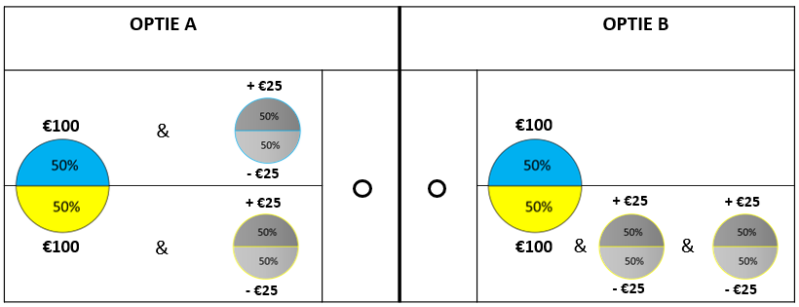


Figure B15: Written Instructions Temperance MPL

Multiple Price List Ambiguity. Table B8 shows the parameters used for the aMPLs.

Table B8: MPL-Ambiguity

	Option A Urn A composition (balls)	Indifference	Option B Urn B composition (balls)
#1	10 red ; 0 blue	0.5∗option A ; 0.5∗option B	Unknown
#2	9 red ; 1 blue	0.5∗option A ; 0.5∗option B	Unknown
#3	8 red ; 2 blue	0.5∗option A ; 0.5∗option B	Unknown
#4	7 red ; 3 blue	0.5∗option A ; 0.5∗option B	Unknown
#5	6 red ; 4 blue	0.5∗option A ; 0.5∗option B	Unknown
#6	5 red ; 5 blue	0.5∗option A ; 0.5∗option B	Unknown
#7	4 red ; 6 blue	0.5∗option A ; 0.5∗option B	Unknown
#8	3 red ; 7 blue	0.5∗option A ; 0.5∗option B	Unknown
#9	2 red ; 8 blue	0.5∗option A ; 0.5∗option B	Unknown
#10	1 red ; 9 blue	0.5∗option A ; 0.5∗option B	Unknown
#11	0 red ; 10 blue	0.5∗option A ; 0.5∗option B	Unknown

Notes: Participants receive this MPL twice. The difference is that in the first list they are informed that the winning color is red and in the second list they are informed that the winning color is blue. Participants are also informed that the proportion of red and blue balls in the ambiguous urn stays the same within each and between both MPLs.

The decision tasks were presented in a list of binary choices with information about the urn composition. Figure B16 shows an example of an ambiguity MPL as presented to participants. Before making decisions, participants received video instructions as well as the option to download written instructions in PDF format. Participants were required to watch the entire video or download the written instructions before being able to continue to the decision tasks. Figure B17 shows the screen with instructions and Figure B18 shows the written instructions (translated to English). The video narrated roughly the same text as the written instructions while highlighting the relevant parts of the decision screen.

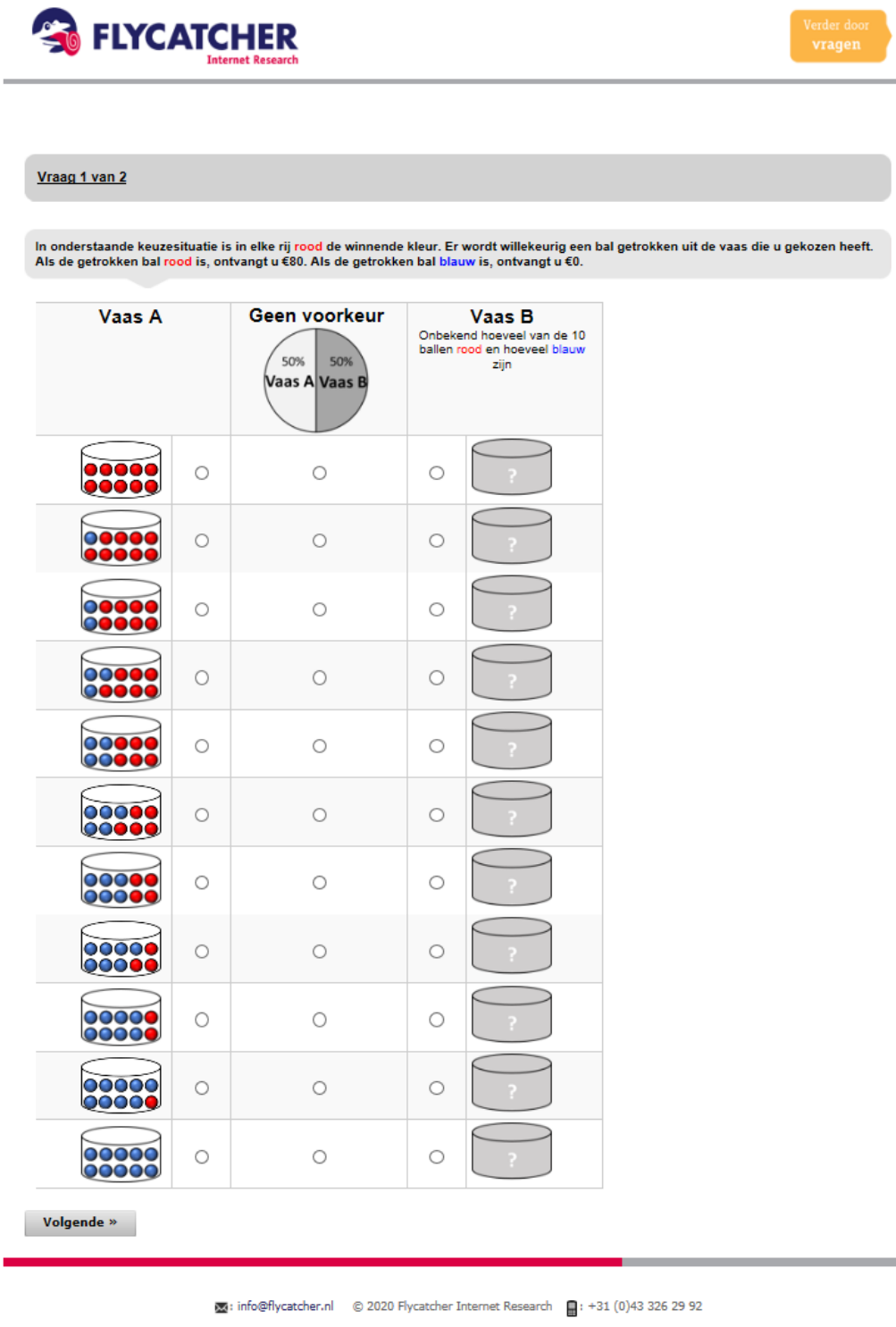


Figure B16: Example Decision Screen aMPL

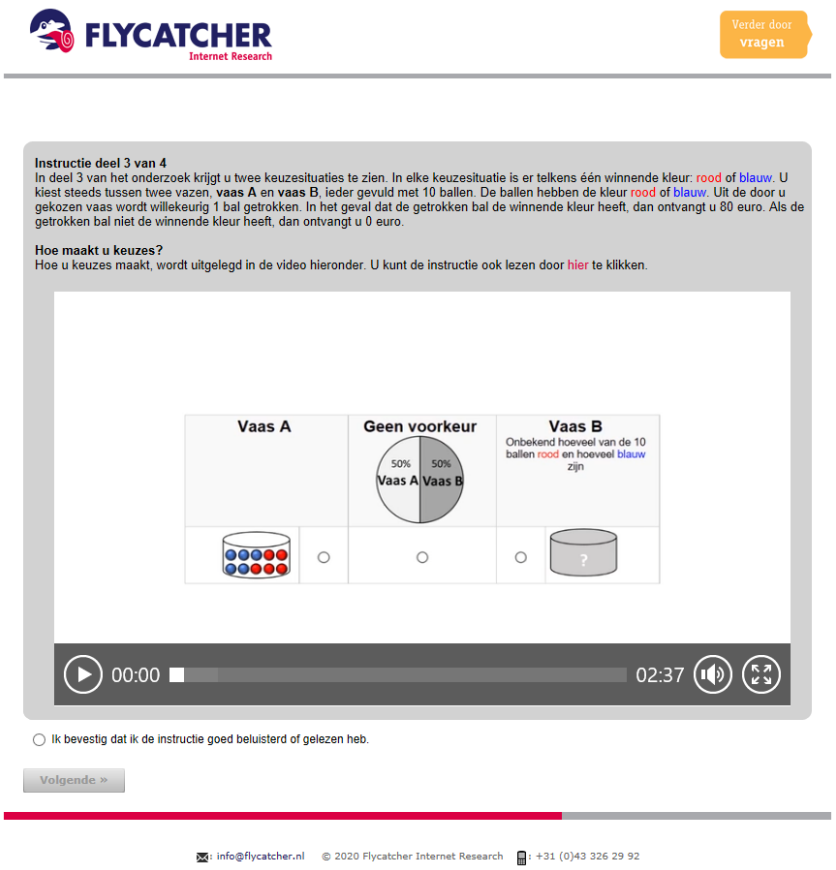
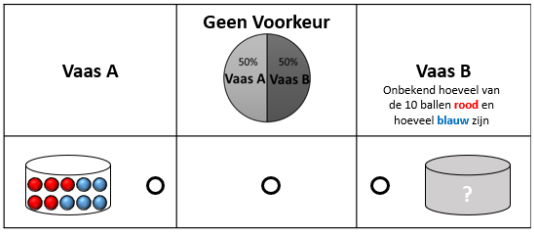


Figure B17: Instructions Screen aMPL

Instructions Part [2/4]

In part 2 of the study, you will be presented with two decision situations. In each decision situation there is always one winning color: **red** or **blue**. You always choose between two urns, **urn A** and **urn B**, each filled with 10 balls. The balls have the color **red** or **blue**. 1 ball is randomly drawn from the urn you have chosen. In case the drawn ball has the winning color, you receive 80 euros. If the drawn ball is not the winning color, you receive 0 euros.



Urn A is transparent: in each choice you can see **exactly** how many of the 10 balls are red and how many are blue. In this example, there are 5 red and 5 blue balls in urn A.

Urn B is opaque: you **do not** know how many of the 10 balls are red and how many are blue. A computer determines the ratio of red and blue balls in urn B once by chance. This could be 10 red balls, 10 blue balls, or anything in between.

The decision situations differ in the number of red and blue balls in urn A. **The content of urn B remains the same for all choices.**

The number of balls of a certain color in a urn determines the probability of choosing this color by a random draw. In this example, there are 5 red and 5 blue balls in the urn. Thus, in a random draw, the probability of getting a red ball is 5 in 10 (i.e. 50%). The chance of getting a blue ball is also 5 in 10 (i.e. 50%).

Your choices

In the choices you are going to make you will be asked to choose between urn A and urn B. You also have the option to choose the option "No Preference". If you choose "No Preference" then the computer will determine by chance (50-50% chance) which urn is chosen.

Figure B18: Written Instructions aMPL

Solidarity Game. For the solidarity game, participants only received written instructions. Figure B19 shows the screen with instructions and Figure B20 shows the decision screen as presented to participants.

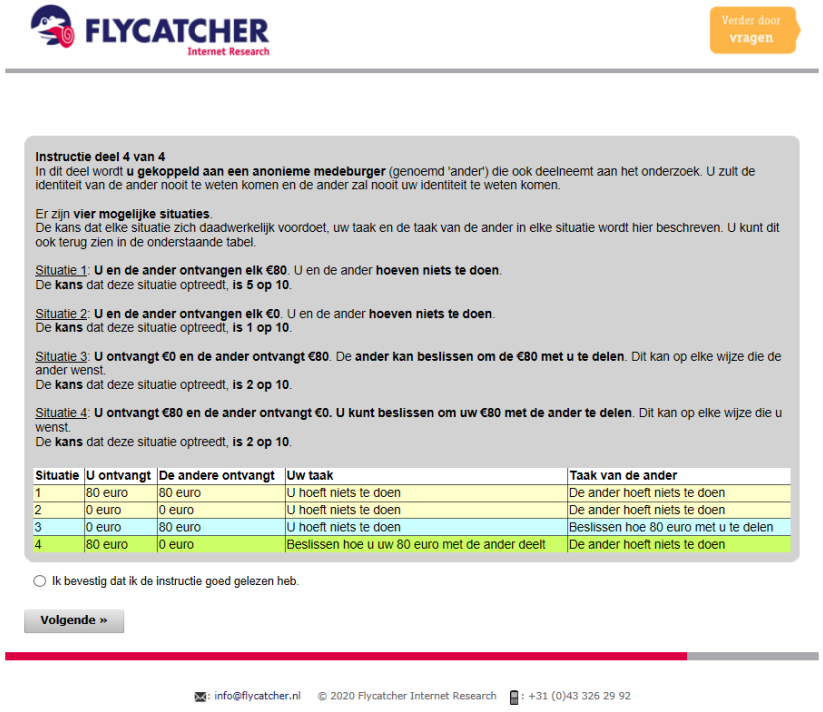


Figure B19: Instructions Screen Solidarity Game

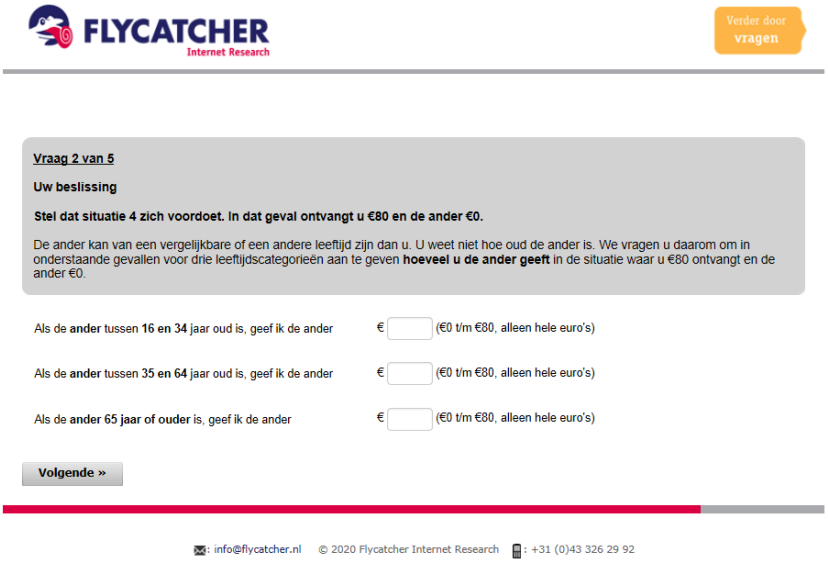


Figure B20: Decision Screen Solidarity Game