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Permanent Instability of Preferences after COVID-19 Crisis: A Natural Experiment from Urban Burkina Faso

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ABSTRACT

Permanent Instability of Preferences after COVID-19 Crisis: A Natural Experiment from Urban Burkina Faso

The salience of the first Covid-19 crisis over a well-identified period makes it an unexpected and abrupt change in the environment. This study uses the onset of the Covid-19 crisis to empirically examine whether risk and time preferences change in response to this exogenous shock, and whether those variations are temporary or durable. We use an original panel dataset conducted in January 2020 (before any event), in June 2020 (just after the removal of strong economic measures) and in January 2022 among women working in the informal sector in Ouagadougou, Burkina Faso. We use individual fixed effects on the balanced panel to isolate the specific causal effect of the Covid-19 crisis on variation in attitudes toward risk and time. Two time horizons are analyzed: immediately at the end of the economic restrictions (short-term effect), then two years later (medium-term effect). We demonstrate strong preference instability: immediately after the shock of the Covid-19, risk aversion changed over the 6-month period in both the gain (12%) and loss (-47%) domains, while impatience increased by 20%. Eighteen months later, preferences have not returned to their pre-shock level, suggesting an abrupt and permanent effect of Covid-19 on individual preferences. We also show that risk aversion (in both domains) is non-sensitive to actual impacts, but appears to be driven by economic fears and concerns related to the Covid-19 crisis.

JEL Classification: D8, D9, C93, I18, O55

Keywords: COVID-19, risk attitudes, impatience, emotions, media exposure

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1 Introduction

In the spring of 2020, the shock of Covid-19 could be assimilated to a rare and sudden event, different from economic downturns or climatic shocks because it was completely unanticipable. In several Sub-Saharan countries, restrictive economic measures were strictly implemented as soon as the first cases appeared in the sub-region, so that the number of cases stayed really low during the first wave. In countries that maintained a low number of cases, the Covid-19 shock was mainly economic and emotional, although it represented an unprecedented and significant change in people's environment. Several articles have shown that the uncertainty and the considerable slowdown of the economy caused a decline in living standards and an increase in economic anxiety, especially at the beginning of the pandemic (Fetzer et al., 2021; Bargain and Aminjonov, 2021). In this paper, we show that the impact of the Covid-19 shock was severe, as it also affected permanently some deep parameters, notably risk and time preferences.

Contrary to the assumptions of standard microeconomic theory, empirical studies recently show that deep parameters (including main personality traits and individual preferences) can vary over time. A growing body of literature points out that these parameters are not immutable and can change due to economic, climatic, or conflict shocks (Biener and Landmann, 2023; Castillo and Hernandez, 2022; Fang et al., 2022; Chuang and Schechter, 2015; Cameron and Shah, 2015; Reynaud and Aubert, 2020; Callen, 2015; Voors et al., 2012; Hanaoka et al., 2018; Sakha, 2019). The results of this literature vary considerably from article to article, partly because of different samples, methodologies, and time frames. Several mechanisms come into play and can explain this instability. The most cited one relates to the adverse consequences of shocks, which modify people's points of reference and thus their risk attitudes (Kahneman and Tversky, 1979; Campbell and Cochrane, 1999). The Covid-19 crisis had a negative impact on the population's standard of living and generated greater risk aversion and impatience, particularly in the economic and financial fields. This change in risk behavior and time preference can translate to all domains, even those not affected by the shock in question. Gollier and Pratt (1996)'s "risk vulnerability" implies that in response to an increase in background risk (non-insurable and non-avoidable, as for the Covid-19 shock), individuals behave in a more risk-averse manner in other domains of avoidable risk. The second mechanism that may alter attitudes toward risk or time after Covid-19 is emotional (Lerner and Keltner, 2001; Loewenstein, 2000; Loewenstein and Lerner, 2003; Botzen et al., 2015; Eckel et al., 2009). Even if they have not experienced any loss, the fear (of contamination or job loss, for instance) and stress induced by economic and health uncertainty may alter risk and time preferences. Some studies have shown that the emotional channel may override more concrete explanations.

When the emotional response induces a shift in risk perception or discount rate, the behavioral change may persist over time (Lerner et al., 2015).

In this empirical study, we make use of an original survey to analyze whether and how risk and time preferences changed following the Covid-19 crisis in Ouagadougou, Burkina Faso. Providing insights to this issue is crucial as risk and time attitudes strongly influence a wide range of behaviors such savings, risk-sharing strategies, and migration decisions, determining various health and work outcomes (Barsky et al., 1997; Dohmen et al., 2011; Dawson and Henley, 2015; Hsieh et al., 2017; Van Der Pol et al., 2017; Kremer et al., 2019). Preference responsiveness after a shock or a change in the environment is potentially even higher in developing countries, where the capacity of public institutions and other compensatory mechanisms to absorb damaging impacts of shocks is often limited (Mosley and Verschoor, 2005; Kremer et al., 2019). Our study is based on a panel survey of women working in the informal sector The survey was first conducted in January 2020, before respondents were aware of the upcoming Covid crisis. Two time horizons are analyzed: immediately at the end of the economic restrictions (short-term effect), then two years later (medium-term effect). The short-term analysis (January-June 2020) is based on a balanced panel of 871 women interviewed twice. We reduced the medium-term analysis sample to 366 women interviewed three times (January 2020, June 2020, and January 2022). To elicit risk attitudes, we propose hypothetical gamble questions, similar to the Holt-Laury Paired Lottery Task (Holt and Laury, 2002). We capture time preferences using four sets of choice tasks, as Andersen et al. (2008) and Cassar et al. (2017). Our empirical identification strategy relies on a before-and-after comparison including individual fixed effects to isolate the variation in preferences in response to environmental changes between the baseline and the midline wave (short-term analysis), and the baseline and the endline wave (medium-term analysis). Therefore, we identify the change in attitudes toward risk and time both over a 6-month and a 2-year period. In the short-term analysis (6 months), we capture a causal effect of the Covid-19 crisis on preferences. Indeed, given the magnitude of the Covid-19 shock over the period, all characteristics that varied over the 6 months are directly or indirectly related to Covid-19. For the medium-term analysis (24 months), the results are very similar to the short term results, both in terms of significance and magnitude. Although we cannot completely rule out the role of other determinants of preferences shifts, we argue that the short term effects persisted over time and that we might capture long-lasting effects of the Covid-19 crisis.

We find a 12% increase in risk aversion when lotteries are presented in monetary gains in the short-term period. Eighteen months later, risk aversion has not returned to its pre-Covid level, as we see an 11% increase between the baseline level (January 2020) and the endline (January 2022),

once time-variant characteristics have been taken into account. Risk aversion instability is larger when lotteries are presented in terms of losses, with risk aversion decreasing by 47% in the short term. It remains at this level in the medium term, as we also see a 46% drop between the baseline and the endline. The reversal of the sign of the effect according to the framing is consistent with the reflection effect of Kahneman and Tversky (1979), which postulates that preferences depend on the reference, inducing risk aversion for gains and risk-seeking for losses. We also find that preference for present increased by 20% over the short-term period and by 15% over the medium-term period. These results are robust to the different specifications. Then, we aim at revealing potential transmission channels through the identification of heterogeneous effects. We compare variations of preferences according to individuals' self-reports of their experience of the Covid-19 crisis (personal contamination, contamination of a relative), its impact on their daily life (recent loss of job, difficulties to meet the household basic needs) and their pandemic-related concerns. This suggestive evidence shows little effect of the direct consequences of Covid-19: preference instability is only amplified when the individual reports having difficulties with food or water access during the period, but is not affected by job loss nor by low-income levels. We find no different effect related to the respondent's health status (such as poor general health or having had Covid-19 symptoms during the study period). In contrast, preference instability is exacerbated when the respondent expresses concerns about the Covid-19 crisis (particularly regarding economic concerns and concerns related to more catastrophic scenarios such as economic collapse). We also capture the emotional mechanism through the exposition to different media. Indeed, media can reinforce the emotional response by increasing risk perception and anxiety (Shachat et al., 2021; Sadish et al., 2021; Fetzer et al., 2021). We do find that the more informed individuals exhibit wider change in their preferences over the study period. Unfortunately, we do not know the type of information assimilated, nor its veracity. However, the type of media used to keep up to date about the pandemic provides indications. We find that social networks as a primary source of information exacerbate preferences instability. In contrast, traditional media - television, radio, newspapers (which provide commentary and analysis on the situation and government announcements) and discussions with family and friends do not affect the impact on preference variation. This is in line with the results from Depoux et al. (2020): social networks (Facebook, Whatapps) are more likely to generate fear and anger than traditional media. Together, this set of findings suggests that the emotional channel is dominant in Covid-19-related variation in risk and time preferences.

We contribute to the literature in several ways. First, we complement the research stream that studies the stability of risk and time preferences after the experience of a shock. Our specific setting (a sudden and unanticipated shock, pre- and post-shock panel data) allows for a clean identification,

which avoids the main empirical flaws of the literature. The latter has not reached a consensus (see next section), partly because of the difficulty of identifying the causal effect of shocks on preferences in a natural setting. Macroeconomic, natural disasters, and some conflicts (predominantly studied in the literature) can, to some extent, be anticipated or avoided (by migration to less risky locations or by insurance), which leads to selection bias-related issues. In this study, we observe the same individuals just before the Covid-19 pandemic, and six months after, once the various measures put in place at the beginning of the pandemic have been alleviated. Moreover, our short-term sample does not suffer from migration bias (no one migrated between the two waves) or selective attrition (we reached 95% of our respondents at midline and verified that there are no big differences between attritors and non-attritors both at midline). Our short-term analysis is then a causal one.

Second, we propose to study whether the instability observed in the short term persists over time, and we do find that preferences have not returned to their initial levels. To our knowledge, no paper has studied the variation in preferences at multiple points in time in the context of a developing country. These two-time analyses of the same individuals support the idea that exogenous shocks generate abrupt changes, which may be permanent. We acknowledge the fact that over the two years, many other changes, potentially independent of the consequences of Covid-19, may have maintained these new levels of preferences, and that this could affect our identification strategy.

Third, we contribute to the literature on Covid-19 related preference change (Castillo and Hernandez, 2022; Aragon et al., 2022; Angrisani et al., 2020; Drichoutis and Nayga, 2022; Gassmann et al., 2022; Bu et al., 2020; Li et al., 2020; Ikeda et al., 2020; Shachat et al., 2021). Most of these articles use small samples and very specific populations (mainly students or informed internet users) that may not consistently reflect behaviors in the field due to their singular characteristics. Furthermore, to our knowledge, no study has examined the impact of Covid-19 on preference stability in Africa. African countries were hit by Covid-19 with an unequal intensity, and in several countries few cases were recorded in 2020. For example, in Burkina Faso, the number of confirmed cases was 1000 and the number of deaths was 54 in July 2020.[1] The nature of the Covid-19 shock is different in these countries than in other contexts studied in the literature, such as China or Europe, where the economic crisis was mixed with the health crisis. In this respect, the context of low-impacted countries (regarding Covid-19 incidence) deserves specific investigation.

Fourth, this article contributes to the literature showing the importance of media and information in shaping a wide range of behaviors and beliefs (Dupas, 2011; La Ferrara et al., 2012; La Ferrara, 2016; Banerjee et al., 2019) and responses to Covid-19 perceptions and behaviors (Simonov et al.,

[1] These numbers are most likely underestimated because only suspected cases and travelers were tested. The number of available tests was limited, and many Burkinabe people were reluctant to get tested because of the psychosis caused by the disease and the fear of the disease (Kobiane, 2020).

2020; Gutierrez et al., 2022; Bursztyn et al., 2020; Banerjee et al., 2020; Fetzer et al., 2021). We hypothesize that the media may have reinforced emotional responses to shocks by giving greater prominence to Covid-19 issues and, as a result, altering risk perceptions. This mechanism echoes Shachat et al. (2021), which observe a significant increase in risk aversion relative to gains among the study population immediately after two newsworthy events (the announcement of the Wuhan city lockdown and the death of media figure Dr. Li Wenliang). Our results suggest that the source of the media used matters: we do find an exacerbation only when the individual uses social networks.

The remainder of this paper proceeds as follows. In Section 2, we provide an overview of the expected impact of Covid-19 on preferences, and of the mechanisms underlying this potential impact. Section 3 describes our data and preference measurements. Section 4 presents the methodology used to estimate the expected change in attitudes after the onset of the Covid-19 pandemic. Section 5 provides the results and gives some robustness checks. Section 6 discusses the potential limitations of our study, and Section 7 concludes.

2 Expected impacts of the Covid-19 crisis on preferences

Unstable preferences. There is no consensus on the empirical concept of stability, so we first explain what we mean by instability. The strict definition of the preference stability assumption of Stigler and Becker (1977) empirically implies that an individual's observed preferences must be the same when measured at different points in time. Thus, according to the canonical approach, if we observe a change in preferences, it reflects only measurement errors and should be considered as meaningless noise (Schildberg-Hörisch, 2018). However, given the growing empirical evidence that preferences change significantly over time (due to age or shocks), it seems unlikely that notable changes in preferences are due solely to measurement errors. To harmonize the different concepts of preference instability, Schildberg-Hörisch (2018) proposes a conceptual framework where risk preferences are no longer considered as a single parameter but as a distribution, characterized by its mean and variance.[2] According to this framework, there are three possible reasons for the instability of individual preferences over time. First, it could result from a continuous change in the average level of risk preferences over the life cycle (the aging effect). An observed change

[2]The conceptual framework of Schildberg-Hörisch (2018) draws on research in psychology on the stability of individual-specific personality traits (which might be related to what economists refer to as individual-specific parameters determining the curvature of the utility function). Personality traits are considered stable, but should be conceptualized as density distributions that can vary for the same individual in response to a change in their environment. This intra-individual variability is referred to as conditional stability in Fleeson (2001).

in preferences over time may indeed simply reflect the aging of an individual, who becomes less risk-averse and more patient over the life cycle (Yesuf and Bluffstone, 2009; Tymula et al., 2013; Dohmen et al., 2017). Second, some exogenous shocks could induce an abrupt (and potentially permanent) change in the average level of risk preferences. Finally, temporary variations could be observed due to stress or emotions, causing high variance around the average level of preferences.[3] Our analysis excludes the aging explanation because the short period between our three surveys does not capture any life-cycle effect. However, preferences may vary within the time frame of our study because the consequences of Covid-19 are similar to those of a negative shock or because the period of the first half of 2020 was characterized by a high level of uncertainty, generating stress and anxiety (Fetzer et al., 2021).

Previous literature Much of the empirical literature studies the impact of natural disasters and conflict, and the evidence is ambiguous. Some studies demonstrate higher levels of risk aversion after exposure to shock (Fang et al., 2022; Cassar et al., 2017; Cameron and Shah, 2015; Reynaud and Aubert, 2020). Conversely, others show a decrease in risk aversion (Biener and Landmann, 2023; Castillo and Hernandez, 2022; Eckel et al., 2009; Kahsay and Osberghaus, 2016; Voors et al., 2012), and some find different results depending on the domain (loss or gain) studied (Reynaud and Aubert, 2020). Regarding time preferences, results are also divergent, as some find that natural shocks increase impatience (Bchir et al., 2013; Cassar et al., 2017) while others show that they decrease impatience (Callen, 2015; Voors et al., 2012). Sample sizes, time horizons, and methodology differ widely across studies and may explain these divergent results. Regarding idiosyncratic shocks such as changes in income, unemployment, health status, or family composition, they do not appear to have an impact on preference changes over time (Chuang and Schechter, 2015; Sakha, 2019). On the contrary, macroeconomic shocks tend to have long-term effects on an individual's risk attitudes (Sakha, 2019). A more comprehensive review of the literature (including life-cycle effects) is available in Chuang and Schechter (2015). These studies are not easily comparable with our, since most of them only observe preferences after the shock occurrence, introducing noise into the causal identification. Moreover, selective attrition (if correlated with temporal stability of preferences) also makes it challenging to construct a valid counterfactual. Within the last years, though, several studies used stronger identification strategies. Among the studies most comparable to our, Hanaoka et al. (2018) track the short-term changes in risk preferences of the same individuals just before and several months after the 2011 Great East Japan Earthquake. They found that

[3]Measurement errors are excluded from the framework of Schildberg-Hörisch (2018) because the observed change in individual preferences in empirical studies is systematic and substantial.

women become more risk averse at the high-intensity locations, although they recognize that their results for women are not very robust. Sakha (2019) examine macro- and micro-level influences on changes in risk preference over a period of five years in rural Thailand. They observe high levels of risk aversion during the 2007/08 global financial crisis, following by a phase of return and "normalization" of levels of risk aversion thereafter. More recently, Biener and Landmann (2023) analyze the very short-term (10 days) causal impact of exposure to typhoon in the Philippines on locus of control, beliefs in reciprocity, and risk preferences. They found that people report to be less risk averse immediately after the storm.

The use of natural disasters and macroeconomic shocks to assess the change in preferences after the shock experience, as has been done in the studies cited above, suffers from a significant flaw: their anticipatory nature. This creates the possibility of selective migration and bias in the analysis. In contrast, sudden pandemics, as it was the case with Covid-19, cannot be anticipated and provide a more exogenous and robust framework for identification. Recently, several articles have studied the impact of epidemics. For instance, Fang et al. (2022) analyze the very long term impact of exposure to the 1967 meningitis epidemic in China. They find that intense exposure to the meningitis epidemic during childhood led to increased risk aversion. Regarding the impact of Covid-19, Castillo and Hernandez (2022) and Aragon et al. (2022) are the closest articles to this paper.[4]

[4]Various articles and working papers studied the impact of Covid-19 on preferences. These articles are less comparable to ours since they use a different population (students, internet users), in industrialized countries, and often use very short-term time horizons to measure the instability. Among this literature, we can cite Zhang and Palma (2022) that study the short-term (up to 20 days after the emergency declaration) stability of preferences using an experimental design on a US online platform. They find that individuals, on certain risk games, are more risk averse after the pandemic. Angrisani et al. (2020) analyzes the risk preferences of professional traders (48 subjects) and undergraduate students (60 subjects) in London, England, and finds no change in risk aversion levels before and during the Covid-19 outbreak. Drichoutis and Nayga (2022) also find no significant difference in the preferences of 300 students in Athens, Greece, between before and after the pandemic. Gassmann et al. (2022) analyze the impact of the lockdown on time, risk, and ambiguity aversion during the first pandemic wave in France and compare it to what was observed in 2016 (unbalanced panel of 314 subjects aged 18 to 25). They observe a decrease in patience and risk aversion during the lockdown, although the effects tend to disappear after a few months. Bu et al. (2020) exploit a survey of risk-taking behavior among 225 students in the city of Wuhan. They find that people in the hardest-hit provinces of China are even more risk-averse. Shachat et al. (2021) also find a short-term "disruption" in economic preferences from late January to early March 2020 among 396 students in Wuhan. Using online experiments, they provide evidence that people became more risk-averse and impatient than before the Covid-19 pandemic in China. Ikeda et al. (2020) administered an Internet survey in Japan (737 subjects over three waves) and find that people become more risk-tolerant. Harrison et al. (2022) find an increase in atemporal risk aversion pre-post pandemic, while temporal preferences remained stable on an unbalanced sample of 598 online respondents over 6 different waves from a population of undergraduates at Georgia State University (GSU).These studies, however, focus primarily on

Castillo and Hernandez (2022) conducted two survey rounds at the end of 2019 and in May–June 2020 among agricultural smallholders in Guatemela. They observe a significant increase in risk tolerance. Aragon et al. (2022) use longitudinal dataset from a survey of cab drivers in Lima (Peru) conducted before and nearly a year after the pandemic onset. They also find a significant increase in risk tolerance and patience. Beyond the different methodologies and populations studied, the various mechanisms at work in instability may explain why the literature is inconclusive.

Mechanisms. Two main mechanisms influence preference instability over time: shock-induced variation in wealth and background risk, and the influence of emotions.

A change in wealth is the mechanism most often cited in the literature to explain the instability of preferences following shocks. According to the habit persistence model, risk aversion varies with wealth level (Campbell and Cochrane, 1999). In this model, increasing wealth leads to a decrease in risk aversion. Cumulative prospect theory also adds that preferences depend on a reference point, not on absolute levels of wealth. This reference point may vary over time and across domains (gains or losses). By causing an unprecedented change in people's environment, the Covid-19 shock may have changed this reference point, modifying preferences accordingly. Because of its unprecedented nature, the Covid-19 crisis can also be viewed as a new background risk, or in other words, a new source of exogenous and non-insurable (economic and health) risks. With the deterioration of the individuals' wealth, Covid-19 should induce greater risk aversion in the economic and financial sphere. However, the change in attitudes may translate to all domains, even those not affected by the Covid-19 shock (Eeckhoudt et al., 1996; Guiso and Paiella, 2008; Gollier and Pratt, 1996). Eeckhoudt et al. (1996) models the fact that individuals become more risk-averse when the background risk becomes riskier, even in other independent risks. This property is described as "risk vulnerability" by Gollier and Pratt (1996). It implies that, in response to this additional background risk and even though the risks are independent, individuals behave in a more risk-averse manner for avoidable risks (Gollier and Pratt, 1996; Eeckhoudt et al., 1996). Individuals reduce their exposure to avoidable risks in order to control their overall risk exposure (Zhang and Palma, 2022; Kimball, 1993). Macroeconomic and financial evidence confirms these theoretical predictions: the presence of (uninsurable) labor income risks alters saving and consumption behaviors, as well as the demand for insurance (Guiso and Paiella, 2008). Therefore, individuals facing new and multidimensional risks should be more risk-averse for other (insurable) risks[5].

samples that belong to particular demographic groups (such as university students, or a specific profession), which limits the external validity of their results.

[5]Kahneman and Tversky (1979) indicate a decreasing sensitivity effect: when the level of risk is already high, adding small independent risks does not change people's behavior. However, it is impossible to estimate the level of

The Covid-19 crisis can also affect individuals' willingness to take risks and impatience by altering their emotions, even if they have not experienced any loss (Guiso et al., 2018; Barberis et al., 2001). For example, Li et al. (2020) and Lerner and Keltner (2001) mention that the fear of contamination influenced risk attitudes toward less risky decisions. Dalton et al. (2020) confirm these findings in a lab-in-the-field experiment with small retail business owners in Vietnam. They report that, consistent with recent lab experiments on risk-taking under stress, small business owners exogenously exposed to financial concerns report higher stress levels and have lower risk aversion than those who received a placebo treatment. Variations in impatience may also be explained by higher emotional stress that tends to reduce self-control (Tice et al., 2001). These studies echo previous literature emphasizing that fear, helplessness, and loss of control, the primary emotional responses to adverse shocks, can alter risk and time preferences (Fang et al., 2022; Lerner and Keltner, 2001; Loewenstein, 2000; Loewenstein and Lerner, 2003; Botzen et al., 2015; Eckel et al., 2009). The emotional pathway might, in some cases, perform better than other explanations: Guiso et al. (2018) show that changes in risk aversion after the 2008 global financial crisis are primarily triggered by fear and a change in perceived probability (while changes in wealth or expected income have no impact). Stress or fear are temporary and, therefore, may induce only short-term changes in preferences. In the same vein, Hetschko and Preuss (2020) show that risk aversion increases after a job loss. Interestingly, this effect is not due to the immediate loss of income but to lower expectations of future income and greater uncertainty about future income. When the emotional response induces a shift in risk perception or discount rate, the behavioral change may persist over time (Ho et al., 2008; Lerner et al., 2015; Brown et al., 2018)[6]. Indeed, shocks could change the perceived utility of bad outcomes and increase the curvature of the utility function (Loewenstein and Lerner, 2003; Guiso et al., 2018; Cassar et al., 2017). It can also affect the expected distribution of returns by altering the salience of some realizations: the salience theory of Bordalo et al. (2012) argues that individuals' attention is in fact directed toward particular realizations that, as a result, receive disproportionate weight. There is no doubt that in 2020, greater importance has been given on the Covid-19 context: most media around the world have crystallized their editorial lines on the news of the pandemic, with some even talking about "infodemic"(Zarocostas, 2020). The higher salience in Covid-19 issues probably intensified the perception of health and economic risks and, in

risk in the pre-Covid-19 Burkinabe environment, or even to estimate the importance of the additional risks induced by Covid-19 relatively to other risks.

[6]Some studies show that risk perceptions tend to be strongly altered after exposure to an adverse event. For example, fear causes people to express more pessimistic risk perceptions and leads them to make more risk averse choices. Brown et al. (2018) also find a change in risk perceptions, as well as in the individual's beliefs about the frequency and magnitude of future shocks

this way, may have influenced risk and time preferences.

3 Data and Descriptive Statistics

3.1 Panel Survey of Women in Ouagadougou

Baseline survey. We rely on an original panel survey that is part of a larger project aiming to understand the health and economic behaviors of women working in the informal sector in Ouagadougou, the capital of Burkina Faso.[7] We conducted a baseline survey in January and February 2020 (face-to-face interviews, see Table B1). At that time, no respondent could have anticipated the coronavirus crisis in Burkina Faso or its economic consequences. Our sample comprised 1,700 female loan recipients randomly selected from two microfinance agencies. In this baseline survey, we collected information on the socioeconomic characteristics of respondents and their household members and their health and work behaviors.[8] We also asked questions about hypothetical lottery choices to elicit individual risk and time preferences (see the following subsections).

Midline survey. In June and July 2020, we conducted a follow-up telephone survey. Due to financial and logistical constraints, only half (randomly selected) of the baseline sample was re-interviewed. Before randomly selecting participants for follow-up, we excluded women without cell phones (1% of baseline survey respondents) from our sampling frame. Our follow-up rate was exceptionally high, reaching 95% of randomly selected participants.[9] Although selective attrition is not an issue for this round, we can confirm in the table that there are no significant differences between respondents selected to participate in the midline survey and those who are not. The balancing tests between these two types of respondents are reassuring (Table B2 in Appendix),

[7]This project is being conducted in partnership with a local microfinance institution with several agencies in Ouagadougou. The main objective of this large project is to assess the impact of a novel health-insurance program, introduced in 2021, on a range of behaviors, including health, work, women's empowerment, and risk and time preferences. The first two waves of surveys were conducted several months before implementing the health-insurance program.

[8]Note that our measure of wealth refers only to living conditions (location of water supply, type of toilet, electricity, type of fuel used for cooking and lighting) and asset ownership (radio, television, cell phone, refrigerator, car, motorcycle, farmland). Indeed, income and earnings are inappropriate for informal workers because they are very volatile. In addition, it is difficult to compare women's income levels because some pool their income with their husbands, but others do not. In addition, in the pilot survey, we found that these questions about individual or household income and earnings were embarrassing because they made respondents uncomfortable.

[9]The telephone survey protocol required interviewers to make three contact attempts in two days, with at least one day between attempts. We did not provide financial incentives to follow-up respondents.

although we find that midline sample respondents are significantly more likely to have a formal job (still less than 5%) and more likely to own a television. Other characteristics (e.g., health status, employment status, financial status, preferences) are not significantly different between the respondents selected for the baseline and midline and those interviewed only in the baseline. In this follow-up survey, we re-asked questions about respondents' health and employment status and their risk and time preferences to observe these characteristics at two different time points. Socioeconomic characteristics (such as education or standard of living as measured by assets owned) were only collected in the first wave. Indeed, we assumed that these characteristics were unlikely to have changed over the six months. These variables are therefore considered invariant for the 2020 period, or in other words, not affected by the Covid-19 crisis in the short-term. However, we supplemented the follow-up questionnaire with a series of questions on perceptions of the coronavirus, ways to obtain information, and specific economic impacts of the Covid-19 crisis.

Endline survey. We conducted the endline survey in January/February 2022, in person, so that the conditions would be as close as possible as the ones of the baseline survey (same season, same training). In a consistency perspective, the field team (all managers and three quarters of the surveyors) remained the same. The attrition rate between baseline and endline is very high (57.98%) and come from individuals having left the microcredit agency. Table B3 in the Appendix shows us that, except for risk and time preference levels, there are significant differences between attritors and non-attritors on several characteristics, such as the sector and the location of the economic activity, or the probability of having been sick in the three months prior to the survey. Although significant, the differences in characteristics are small in their magnitude and should not affect the results. As our analysis intends to track the evolution of preferences over time for the same individual, we do not correct selective attrition.

3.2 The COVID-19 crisis in Burkina Faso

Government response to COVID-19. As in most African countries, Burkina Faso recorded few cases of Covid (at the end of our follow-up survey in July 2020, the number of confirmed cases in Burkina Faso was 1,000, and the number of deaths was 54). These low numbers are partly due to strict measures restricting the movement of people, goods, and services implemented from mid-March 2020. Those restrictions included a two-and-a-half-month curfew, a ban on public gatherings and events, the quarantine of major cities, the closure of schools, bars, restaurants, public markets, and religious places for several weeks and the disruption of public transportation for several months.

Each week, the government made a public communication to inform the population about the evolution of the pandemic and the new measures put in place. In addition, prevention messages were widely disseminated through public and social media, such as wearing masks, washing hands with soap, using alcohol-based hand sanitizers, and social distancing.[10] Restrictions had been withdrawn by the time of our follow-up investigation, although protective measures such as social distancing are still strongly recommended.

Economic impacts. The low number of infections raises the question of the real impact of the Covid-19 epidemic on the daily lives of Burkinabes, particularly a few weeks after the measures were relaxed. First, the population of Ouagadougou did comply with the measures put in place (Mathonnat et al., 2021). The figure C1 in Appendix C illustrates population movements in the Ouagadougou region based on Google community mobility trends. It shows a substantial increase in the location of private residences and a sharp decrease in mobility to recreation, grocery stores, and workplaces over our study period (in blue). In addition, our data suggest that respondents were aware of the measures in place. First, 98% cited public places as the most significant risk of contamination. The majority of people agreed (40%) or strongly agreed (54%) with the economic measures taken by the government. In addition, 88% of those surveyed in June and July 2020 still wore masks, while only 54% respected the social distance. The likely trade-off between the need for sustainable income generation and compliance with government measures may explain why recommended sanitary practices were not fully respected. These results are consistent with those found in Mathonnat et al. (2021), where respondents report compliance with sanitary and social distancing habits in general but admit to not following them all. Despite the imperfect compliance and the period of return to normalcy during the second wave, the restrictive measures adopted had negative consequences that persisted in July 2020. First, we see an increase in concerns about health and economic issues. For example, 35% of respondents anticipated a worsening economic situation in the medium term (Table C7 in Appendix). Second, the economic situation deteriorated between the two survey waves: only 83% of respondents were working the week before the second interview, whereas this was the case for 92% of them in the first wave. In addition, 54% of respondents reported frequent restrictions in their economic activities, and 7% said that these restrictions were systematic (Table C6 in Appendix). These statistics echo those found in studies describing that vulnerable (informal) workers in Africa have been disproportionately affected by the Covid-19 crisis

[10]Because no official website has centralized all actions taken or recommended, we rely on a review of major online newspapers, the government website, and social networks (Facebook). For a timeline of government responses to the real-time assessment of the epidemic situation, see https://askabout.io/covid-19/ask/what-is-the-government-response-timeline-for-burkina-faso/.

(Price, 2020; Mahmud and Riley, 2020).

3.3 Measuring risk and time attitudes

Risk attitudes. To obtain information about attitudes toward risk, we used non-incentivized hypothetical gambling questions similar to Holt-Laury Paired Lottery Task (Holt and Laury, 2002). Each respondent was presented with three scenarios involving paired lotteries in an abstract environment with payoffs ranging from 0 to 20,000 FCFA. For each scenario, the respondent was asked to choose between an option where the payoff is certain (option A) and an option with two possible payoffs with equal probabilities (option B). The first pair of choices gives a higher expected payoff for the riskier choice (option B). On the contrary, the last pair of choices gives the same expected payoff for the option B as the option A (the safer choice, see Figure A1). We replicate the same experiment in the loss domain (Figure A2). Tables A1 and A2 illustrate how we measure risk aversion in the gain and loss domains. The number of risky decisions made by the respondent measures the individual's degree of risk aversion in each domain on a scale of 1 to 4. Specifically, we construct ordinal variables ranging from 0 (high risk taking, i.e. consistently choosing the lottery) to 3 (high risk aversion, i.e. consistently choosing the safe option). In the main empirical analyses, we use a binary variable indicating that the respondent is "risk averse", i.e., always chose the safer option.

Figure 1 below shows how risk and time attitudes changed between the two (balanced panel on baseline and midline) or the three surveys (balanced panel on baseline, midline and endline). While the sample size differs, a similar trend can be observed. In the gain domain, individuals tend to be risk averse: in January 2020, 75% (/72%) of respondents from the two-waves panel (/the three-wave panel) were in the most risk averse category (see also Table A4). The Covid-19 crisis has increased risk aversion, with this proportion rising to 83% (86%) in June 2020. For respondents also observed in January 2022, the proportion of risk-averse individuals has returned to about its initial level, at 74% precisely. Consistent with the reflection effect of Kahneman and Tversky (1979), only 60% (/61%) of people from the two-waves panel (/the three-wave panel) showed high risk aversion in January in the loss domain (Table A5). This proportion dropped to 30% (/28%) in June 2020. Interestingly, the proportion of risk-averse individuals was only 37% in January 2022, suggesting a long-term effect of Covid-19 on risk aversion in the loss domain.

Time preferences. Following Andersen et al. (2008) and Cassar et al. (2017), time preferences are obtained using four sets of choices. Each set consists of a choice between hypothetically receiving 5,000 FCFA on the day of the survey or hypothetically receiving 20,000 FCFA in a longer time frame. We set up four different time horizons that vary according to the choice set: the day of the

survey versus one month, three months, six months, and twelve months (Figure C3). To measure subjects' impatience, we create a categorical variable ranging from 0 (High patience) to 4 (High impatience). We also use in the empirical analysis a binary variable indicating that the respondent is "impatient", capturing by the last category. We observe in Figure 1 an increase in preference for the present after the Covid-19 crisis: individuals from the two-waves panel (/the three-wave panel) were more impatient in June 2020 (79% / 83%) compared to January 2020 (65% / 68%). For the sample of individuals observed at 3 points in time, a high degree of impatience remains in January 2022, at 76% (Table A6). The following section extends the analysis to examine whether these changes hold once we control for observable and unobservable characteristics.

Validation of preference measure We build our preference measures on hypothetical and non-financially incentivized questions. Several studies have demonstrated the ability of these survey methods to capture individuals' induced preferences and accurately predict the attitudes measured in a more experimental setting or in real life (Fang et al., 2022; Dohmen et al., 2011; Guiso et al., 2018). However, various biases may affect the validity of these methods in capturing Burkinabes' risk and time preferences. First, understanding the questions may be challenged when addressed to a population with limited education. To limit these comprehension biases, we presented each scenario with a visual representation of the amount of money the respondent could earn by choosing options A and B (see for example Figure A4). In addition, before each set of risk questions, we checked that the person understood the game by asking them to choose between option A (e.g., for the risk in the gain domain, having a certain gain of 5000 FCFA) and a non-rational option B (a 50-50 chance of winning 5000 FCFA or nothing, see Figure A5). Few people chose the non-rational option in these pre-game questions (respectively, 5% for the gain domain, 6.8% for the loss domain). If they did, the interviewers re-explained the game. Another concern relates to the calibration of the game amounts or time horizon, since unsuitable scenarios can induce noise in the measurements and affect the understanding of the games. On the one hand, we extensively tested the calibration of the amounts and time horizon in the pilot phase of the survey (in November 2019) and solicited feedback from pilot project participants. On the other hand, we can see from Figure 1 that preferences are quite polarized, since few individuals fall into the intermediate categories. Indeed, we observe little variation in the options changes for the same individual in the same wave of survey. More precisely, 95% of the individuals who chose option A in the first scenario will stick with this option in the last scenario of the game (and similarly if the person chooses option B in the first scenario). Regarding the risk measures, we also tested whether a tipping point appeared by adding a scenario, namely the choice between +/-5000 euros for sure and a lottery of +/-25000 euros. The addition of this extra scenario keeps the risk attitude categorization the same.

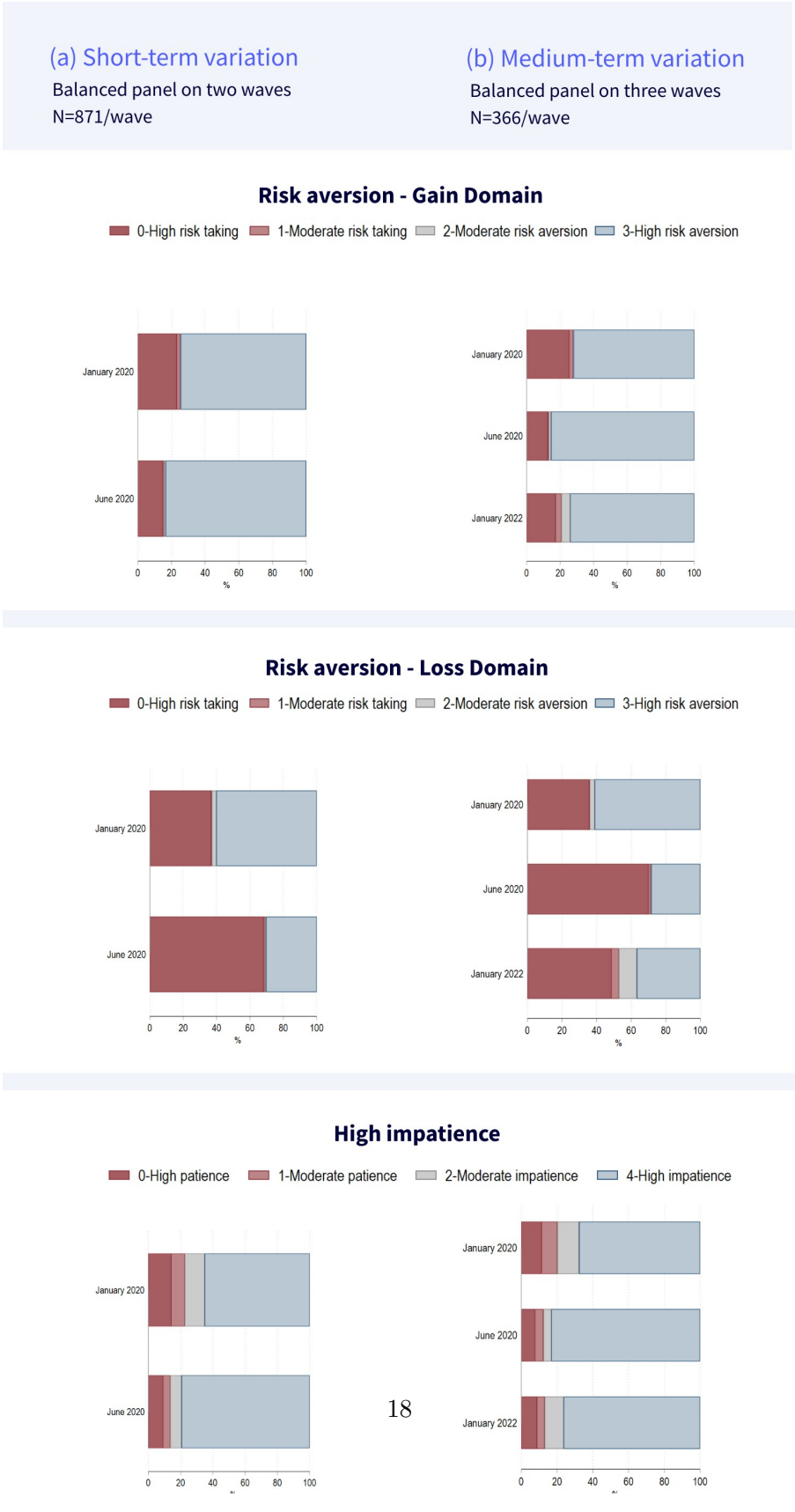
Concerning time preferences, we also tested a fourth scenario, reducing the time horizon of Option B to one week. Similarly, adding this alternative keeps the choices the same, i.e., respondents who chose option A for a time horizon of one week consistently choose the same option when the time horizon is extended to one month, and vice versa for option B. There is also no change between a time horizon of 6 months and one year. A final calibration test was performed on time preferences by increasing the gain to 40,000 FCFA francs. Again, individuals are not very sensitive to the design of the options and remain consistent with their choice.

Predictive power of our preference measures We check whether our preference measures were actually associated with real behaviors regarding risks. In our midline survey, we asked respondents whether they had interrupted their activity for a day or more during the Covid-19 period, and the reasons associated with the interruption (or non-interruption, if any). Responses include options related to restrictions and others pertaining to individual fears about the virus. We consider that stopping an activity for fear of contracting or transmitting the virus reveals greater risk aversion than stopping activities to comply with restrictions, as the latter individuals would have continued to work without legal restrictions. On the contrary, continuing to work despite restrictions is a risk-loving attitude because it implies that people accept the consequences of potential punishment if caught and possible illness if infected. We construct a risk-loving behavior variable, with a value of 0 if the respondent stopped working because they feared contracting or spreading the virus (and did not mention restrictions as a reason), 2 if respondents continued working because they could not afford to have any income (and no other reason), and 1 for different situations. We also know how respondents feel about the country's economic development one year from now (measured on a Likert scale, ranging from strongly worse to strongly better). We argue that this is an immediate and concrete indicator of respondents' willingness to engage in risky ventures (taking out a loan to start or expand a business, for example), at the point where all restrictions have been lifted. We estimate a linear model to test the relationship between these two measures and our measures of risk and time preference. Our results (Table 1) show that our risk aversion measure significantly and negatively predicts risk-loving behaviors. In contrast, risk aversion in the loss domain and present preference have significant and negative coefficients. These results are robust to introducing control variables related to individual characteristics and the frequency with which individuals experienced difficulties seeking care or finding medication during Covid-19. These results, coupled with the literature validating the use of hypothetical lotteries to reveal preferences, support our belief that our preference variables accurately measure respondents' mindsets regarding risk and temporality.

Table 1: Validation of the risk and time preference measures

	Risk-loving behavior		Beliefs on economic evolution	
	(1)	(2)	(3)	(4)
Risk aversion (loss)	0.001	-0.006	-0.181***	-0.187***
	(0.013)	(0.032)	(0.013)	(0.033)
Risk aversion (gain)	-0.037**	0.035**	-0.017	0.017
	(0.019)	(0.047)	(0.018)	(0.047)
Preference for present	0.003	0.010	-0.131***	-0.128***
	(0.016)	(0.041)	(0.016)	(0.042)
Controls		✓		✓
Nb. Observations	730	727	730	727

Figure 1: Changes in risk and time preferences between January and June 2020



4 Changes in risk and time preferences

4.1 Empirical specification

To test whether attitudes toward risk and time have changed due to Covid-19, we denote as Y_i the outcome of interest, representing the different measures of preferences (risk aversion in the gain domain, risk aversion in the loss domain, or impatience). Our treatment variable is a time dummy taking the value of 1 for the post-Covid-19 period (June 2020 and January 2022) and 0 for the pre-Covid period (January 2020).[11] We estimate two types of effects from two different samples. The first is a short-term effect, based on the balanced panel of 853 women interviewed between baseline (January 2020) and midline (June 2020). The second one is a medium-term effect, based on the balanced panel of 390 women interviewed three times, at baseline (January 2020), midline (June 2020), and endline (January 2022). Pooling the several waves, we estimate our model as follows:

$$Y_i = \alpha_i + \beta \cdot PostCovid_i + \theta_i + \delta W_i + \mu Y_i' + \varepsilon_i \tag{1}$$

In order to present a clearer relationship between preferences and the Covid-19 crisis and to control for any spurious associations that might bias our estimates, we include in some specifications individual fixed effects θ_i that eliminate any time-invariant characteristics. We also control for W_i, i.e., having worked in the week prior to the survey. Moreover, as recommended in this literature, we include the time (or risk) preferences Y_i' to account for relationships between these variables (Dohmen et al., 2010; Bchir et al., 2013; Cassar et al., 2017).

In the short-term, β captures the causal effect of the Covid-19 crisis on preferences. This is the global and multidimensional effect of Covid-19, encompassing changes in income, occupational status, stress, and uncertainty in the first six months of 2020. Our estimates are unlikely to suffer from reverse causality or selection bias because of the exogenous and unexpected nature of this singular shock. Given the importance of this single event, we consider any change during this period in economic (income, employment) and emotional (stress, uncertainty, anxiety) outcomes to be related to Covid-19, either directly or indirectly. However, some omitted variables may remain

[11] The use of a dummy variable as a treatment implicitly implies that the Covid-19 crisis affected every woman in our sample homogeneously. In our case study, this is not a strong assumption: as mentioned earlier, our sample is composed of women microentrepreneurs living in the same area (Ouagadougou) and exposed to the same implemented measures and health risks.

and lead us to misinterpret any change in preferences over the analysis period as being caused solely by Covid-19. Some factors, time-invariant, are captured by the individual fixed effects. For example, the willingness to take long-term risks or the curvature of the individual utility function and its risk premium should be considered as personality traits, which vary little over the life cycle. Other determinants of preference instability, such as education or age, are unlikely to have changed over the 6-month period. These characteristics are also absorbed by fixed effects. An exception may be changes in wealth over the period that may have induced a change in attitudes, if they are reference-dependent. As explained earlier, our empirical measure of wealth focuses on asset ownership to avoid the reporting bias associated with income. Indeed, income emerged as a sensitive issue in the pilot survey and was difficult to compare across individuals, since some women do not pool their income with family members. Asset ownership is a very stable measure of living standards, and it is unlikely to have changed over the study period for reasons non-related to the Covid-19 crisis. However, a change in income between January and June 2020 unrelated to Covid-19 may have happened. We believe that if unrelated to Covid-19, i.e., not related to existing restrictions or declining overall economic activity, this short-term income change should not alter preferences. Indeed, seasonality in income is predictable and to our knowledge, no study has shown that attitudes toward risk and time change with seasonal fluctuations in income. In addition, no other shocks occurred in Ouagadougou between January and June 2020.

Over a two-year horizon, we are able to complement our analysis by tracking the persistence of shifts in respondents' preferences over a longer time. The significance of coefficient β indicates whether the changes observed over the first semester 2020 were temporary because preferences are back to their initial level (if β is non-significant) or they persisted over time are still observed 2 years after (if β is non-significant). Nonetheless, we acknowledge that one needs caution while attributing the causal effect of Covid-19 to coefficient β, for several reasons. First, the individual fixed effects are no longer sufficient since, during these two years, individuals may have increased their level of education and changed their occupation, family situation, and wealth status. Therefore, we control for the characteristics likely to vary during these two years and are well-known predictors of risk and time preferences. Second, between January 2020 and January 2022, Burkina Faso experienced several significant events, such as the continuous deterioration of the national security situation, the food crisis, high inflation (the inflation rate was 17.8 in June 2022), and the coup of January 2022. It is, therefore, difficult to distinguish the effect on preferences of the persistence of the Covid shock from that of the other shocks that have passed through Burkina Faso in two years and to make a safe causal inference.

Another possible explanation for the observed variation in preferences over time is related to measurement issues. We explained in the previous section that our measures were calibrated to best fit the context and designed to avoid misunderstandings with respondents as much as possible. In addition, cognitive ability, education, and age, which are strongly correlated with noisy behavior in risk elicitation experiments (Andersson et al., 2020; Choi et al., 2014), are captured by individual fixed effects. Thus, we assume homogeneous noise (i.e., classical measurement errors) over time for each individual in our estimates. In other words, once fixed effects have excluded cognitive abilities, arbitrary and inconsistent responses can be considered random. Another concern relates to the mode of administration of the surveys: for the midline wave, surveys were conducted by phone. Phone surveys exclude visual aids and may alter the understanding of the game. We argue that this is unlikely to happen since the baseline and midline surveys are very close in time, so the respondent faced the same decisions at two points close in time. The short timespan between surveys actually increases the risk of path dependence, i.e., perfect correlation over time for each individual. As a result, the probability of finding variation in preferences is reduced. In addition, in the endline we went back to a face-to-face survey (with the same interviewers) which is, therefore, comparable to the baseline. Lastly, one may be concerned that in the midline, the seasonality is different, which may explain the variability in preferences. While this concern may apply to short-term effects, it is no longer relevant to long-term effects as the baseline and endline surveys are conducted over the exact same period (January and early February). Although we cannot rule out the existence of some measurement error in our estimates, it seems unlikely that noise alone could cause such large differences in individual preferences.

4.2 Main results

Changing attitudes towards risk in the gain domain. Table 2 presents estimates of the impact of the Covid-19 crisis on risk attitudes in the gain domain, using linear probability models. The dependent variable is binary, representing high risk aversion. All specifications allow for robust standard errors. We separate short-term estimates, based on the balanced sample between the baseline and the midline, and medium-term estimates, based on a balanced sample of the three survey waves.

We begin with column (1) and (4), which estimates the short-term and medium-term impact of Covid-19 on risk aversion without any controls or fixed effects. Consistent with what we observe in Figure 1, the estimates confirm a significant shift in risk attitudes in the gain domain towards

Table 2: Temporal variation of risk aversion (gain domain)

	Short-term variation			Medium-term variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.090***	0.092***	0.093***	0.078***	0.079***	0.069**
	(0.019)	(0.019)	(0.020)	(0.027)	(0.027)	(0.029)
Baseline mean (%)	74.53			71.90		
Relative effect (%)	12.03	12.08	12.08	10.85	11.13	9.74
Nb. Observations	1710	1710	1604	1087	1087	1043
Robust standard errors	✓	✓	✓	✓	✓	✓
Individual fixed-effect		✓	✓		✓	✓
Controls			✓			✓
Nb. Observations	1710	1710	1604	1087	1087	1043

Notes: Short-term variation : on balanced panel between baseline and midline.
Medium-term variation: on balanced panel between baseline, midline and endline.
Post is a dummy variable indicating the second wave and the third wave.
Controls include having a job the week before the survey, age, level of education, asset score, household size, subjective health status.
Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

greater risk aversion after the Covid-19 crisis, both in the short and the long-term. On average, individuals are eight percentage points more likely to choose the safest option. For ease of interpretation, we calculate the relative effect of each estimate using the average level of risk aversion of January 2020 as a base reference. In terms of relative effects, our results show a 12% increase in risk aversion between January and June 2020 (column (1)) and a 11% increase between January 2020 and January 2022. Using individual fixed-effects (column (2) and column (5)) does not change the magnitude of the effect. This implies that the instability in risk aversion associated with Covid-19 in the gain domain is not caused by time-invariant characteristics, such as underlying fundamental risk preferences, cognitive abilities, education, age, or personality traits. In the short-term, the estimates are also remarkably stable when we control for being employed in the week before the survey (column (3)).This suggests that job instability during this period does not explain the variation of preferences. The relative contribution of the individual level of impatience (a dummy taking the

value of 1 if the individual has a strong preference for the present) is marginal, as the average effect is barely affected when it is included. In the medium-term regressions, the relative effect is slightly smaller than in the short-term ones, especially when controls are taken into account. This suggests that individual experiences such as job loss, wealth, or health status have only a marginal impact on preference changes over a longer timescale.

Table D1 in Appendix D presents several robustness checks using the ordinal variable instead of the binary one. The results are about the same, which is not surprising given the highly polarized reactions to the games. Table D2 present alternative specifications. Precisely, column (1) and column (4) replace the robust standard errors with bootstrapped standards errors, leaving the results unchanged from the main specification, both for the short and the medium-term. Columns (2) and (5) present the results of the estimation using random effects. Unlike fixed-effects estimates that absorbed time-invariant characteristics, in this specification, we control for age, education, employment status, standard of living, number of people living in the household, and subjective health status. The specification with random effects leads to a similar conclusion: the Covid-19 crisis increased individual risk aversion in the gain domain. We also test whether our results can be influenced by individuals suffering from chronic stress and anxiety by excluding individuals who reported suffering from it in the baseline survey (5% of the initial sample). The results barely change when we restrict the sample to non-anxious individuals (column (3) and column (6)).

Changing attitudes toward risk in the loss domain. One of the contributions of our study to the preference instability literature is to provide evidence on how shocks can influence risk preferences in the loss domain, in the same vein as Reynaud and Aubert (2020). The impact of Covid-19 may be different depending on the domain under study: an individual is more likely to be risk-averse in the domain of gain but risk-lover in the domain of loss (Kahneman and Tversky, 1979; Levin et al., 2012; Reynaud and Aubert, 2020).[12] Little literature provides clues to explain these differential behaviors. The psychological literature mentions a selective allocation of attention to loss or gain outcomes: people tend to pay more attention to outcomes framed as losses than presented as gains (Willemsen et al., 2011; Pachur et al., 2018). Table 3 shows the estimates when the lotteries are expressed in terms of losses. We find different responses to the Covid-19 crisis

[12]The reflection effect has been demonstrated in prospect theory (Kahneman and Tversky, 1979; 2013). People feel losses more intensely than gains. They thus prefer to choose riskier lotteries in the loss domain, offering a possibility of a minimal loss rather than a certain loss. The attitude towards risk is reversed in the gain domain, where the certain gain is preferred in most cases (Li et al., 2011). Some empirical studies show that the error term is smaller in the gain domain than in the loss domain (Lopes, 1987; Gonzalez et al., 2005; Baucells and Villasís, 2010), suggesting that choices in the loss domain create more conflict and cognitive effort and are therefore less stable.

in this domain: the magnitude of the effect is much more substantial in the loss domain than in the gain domain, and the attitude toward risk is reversed. Indeed, we find that respondents are more likely to choose risky options after the Covid-19 crisis. The results show that, on average, individuals are 38 percentage points less likely to choose the safest option. In other words, we observe a 47% decrease in risk aversion in the loss domain between January and June 2020. After two years, we continue to see a decline in the propensity to take risks, of the same magnitude. Risk aversion also decreased by 47% between January 2020 and January 2022, suggesting a permanent Covid-19 effect. Table D1 and Table D2 reproduces the same robustness checks explained in the previous subsection. We find that the results are stable in terms of magnitude regardless of the definition of the dependent variable (categorical instead of binary) or the specification used (bootstrapped standard errors, random fixed effects with time-invariant controls). These results indicate that individuals are more likely to take risks in the loss domain following the Covid-19 crisis. This result is similar to those found in Laury and Holt (2008) and Shachat et al. (2021).

Table 3: Temporal variation of risk aversion (loss domain)

	Short-term variation			Medium-term variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-0.297***	-0.296***	-0.281***	-0.286***	-0.288***	-0.288***
	(0.022)	(0.023)	(0.026)	(0.030)	(0.030)	(0.032)
Baseline mean (%)	60.12			61.13		
Relative effect (%)	-49.46	-49.9	-46.57	-46.76	-47.44	-47.44
Robust standard errors	✓	✓	✓	✓	✓	✓
Individual fixed-effect		✓	✓		✓	✓
Controls			✓			✓
Nb. Observations	1701	1701	1596	1083	1083	1039

Notes: Short-term variation : on balanced panel between baseline and midline.
Medium-term variation: on balanced panel between baseline, midline and endline.
Post is a dummy variable indicating the second wave and the third wave.
Controls include having a job the week before the survey, age, level of education, asset score, household size, subjective health status.
Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

While being a nice illustration of the reflection effect of Kahneman and Tversky (1979), the opposite direction of impact may concretely illustrate that different dimensions of Covid-19 crisis trigger each domain. In a recent study, Galandra et al. (2020) show a preferential allocation of attentional resources to the most relevant domain during the Covid-19 outbreak in Italy. Specifically, the authors use a modified version of the Holt-Laury Paired Lottery Task that is explicitly linked to adverse health and employment outcomes in the context of the Covid-19 pandemic. They observe risk-averse behavior with employment-related lotteries and risk-seeking behavior with health-related lotteries. They suggest that individuals may be more willing to make risky decisions for their health to achieve the best possible outcome. However, people are concerned about the potential long-term economic consequences, for instance in their employment conditions, so they exhibit greater risk aversion in this dimension. We can easily extend the conclusion of this suggestive evidence to consider that time preferences also respond to different aspects of this multidimensional crisis.

Change in impatience Table 4 presents the results for the impact of Covid-19 on impatience. This table uses the same specifications as those used for risk aversion, except that we control for risk aversion in the gain domain (in columns (3) and (6)). We observe that respondents become 13 percentage points more impatient just after the Covid-19 crisis (columns (1) to (3)). We also provide relative effects to assess the magnitude of the impact: impatience increased by 20% between January and June 2020. On the medium run, we also observe a 16% increase in impatience between January 2020 and January 2022. Although slightly lower than immediately after the Covid shock, preferences for the present have not returned to their initial level two years later. Again, as in the case of risk aversion, the results do not vary when we run different specifications or use different definitions (see Table D1 and Table D1). The observed increase in impatience due to Covid-19 is consistent with the results obtained by Bchir et al. (2013) and Cassar et al. (2017).

4.3 Our results in the literature on instability of preferences

Our findings fit into a very diverse empirical literature, where the results depend strongly on the individual characteristics of the respondents and the measurement methods (e.g. stated or revealed). Indeed, the lasting decrease in risk aversion that we observe in the loss domain is consistent with the results of Aragon et al. (2022), Biener and Landmann (2023), both of which use a stated and a revealed measure of earnings-oriented risk aversion, and Castillo and Hernandez (2022), which uses only a reported preference measure. In contrast, the increase in risk aversion observed in the gain domain could only be related to the long-term effect found by Fang et al. (2022). Several reasons can be given to explain these differences. The first is population characteristics: both the Aragon

Table 4: Temporal variation of high impatience

	Short-term variation			Medium-term variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.132***	0.132***	0.133***	0.116***	0.116***	0.113***
	(0.020)	(0.020)	(0.023)	(0.027)	(0.027)	(0.029)
Baseline mean (%)	64.41			66.94		
Relative effect (%)	20.50	20.18	20.18	17.38	17.93	16.43
Robust standard errors	✓	✓	✓	✓	✓	✓
Individual fixed-effect		✓	✓		✓	✓
Controls			✓			✓
Nb. Observations	1742	1742	1604	1099	1099	1043

Notes: Short-term variation : on balanced panel between baseline and midline.
Medium-term variation: on balanced panel between baseline, midline and endline.
Post is a dummy variable indicating the second wave and the third wave.
Controls include having a job the week before the survey, age, level of education, asset score, household size, subjective health status.
Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

et al. (2022) and Castillo and Hernandez (2022) samples are predominantly male. Gender is an important determinant of the level of preferences. If our mostly female sample is initially more risk averse than theirs, as the evidence suggests, this could explain the increased risk aversion in the earnings domain. In contrast, Biener and Landmann (2023) have a predominantly female sample (83% and 79% respectively before and after the shock), but on average, more educated than ours. Given that they find a larger effect on the educated and that our sample is predominantly low-educated, the difference in average results could stem from the fact that our sample concentrates in the low-educated whose risk aversion is most likely to change, because they lack coping mechanisms such as insurance, savings, or labor market opportunities.

Nevertheless, the characteristics of the study population certainly do not explain the discrepancy between the results in the win and loss domains. Since these studies do not use separate lotteries for gains and losses, we can only speculate on the reason for these differences. Kahneman and

Tversky (1979) provides a promising element, emphasizing the importance of the reference point in the analysis of any choice. An individual who has suffered a loss but has not adapted to this new situation might include his loss in any proposed lottery and, as a result, consider a gain lottery as a loss lottery. From this perspective, the proposed gain lotteries by Aragon et al. (2022), Biener and Landmann (2023) might have been analyzed by storm or Covid-19 respondents as broader loss lotteries that included what they lost with the shock, hence the correspondence with our loss lottery results. By this logic, post-shock respondents may be more likely to engage in risky strategies to limit their overall losses even when self-assessing their aversion. Given the lack of insurance or even public compensation for private losses in many developing countries after large shocks and the severity of the economic crisis that follows these events, it is reasonable that this time lag exceeds 18 months (the time lag in our study and in Aragon et al. (2022)).

5 Identification of potential transmission channels

5.1 Actual impact versus concerns regarding Covid-19 experience

Our main results measure the overall impact of Covid-19 without differentiating which dimensions of this crisis generate a change in preferences. In this section, we attempt to shed light on potential underlying mechanisms behind our findings. The graphs below present the results of interactions between the Post-Covid binary variable and various self-reported Covid-19 impacts for the short-term sample.[13] These measures suffer from reporting bias and should not be interpreted as causal mechanisms. Nevertheless, they allow us to differentiate Covid-19's impact on daily life (actual self-reported impact), which is closer to the economic and health pathways, from concerns induced by the Covid-19 crisis, which are more related to the emotional channel.

Two graphs are presented for each domain (gain domain in Figure 2, loss domain in Figure 3, time preferences in Figure 4). The first graph identifies the mechanisms that actually impacted respondents' daily lives: employment status (having a job dropped from 92% to 83% between the two survey waves), having an average standard of living below the sample median, having regularly ran out of food or water during the Covid-19 period (37% of households). We find few effects of these actual economic impacts: having a job significantly attenuates the decline in risk aversion in the loss domain only. In contrast, running out of food or water significantly increases risk aversion

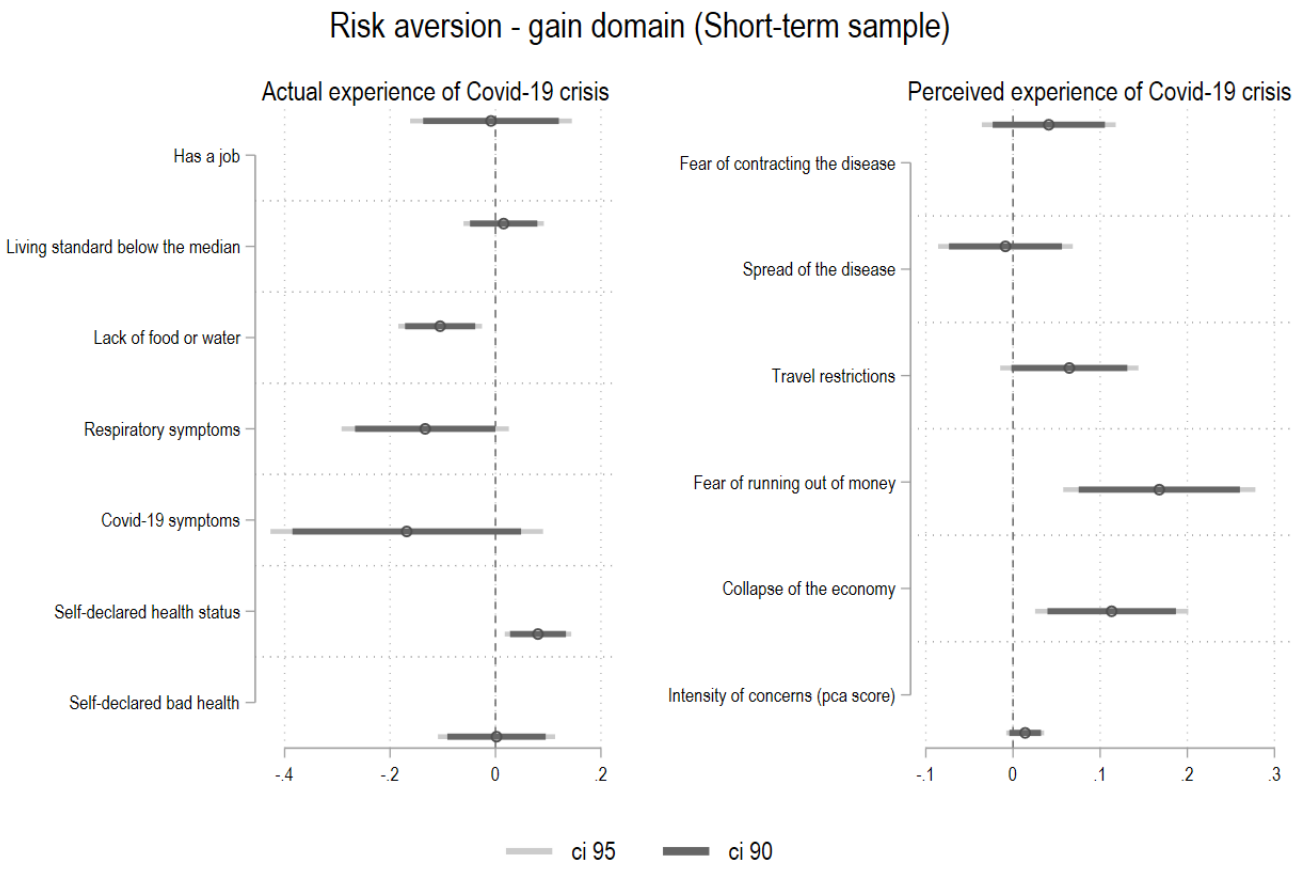
[13] Graphs for the medium-term sample are available upon request, although comments remain the same with this sample.

in the gain domain. We also examine health-related impacts, such as whether individuals experienced coughing and/or breathing difficulties during the period (4.9% of respondents), or whether they experienced Covid-19 symptoms (fever and coughing or breathing difficulties, and vomiting or diarrhea - 2% of respondents). We find no effect, potentially due to the low prevalence of these symptoms. Besides, as noted above, there were very few confirmed cases of Covid-19 at the time of the surveys. Finally, we interact with respondents' self-reported health status (on a scale of 1 to 4) and only with those who reported poor health (15% of respondents), to isolate those most at risk. We find no effect of these variables on the variability of preferences over the period (both for short-term and medium term).

The graphs on the right refer to the respondents' concerns generated by Covid-19. Only 2% of respondents reported having no concerns (see Appendix B). We distinguish several types of concerns: fears that the respondent or a family member will contract the disease (51% of respondents), fears of running out of money (for food, medicine or credit repayment, 33%), fear that the economy will collapse (40%), that it will no longer be possible to travel (42%) and that the disease will spread everywhere (49%). We can see that fears related to the disease have no effect. On the other hand, fears associated with the economic context have a significant effect on risk aversion: being afraid of running out of money increases risk aversion for gains (coefficient of 0.18, corresponding to an additional relative increase of 24%) and decreases risk aversion for losses (coefficient of -0.23, corresponding to an additional relative decrease of 38%). There is also a strong and significant effect of fear of economic collapse (+16% additional increase in risk aversion in the gain domain, and -20% additional decrease in risk aversion in the loss domain). Fear of travel restriction increases risk-taking in the loss domain (-25% additional risk aversion) and increases impatience (+13% additional).

Although prone to reporting bias and measurement errors, it is striking that the actual effects of the Covid-19 crisis had little impact on preferences, while economic concerns significantly increase preference variability over the period. This result suggests that the main channel of preference variation due to Covid-19 is emotional. These results are similar to those of Fetzer et al. (2021) who find an increase in economic anxiety in the early weeks of Covid-19, shaped by individuals' beliefs about the mortality and contagiousness of the coronavirus. In our context, the health risk is less salient than the economic risk, and it is indeed economic concerns that, months after the onset of the crisis and weeks after the end of the restrictive measures, influence preference instability. This result is consistent with the psychosocial literature, which shows that fear is related to risk-taking. For example, Lerner and Keltner (2001) show that more fearful individuals are less likely

Figure 2: Actual impact and concerns regarding the Covid-19 crisis - Risk aversion - gain domain



to take risks in a hypothetical situation. In an experiment involving randomized electric shocks, Cohn et al. (2015) also show that the fear of the electric shock (and not the actual shock) decreases financial risk-taking.

Figure 3: Actual impact and concerns regarding the Covid-19 crisis - Risk aversion - loss domain

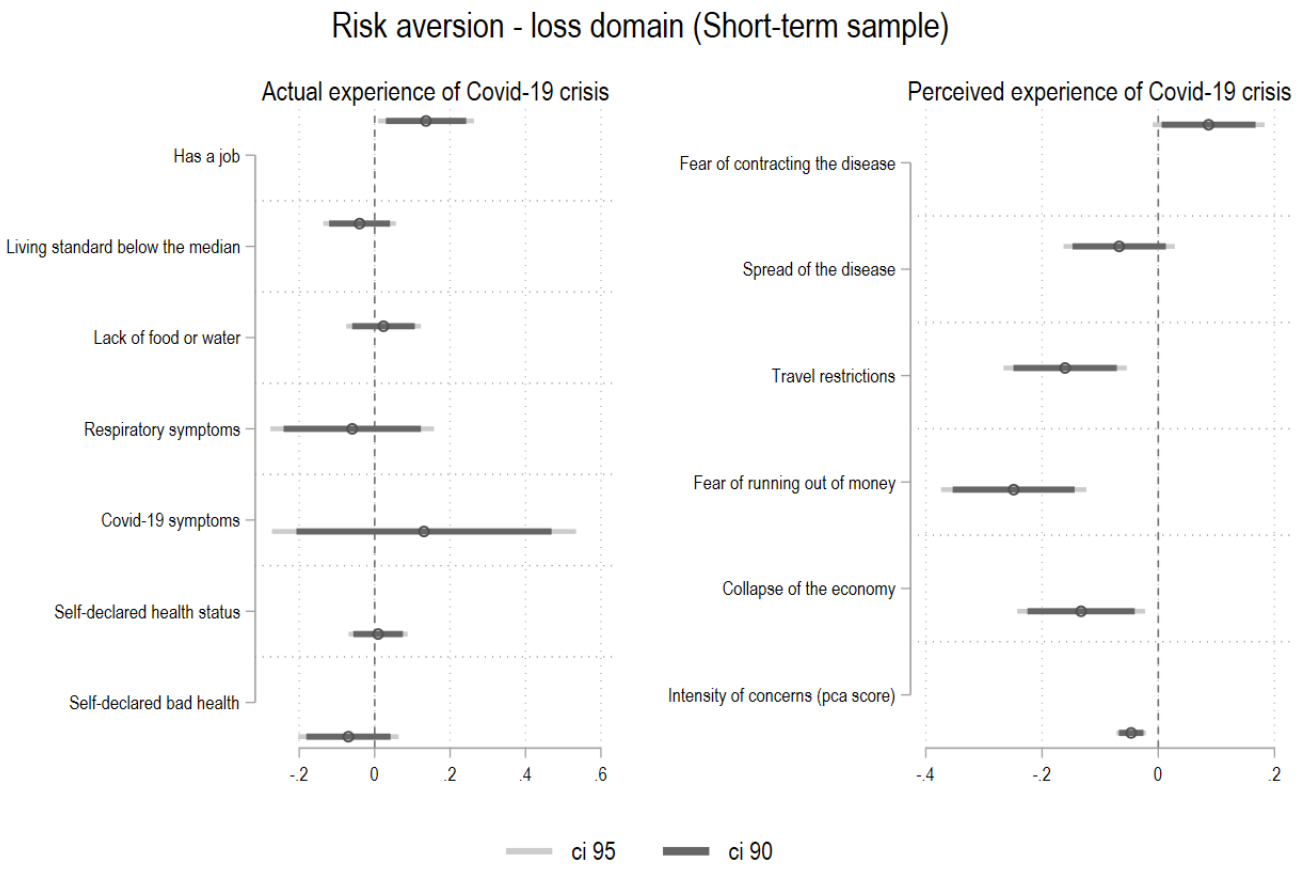
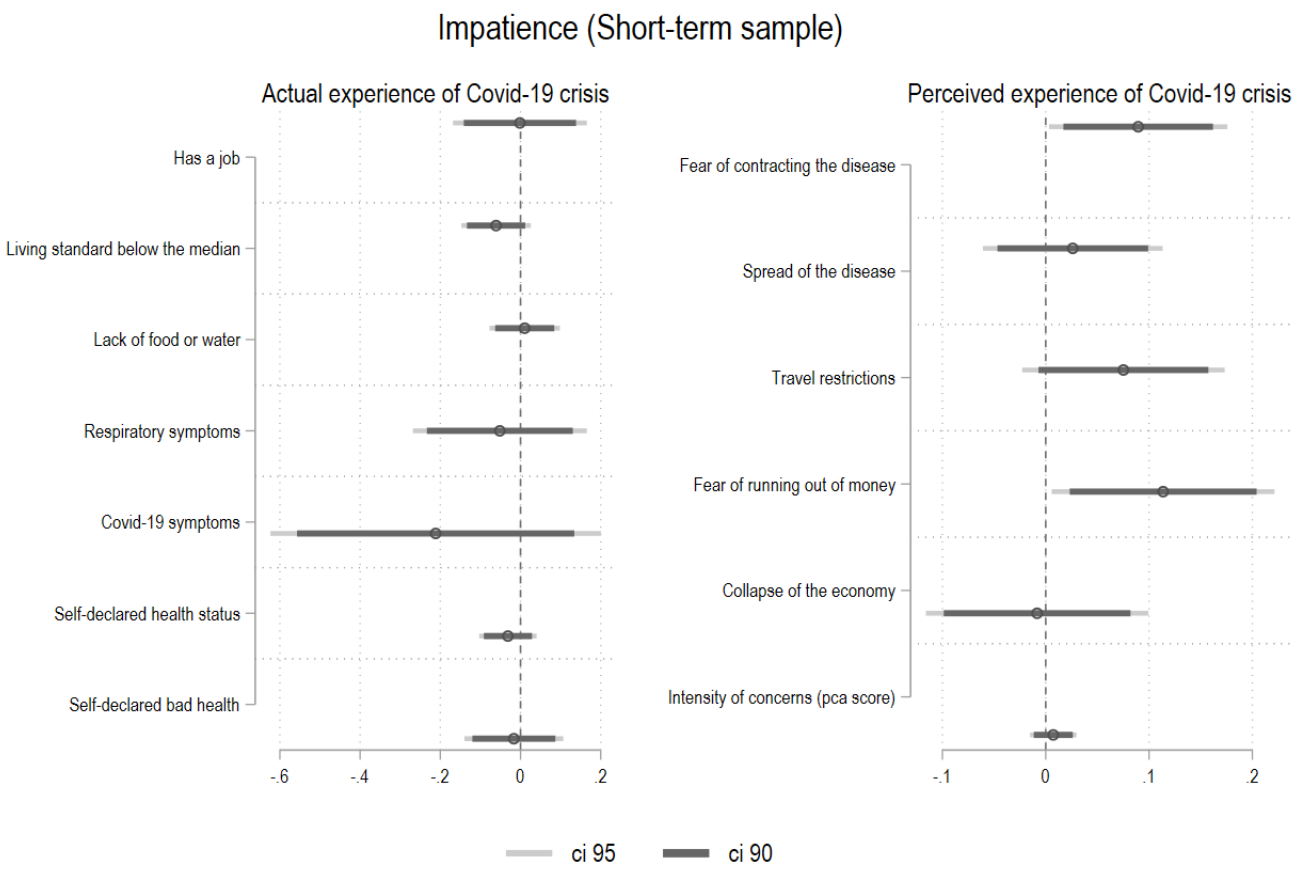


Figure 4: Actual impact and concerns regarding the Covid-19 crisis - Impatience



5.2 Media exposure

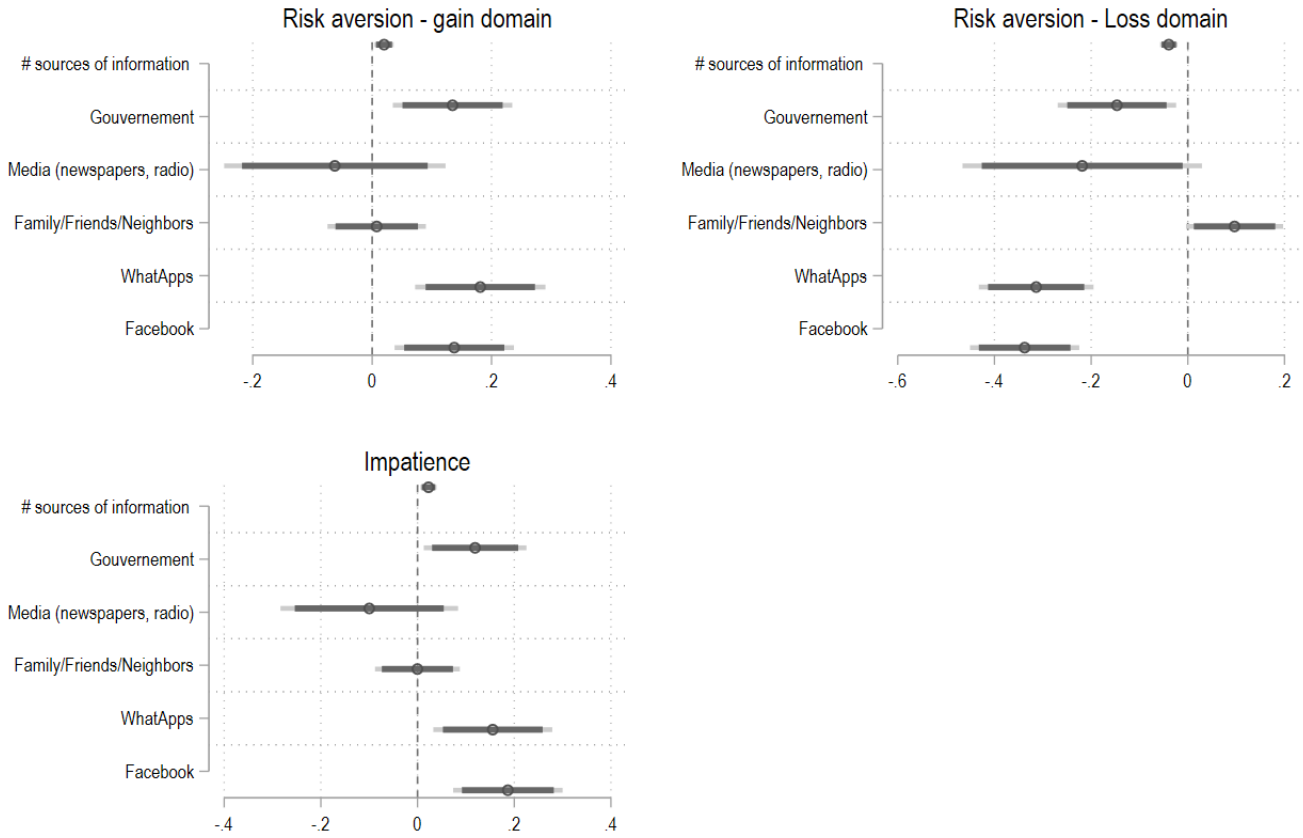
Another indirect way to look at the role of emotion is to examine the role of media exposure during the Covid-19 period. Fetzer et al. (2021) indeed, show that news conveying the mortality and contagiousness of Covid-19 increases economic anxiety. In their study, Shachat et al. (2021), Sadish et al. (2021) also illustrate this mechanism as they observe a significant increase in risk aversion in the gain domain in the immediate aftermath of two publicized events (the announcement of the quarantine of the city of Wuhan and the death of Dr Li Wenliang, a media figure). We start from the intuition that informed people should react differently to the Covid-19 crisis than less informed people. Specifically, the media conveys information about the development of the coronavirus crisis and should reinforce emotional responses to the situation through increased risk perception, fear, and anxiety.

To shed some light on the role of media exposure, we ask participants to report the sources of information they use to keep up to date regarding the Covid-19 evolution and the measures and restrictions implemented by the government (Figure C2 and Table C4). We first interact our Post-Covid dummy with the number of media used to be informed of the Covid-19 evolution. We report in Figure 5 only the interaction term. We find that the more a person uses multiple sources of information, the more strengthened is the impact of Covid-19 on preferences, both in the short and the medium term. Using one more information source increases risk aversion in the gain domain by an additional two percentage points. At the same time, it decreases it by a further four percentage points in the loss domain and increases impatience by an extra 1.6 percentage points. Besides, literature has highlighted the importance of information accuracy on individual beliefs and behaviors in the specific context of Covid-19.[14] Unfortunately, we are not able to capture the type of information received and how much attention they paid to it. Moreover, many unobservable behaviors can explain why people diversify their sources of information. Crepaz and Arikan (2021) expose different motivations explaining a high level of information, such as the seeking out for correct or accurate conclusion or seeking confirmation to prior beliefs. In contrast, a low level of

[14] Gutierrez et al. (2022) randomized information about the epidemic in an online survey in Mexico. They show that inaccurate real-time information due to reporting death delays leads to individuals being slower to adopt protective behaviors and alter their perceptions regarding the severity of the epidemic. Simonov et al. (2020) also find that a one percentage point increase in Fox News viewership, a leading news media channel that denied expert recommendations from the global health communities and minimized the danger of Coronavirus, reduced the propensity to stay at home by 8.9 percentage points. Bursztyn et al. (2020) examine how exposure to different informational content - even in a short-term period-drives beliefs, behavior, and downstream health outcomes and find differences in the timing of adoption of cautious behavior according to which shows is viewed.

information may reflect some distrust in the information disclosed or some backfiring effect (when respondents more strongly endorse a misperception about a controversial issue if their beliefs or predispositions are challenged). We do, however, have data on the sources of information (Figure 5). Social media, for instance, is considered to have a faster diffusion of information and increase fear and anger (Depoux et al., 2020). We first find that governmental and social media (Facebook and WhatApps) have strengthened effects on the instability of preferences due to the Covid-19. These results are in line with previous research on the impact of official information disclosure on behaviors (Banerjee et al., 2019) and on social media (Oh et al., 2021; Zeballos Rivas et al., 2021).

Figure 5: Heterogeneity according to the sources of media - Short-term sample



Author's estimations for the period January 2020 to June 2020. Only the interaction terms is represented in this figure.

6 Limitations

External validity. Our sample comprises women over 18 working in the informal sector in urban areas of Burkina Faso (Ouagadougou). The external validity of our results is questionable. The informal sector constitutes nearly 95% of the national labor force (BIT, 2019) and 55% of people in working age (18-65 years old) are self-employed.[15] Therefore, our parent population (women working as self-employed) represents 31% of the Burkinabe population.

One might question the extent to which a male population can be compared to a female population. Indeed, women were more affected by the Covid-19 crisis than men.[16] Alfonsi et al. (2022) shows that in the Ugandan urban context, high-skilled female workers suffered more than high-skilled male workers from the Covid-19 shutdown. Specifically, they show that lockdowns reduce women's employment more than men's and that after 18 months, male workers had returned to their pre-pandemic jobs. A proportion of female workers had permanently left their jobs or moved on to other opportunities less in line with their skills. Nevertheless, the specificity of their population makes it difficult to make any claims regarding ours. We checked in our overall sample whether women's activity decreased significantly more than men's, which is not the case. Thus, it is unlikely that their preferences are more malleable than men's concerning Covid-19.

Besides, risk aversion (without exposure to shocks) tends to be higher for women than men. Mathonnat et al. (2021) confirms this trend in May/June 2020 in Burkina Faso, using a self-reported measure. However, the literature is pretty silent on the potential malleability of gender preferences following a negative exogenous shock. Because women's initial level of risk aversion is higher than men's, the effect of a shock may be greater for men because they have more room to change. Some studies on the instability of risk aversion are disaggregated by gender but yield conflicting results: Hanaoka et al. (2018) suggests that men's risk aversion is more likely to change than women's after an earthquake in Japan, while Zhang and Palma (2022), studying the effect of the first Covid-19 lockdown in China, finds that the differential results vary depending on the method used to measure risk preferences. As a result, we cannot determine whether preference instability might have been greater for men had they been in our sample. In the same vein, the literature is not explicit about the level of entrepreneurial preference. From the entrepreneur's point of view, after obtaining the loan, borrowing agents are likely to make riskier decisions than they would otherwise have done. However, the argument is that the opposite can happen if the repayment mechanisms are so drastic,

[15] Author's calculation from Enquête Harmonisée sur les Conditions de Vie des Ménages 2018-2019 (EHCVM 18-19, https://microdata.worldbank.org/index.php/catalog/4290/related-materials

[16] Ahinkorah et al. (2021) overviews how the Covid-19 crisis has deepened gender inequalities in Sub-Saharan Africa.

making microentrepreneurs more risk-averse. As a conclusion, we cannot conclude on the changing preferences of non-recipients or non-entrepreneurs.

Causal inference of the midterm results As we briefly discussed in the empirical strategy section, our midterm results may not be, or may not be solely, the causal effect of the Covid-19 crisis in Burkina Faso. For several years, Burkina Faso has suffered from increasing insecurity over most of its territory. This long-lasting insecurity crisis has had dramatic consequences: millions of inhabitants have had to flee their homes to live in refugee camps or host households; inflation is very high and has caused a severe food crisis; political instability is due to the inability of governments to restore security. Each event is likely to redefine individuals' preferences: poor economic conditions affect background risk and risk perception, while exposure and testimony affect preferences. For example, Rockmore and Barrett (2022) use exposure to conflict in northern Uganda to show that receiving violence directly or indirectly-a family member or relative-increases risk-loving attitudes while witnessing or perpetuating violence increases negative attitudes toward risk. In such a context, it is difficult to predict whether our results underestimate or overestimate the true effect of Covid-19, but one can safely state that several mechanisms were at play simultaneously and are difficult to disentangle.

Yet, several elements tend to qualify the role of insecurity on preference change. First, the deterioration of the security situation in Burkina Faso has been more of an ongoing process since 2018 than a temporally situated event. Thus, this does not coincide with our results, namely a clear change between January and June 2020, with an effect maintained but not increased over time. Second, the political instability symbolized by the January 2022 *coup d'état* did not impact preference in the very short run. Finally, because our endline data collection was ongoing when the *coup* occurred in Ouagadougou, we can test, albeit only suggestively, whether respondents' preferences were sensitive to its occurrence. A simple discontinuity estimate of the regression (with the current variable being the date of the interviews) shows no discontinuity in the different types of preferences around the coup.

7 Conclusion and further research

In this study, we take advantage of the Covid-19 epidemic to empirically test whether risk and time preferences remain stable over time. The previous literature on the impact of shocks on preference stability focuses on macroeconomic shocks, natural disasters, or conflicts (Chuang and Schechter, 2015). The Covid-19 shock deserves an appropriate analysis because of its specific characteristics:

it is a singular life-threatening shock, causing anxiety, with long-term consequences. Unlike regular economic downturns or frequent weather shocks, people may change their preferences more substantially as a result of an infrequent and striking event with unpredictable consequences. More importantly, the Covid-19 crisis was unexpected, uninsurable, and exogenous: it is a quasi-perfect natural experiment. We rely on a unique panel data set that allows us to track changes in the risk and time preferences of the same individual, observed just before the Covid-19 pandemic (January 2020), six months after (June 2020) and then two years later in Ouagadougou (Burkina Faso). We combine before-and-after comparisons with individual fixed effects to isolate the specific impact of Covid-19 on preference instability. This panel data allows us to provide a clear identification, with two different timespans.

This paper demonstrates that individual preferences have changed following the Covid-19 crisis, and that those changes are still observed two years later. Specifically, we show a 12% increase in risk aversion in the gain domain between January and June 2020 and a 47% decrease in risk aversion in the loss domain over the same period. Impatience increases by 20%. The results are robust to alternative specifications and outcome definitions. Eighteen months later, we observe that individual preferences have not returned to their initial level before the Covid-19 shock, which indicates that the impact of the pandemic on preferences was both immediate and long-lasting. We also try to identify the mechanisms underlying this preference instability. Using interactions, we show that preference variability is weakly influenced by the actual consequences experienced by respondents during the Covid-19 crisis, such as loss of a job, lack of food and water, or poor health in general, or symptoms of the Covid-19 crisis. In contrast, preference instability is exacerbated when respondents express strong concerns about the economic aspects of the Covid-19 crisis, such as fear of running out of money or economic collapse. Fears related to health aspects, such as spreading or contracting the disease, had no effect. These results suggest that the emotional channel has much more influence on preference instability than the actual consequences of the Covid-19 crisis. A second piece of evidence for the prominent role of emotion is highlighted by media exposure, which can increase anxiety and fear, and thus enhance the emotional response. The more informed a person is, the more unstable their preferences become. Similarly, we report that these effects are enhanced when she uses social networks (WhatsApp and Facebook) to keep up with health and economic developments in Covid-19. Our study includes limitations, mainly linked to the external validity of our sample, constituted of urban female informal workers, and to the existence of several other potential causes of preferences' shift in our two-year span analyses.

Increasing empirical evidence shows that preferences are not static and can change over time. The

stability of preferences is a fundamental principle of economic theory, but it is also practical from an empirical point of view. Indeed, assuming stability means that preferences are exogenous to any outcome of interest. Our results show that preferences change in response to life shocks. This implies that empirical inferences are biased with potential reverse causality and simultaneity bias ((Cobb-Clark and Schurer, 2012) provide a thorough discussion of endogeneity problems when the assumption of preference stability does not hold). In addition, preference instability has implications for policy design. If policies are based on the assumption of stable risk and time preferences, it may be challenging to predict appropriate behavioral responses in a post-shock period. For instance, the government or lenders may provide inadequate lending opportunities to entrepreneurs if they do not consider changes in economic agents' risk and time preferences. For example, our study shows that individuals exhibit greater impatience and a more risk-lover attitude toward losses. Thus, they may have been less inclined to use insurance since the onset of the Covid-19 crisis (). Given the low adoption of voluntary insurance in developing countries, our results could lead to advocating for insurance models that encourage people to enroll (such as mandatory enrollment). Finally, using the uniqueness of the Covid crisis, our study establishes causal evidence that preferences can change rapidly in response to a shock and remain permanently at this new level. This non-return to normal is all the more surprising given that we identify the emotional channel as the primary driver of these changes. Whereas previous literature suggests that emotional instability of preferences is temporary Schildberg-Hörisch (2018), our results suggest that the emotional response to the Covid-19 crisis altered, at least in the medium term, the perception of global and/or background risk (Ho et al., 2008; Lerner et al., 2015; Brown et al., 2018). Understanding the mechanisms underlying these changes is critical to designing effective policies and programs. Thus, future research should focus on better understanding the role of emotions and concurrently on the issue of identifying these emotional mechanisms in a household survey.

Authors statement

Declaration of competing interest

We, Delphine Boutin, Haris Megzari and Laurene Petitfour, the authors of the manuscript entitled "Instability of preferences due to Covid-19 Crisis and emotions: a natural experiment from urban Burkina Faso", gratefully acknowledge financial support from Bordeaux School of Economics (University of Bordeaux) and from Agence Française du Développement (AFD). We have no material or financial interest in this investigation or any other funding to disclose. The findings expressed in this paper are those of the authors and do not necessarily represent the views of the IMF or its partners.

Pre-registration

The trial was pre-registered with the American Economic Association's Trial Registry https://www.socialscienceregistry.org/trials/8548.

Ethics

This study was approved by the *Comité d'éthique institutionnel pour la recherche en Sciences de la santé- IRSS A027-2019*. All study participants provided informed consent.

Contributorship statement

Delphine Boutin: Design the study; Data collection; Funding acquisition; Methodology; Literature review, Data cleaning, Data analysis, Formal analysis; Writing - original draft. Laurène Petifour: Design the study; Data collection; Funding acquisition; Data cleaning, Data analysis Haris Megzari: Literature review, Data cleaning Delphine Boutin and Laurène Petitfour designed the study, sought funding and conducted data collection. Delphine Boutin, Laurène Petitfour and Haris Megzari performed the data analysis. Delphine Boutin wrote the manuscript. Delphine Boutin, Laurène Petitfour and Haris Megzari agreed with the submitted manuscript.

Data availability

Anonymized data will be made available upon request.

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Appendix A: Risk and time preference measurement

Figure A1: Elicitation of risk attitudes in the gain domain

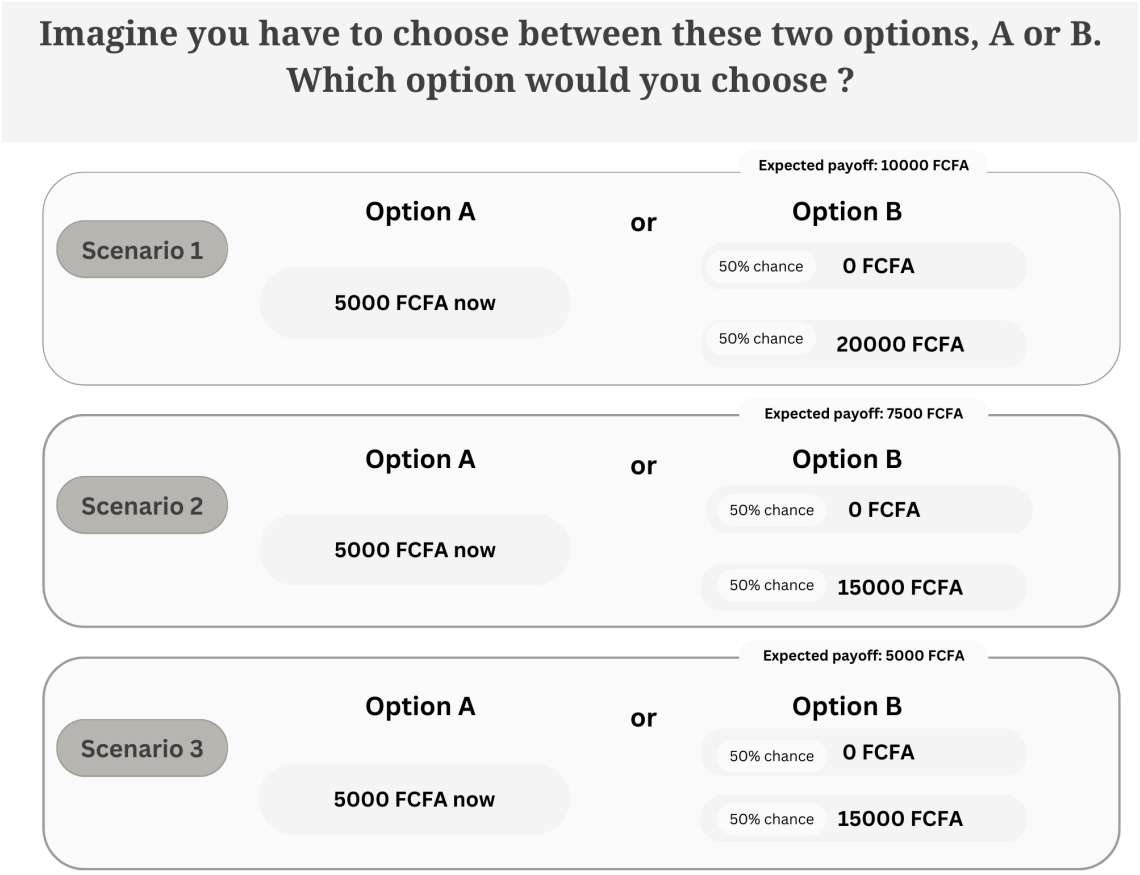


Table A1: Measurement of risk attitudes in the gain domain

	Scenario 1	Scenario 2	Scenario 3
0- High risk taking	B	B	B
1	B	B	A
2	B	A	A
3- High risk aversion	A	A	A

Figure A2: Elicitation of risk attitudes in the loss domain

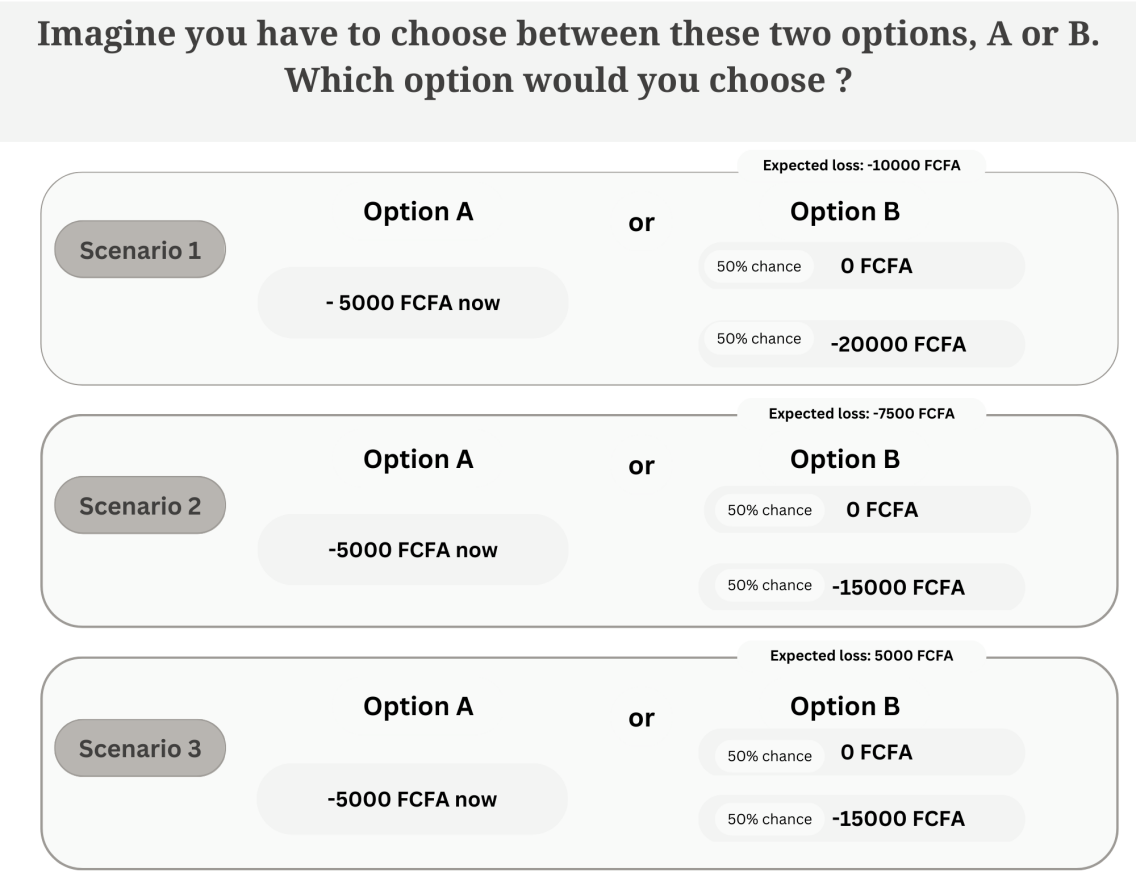


Table A2: Measurement of risk attitudes in the loss domain

	Scenario 1	Scenario 2	Scenario 3
0- High risk taking	B	B	B
1	B	B	A
2	B	A	A
3- High risk aversion	A	A	A

Figure A3: Elicitation of impatience

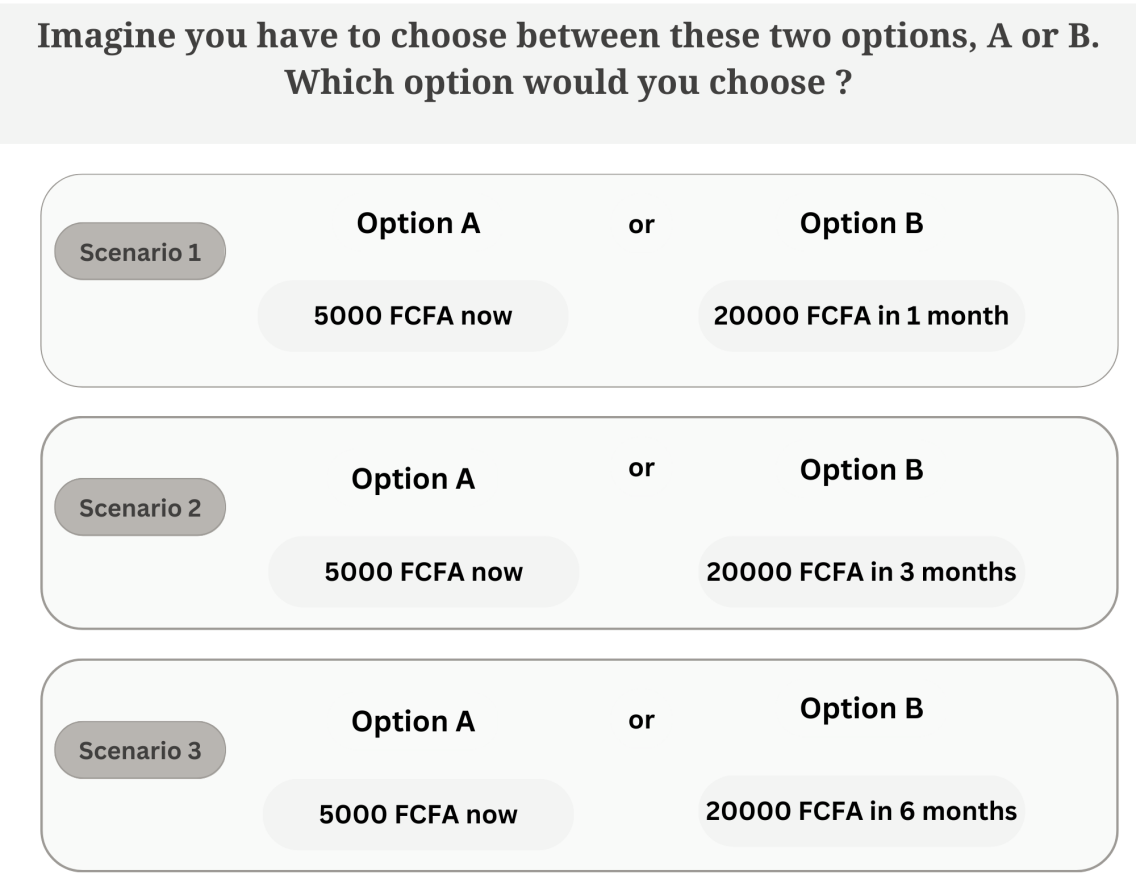


Table A3: Measurement of impatience

	Scenario 1	Scenario 2	Scenario 3
0- High patience	B	B	B
1	B	B	A
2	B	A	A
3- High impatience	A	A	A

Table A4: Descriptive statistics for risk aversion (gain domain)

	Balanced panel on two waves		Balanced panel on three waves		
	Jan 2020	June 2020	Jan 2020	June 2020	Jan 2022
0 - High risk-taking	23.01	14.64	25.34	12.57	17.21
1 - Moderate risk taking	2.10	0.94	2.48	0.56	3.55
2 - Moderate risk aversion	0.35	0.94	0.28	1.4	5.19
3 - **High risk aversion**	**74.53**	**83.49**	**71.90**	**85.47**	**74.04**

Table A5: Descriptive statistics for risk aversion (loss domain)

	Balanced panel on two waves		Balanced panel on three waves		
	Jan 2020	June 2020	Jan 2020	June 2020	Jan 2022
0 - High risk-taking	36.69	68.11	35.77	69.97	48.49
1 - Moderate risk taking	0.47	1.05	0.28	1.38	4.38
2 - Moderate risk aversion	2.72	0.47	2.82	0.28	10.41
3 - High risk aversion	**60.12**	**30.37**	**61.13**	**28.37**	**36.71**

Table A6: Descriptive statistics for present preference

	Balanced panel on two waves		Balanced panel on three waves		
	Jan 2020	June 2020	Jan 2020	June 2020	Jan 2022
0 - High patience	14.15	9.05	11.33	7.58	8.72
1 - Moderate patience	8.47	4.58	8.84	4.78	4.36
2 - Moderate impatience	12.3	6.93	12.15	4.49	10.63
3 - High impatience	**65.08**	**79.44**	**67.68**	**83.15**	**76.29**

Figure A4: Example of visual support during the survey to facilitate the choice

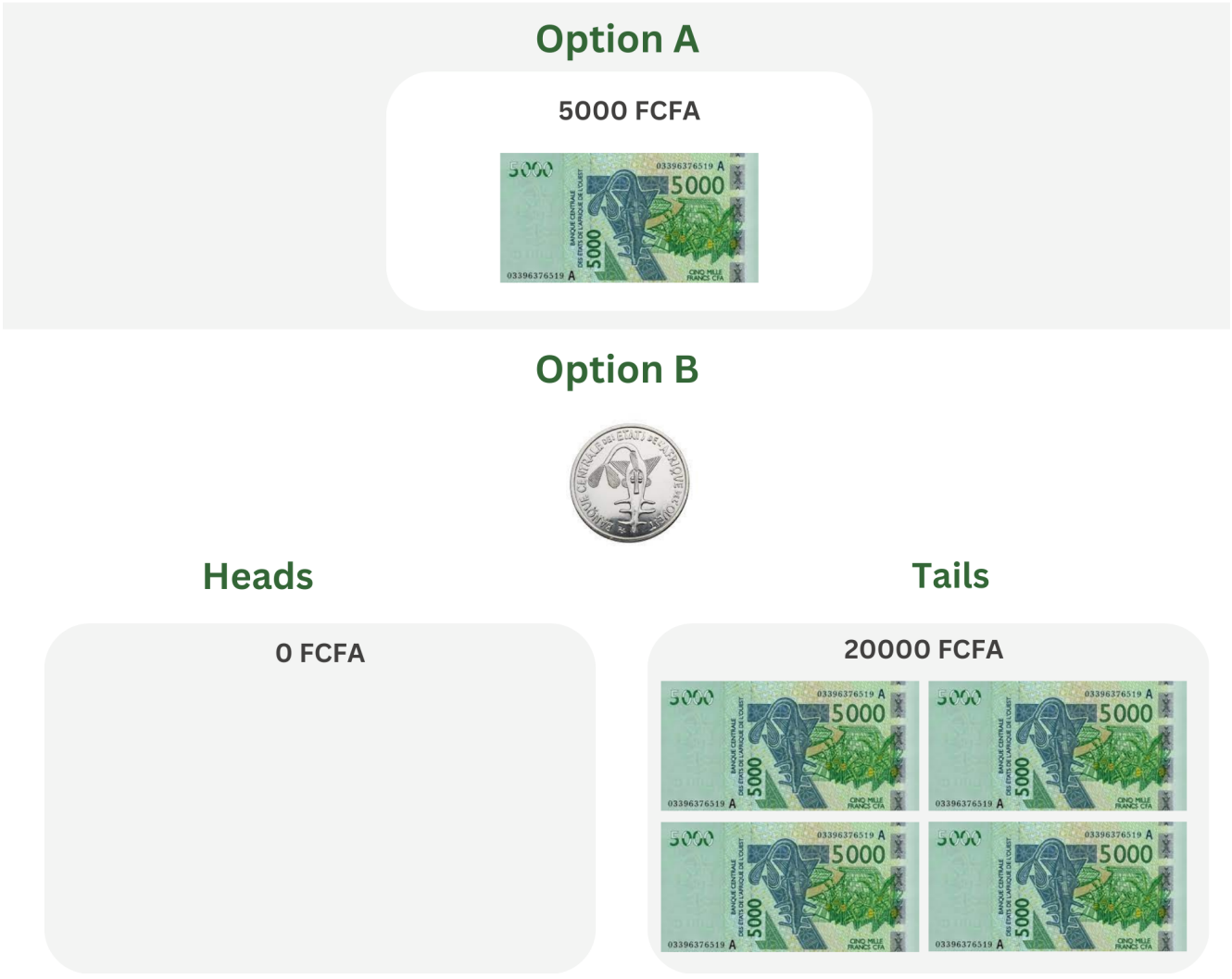
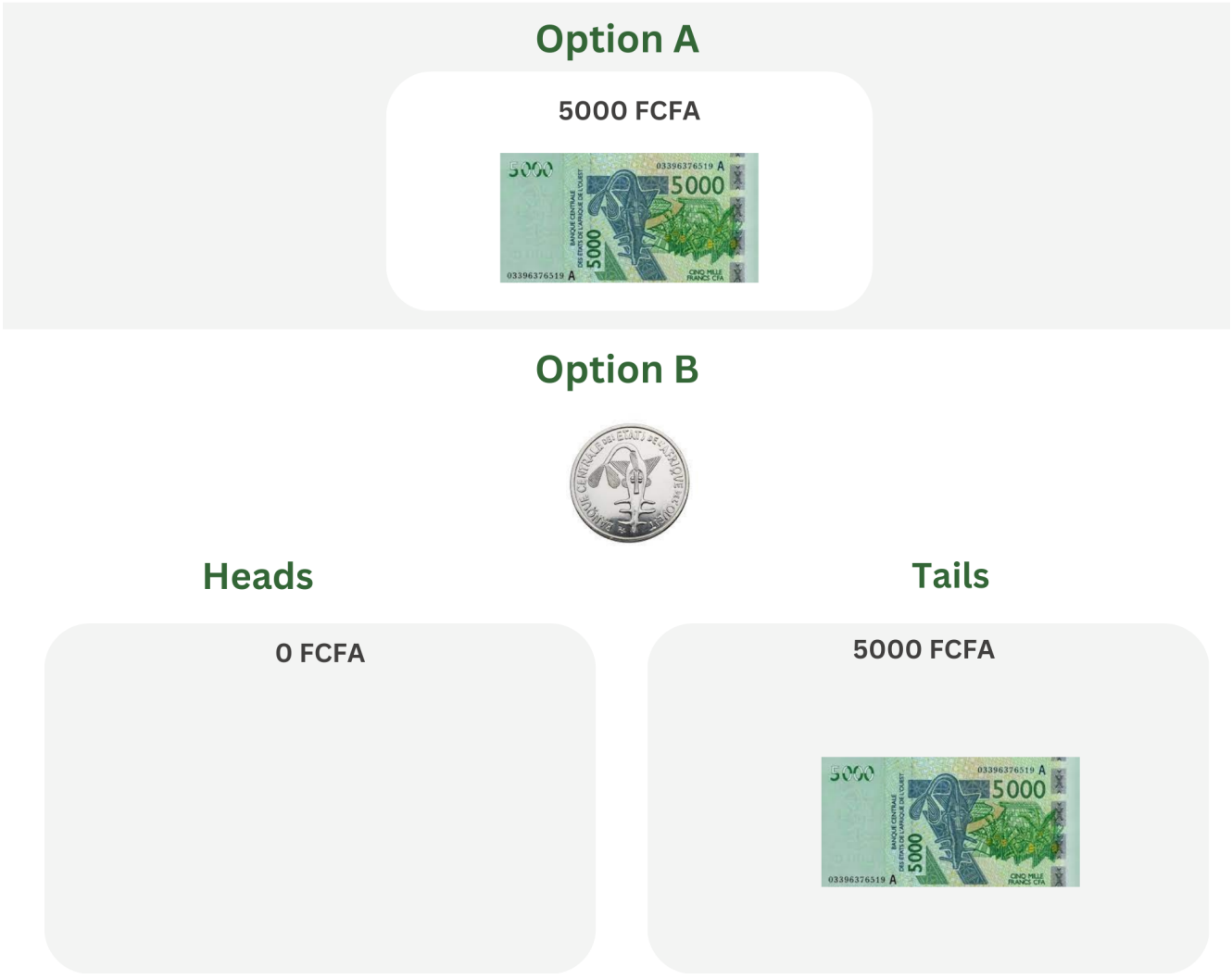


Figure A5: Example of visual support of comprehension question



Appendix B: Test for selective difference in samples

Table B1: Samples characteristics

	Baseline	Midline	Endline
Period	January - February	May- June	January - February
Year	2020	2020	2022
Survey type	Face-to-face	Phone	Face-to-face
Initial sample size	1832	871	1559
Short-term sample size	871	871	-
Medium-term sample size	366	366	366

Table B1 explains the different types of surveys. Initially, we had 1832 women interviewed in the baseline survey (randomly selected from approximately 10,000 women microentrepreneurs based in Ouagadougou). As explained in the data section, we could only interview half of these 1,839 women (randomly selected for the interim survey) in the midline survey due to budgetary constraints. Thus, the 871 women interviewed in the midline survey are balanced with our baseline survey. Our short-term sample thus includes these 871 women, interviewed twice (baseline and intermediate survey).

In the final survey, we tried to find as many of the 1,832 women interviewed in the baseline survey as possible. We were able to locate 838 of these women, 366 of whom had also been interviewed in the midline survey. The microcredit offered to these women is solidarity-based, in the sense that they must group, with group sizes ranging from 10 to 40 people. Therefore, we replaced the 1,228 attritors with 903 women who belonged to the exact same microcredit group from which the attritors came. Our total sample size for the final survey is, therefore, 1559 women. For this study, however, our medium-term sample includes only those women who were actually observed three times.

Table B2: Test for selective difference in two-waves sample (baseline and midline)

	Jan 2020 only N=961		Jan 2020 and June 2022 N=871		Difference	
	Mean	St. Dev.	Mean	St. Dev.	Raw diff.	P-value
Time-invariant characteristics						
Married	87.41	0.33	86.34	0.34	1.07	0.498
Ethnics: Mossi	87.1	0.34	83.35	0.37	3.74	0.024
Muslim	66.81	0.47	69.23	0.46	-2.43	0.267
Catholic	25.81	0.44	24.11	0.43	1.7	0.403
Not Burkinabe	10.09	0.30	10.68	0.31	-0.58	0.683
Cannot read or write	32.47	0.47	33.98	0.47	-1.52	0.491
Never been in school	63.68	0.48	60.28	0.49	3.41	0.133
Primary level of education	24.56	0.43	27.67	0.45	-3.11	0.130
Covid-19 vulnerable characteristics						
Has a job (last week)	91.13	0.28	92.36	0.27	-1.23	0.343
Has a formal job	3.02	0.17	4.59	0.21	-1.57	0.077
Sector of activity: small business	86.99	0.34	85.65	0.35	1.34	0.403
Has a local or specific place for her activity	44.95	0.50	41.68	0.49	3.28	0.158
Has not been sick (last 3 months)	50.99	0.50	51.89	0.50	-0.91	0.699
Use of healthcare if sick	87.82	0.33	89.86	0.30	-2.04	0.333
Financial situation						
Has a credit	80.75	0.39	81.63	0.39	-0.88	0.630
Has a credit for less than 2 years	74.19	0.44	74.37	0.44	-0.17	0.932
Use credit for business	80.02	0.40	81.4	0.39	-1.38	0.455
Has a moto	87.72	0.33	85.19	0.36	2.53	0.113
Own some cultivable land	8.84	0.28	7.12	0.26	1.73	0.174
Has a tv	50.16	0.50	54.42	0.50	-4.26	0.068
Has a phone	98.54	0.12	99.66	0.06	-1.11	0.013
Risk and time preferences						
Risk averse (gain domain)	73.11	0.44	74.53	0.44	-1.42	0.495
Risk averse (loss domain)	60.85	0.49	60.12	0.49	0.73	0.752
High impatient	67.74	0.47	64.41	0.48	3.33	0.132

Joint F-test for orthogonality : 0.19

Note: In this two-wave sample, there is no attrition. We were not able to re-interview all respondents in the database due to financial constraints. We randomly selected nearly half of the participants and were able to interview all those selected.

Table B3: Test for selective attrition in three-waves sample (baseline, midline and endline)

	Jan 2020 only N=961		Jan 2020 and June 2022 N=871		Difference	
	Mean	St. Dev.	Mean	St. Dev.	Raw diff.	P-value
Time-invariant characteristics						
Married	85.74	0.35	87.16	0.34	-1.42	0.549
Ethnics: Mossi	83.96	0.37	82.51	0.38	1.45	0.572
Muslim	71.09	0.45	66.67	0.47	4.42	0.163
Catholic	21.78	0.41	27.32	0.45	-5.54	0.059
Not Burkinabe	12.28	0.33	8.47	0.28	3.81	0.073
Cannot read or write	33.66	0.47	34.43	0.48	-0.76	0.815
Never been in school	62.38	0.48	57.38	0.50	5	0.137
Primary level of education	24.75	0.43	31.69	0.47	-6.94	0.024
Covid-19 vulnerable characteristics						
Has a job (last week)	91.45	0.28	93.63	0.24	-2.18	0.235
Has a formal job	4.16	0.20	5.19	0.22	-1.03	0.473
Sector of activity: small business	87.33	0.33	83.33	0.37	3.99	0.097
Has a local or specific place for her activity	39.21	0.49	45.08	0.50	-5.87	0.083
Has not been sick (last 3 months)	47.72	0.50	57.65	0.49	-9.93	0.004
Use of healthcare if sick	90.53	0.29	88.75	0.32	1.78	0.557
Financial situation						
Has a credit	83.17	0.37	79.51	0.40	3.66	0.169
Has a credit for less than 2 years	75.2	0.43	73.22	0.44	1.97	0.511
Use credit for business	82.57	0.38	79.78	0.40	2.79	0.296
Has a moto	84.75	0.36	85.79	0.35	-1.04	0.670
Own some cultivable land	6.14	0.24	8.47	0.28	-2.33	0.187
Has a tv	53.66	0.50	55.46	0.50	-1.80	0.599
Has a phone	99.41	0.08	100	0.00	-0.59	0.140
Risk and time preferences						
Risk averse (gain domain)	76.47	0.42	71.9	0.45	4.57	0.130
Risk averse (loss domain)	59.39	0.49	61.13	0.49	-1.74	0.611
High impatient	62.57	0.48	66.94	0.47	-4.37	0.185

Joint F-test for orthogonality : 0.00

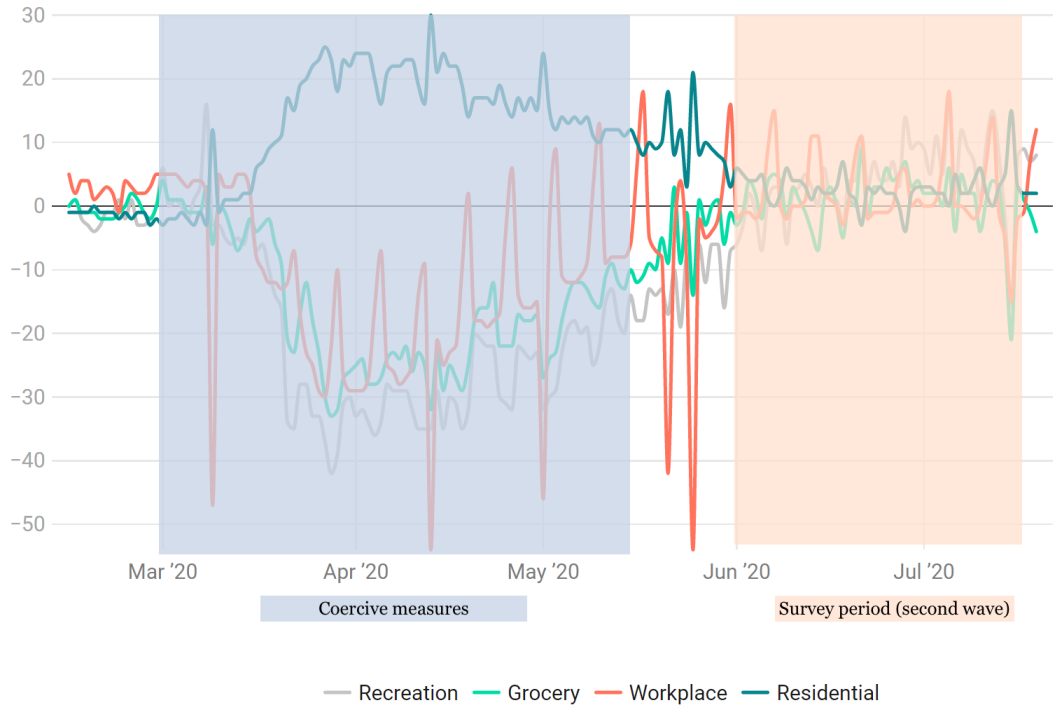
Note: Note: In this three-wave sample, the attrition rate is 57.98% : among the 871 respondents surveyed in January and June 2020, we were able to reach only 42.02%.

Appendix C: Coronavirus Crisis in Ouagadougou (Burkina Faso)

Suggestive evidence of compliance

The figure below shows the compliance of Burkinabe located in the Ouagadougou region with the measures put in place to contain COVID-19. Data comes from the Google Community Mobility dataset.[17]

Figure C1: Flow of people's movement since the first Covid-19 case in Burkina Faso



Authors from Google Community Mobility data in Ouagadougou region (Burkina Faso)

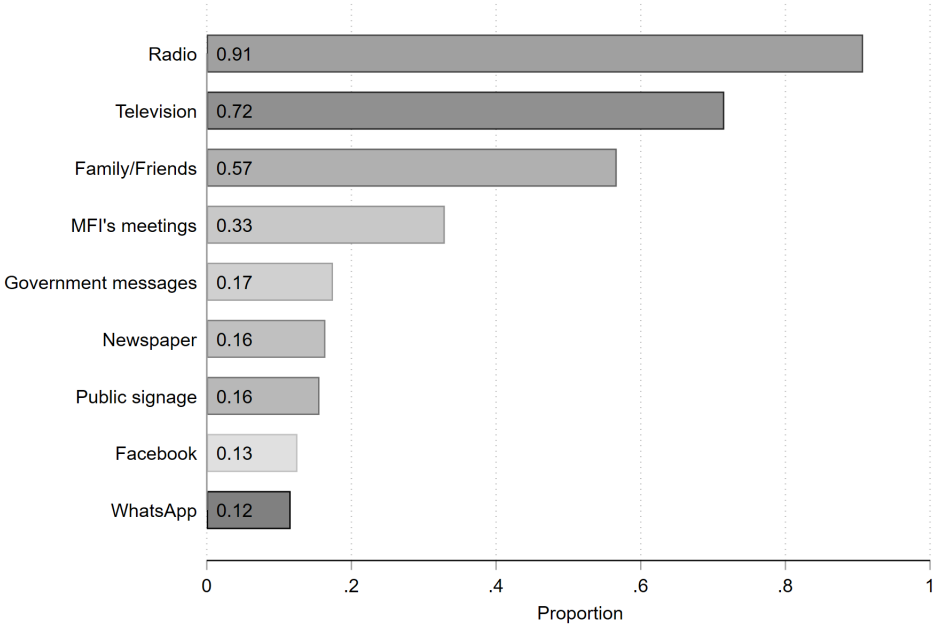
[17] Using user's history data from mobile device location applications (such as Google Maps), Google aggregates anonymized datasets and publicly provides population movements throughout the pandemic. The data shows how visits to places, such as grocery stores and parks, are changing in each geographic region. Each day, the number of visitors to specific categories of places (e.g., grocery stores, parks, train stations) is measured and compared to a baseline day (estimated before the start of the pandemic over the five weeks from January 3 to February 6, 2020).

The remaining part of this Appendix B presents some descriptive statistics regarding the sources of information used by the respondents, their perceptions of the coronavirus crisis, and its impact on daily life.

Sources and types of information

Figure C2 shows the main sources of information used by respondents to keep up to date with Covid-19 and the measures and restrictions put in place by the government. Almost all respondents (91%) were getting information from listening to the radio and most (72%) from watching television. Official government messages (17%) and public signage (16%) were relatively unused communication channels. On the other hand, 33% of respondents got their information from meetings organized by MFIs. Physical and online social networks played an important role: 57% of respondents obtained information by talking with friends and family, and 12% and 13% through WhatsApp and Facebook.

Figure C2: Main sources of information about the coronavirus



More generally, 96% used an official source of information (government message, newspapers, radio, television, public signage), 66% exchanged information through discussions with family and friends

or at MFI meetings, and 14% through online social networks (Table C4). Most respondents use multiple sources of information. Only 11% use only one source, while 28% use two sources of information, 37% use three, and 24% use at least four. They also diversify the type of media they use, with only one-third of respondents getting their information exclusively from official channels and 4% only from discussions. It should be noted that over-information or diversification of information sources does not necessarily mean that the respondent will change their behavior. Indeed, some official messages were contradictory (e.g., those about wearing masks), and several false rumors (about the very existence of the virus or the immunity of blacks) circulated, which may have led to misinformation among respondents.

Table C4: Main sources of information about the coronavirus

	Obs.	Freq.
Information sources		
Official[1]	821	96.14
Discussions[2]	559	65.46
Online social networks[3]	117	13.70
Official[1] only	275	31.01
Discussions[2] only	30	3.51
Online social networks[3] only	0	0.00
Number of sources of information used		
1	94	10.79
2	240	28.10
3	313	36.65
4+	201	23.53

Note: [1]Government messages, newspapers, radio, television, public signage. [2]Discussions within family, friends or at MFI's meetings. [3]WhatsApp and Facebook.

Concerns about Covid-19

The main concerns about the coronavirus crisis are primarily health-related (Table C5): 78% are afraid of contracting the disease and 58% are afraid of a family member contracting it. These concerns are considered the most worrisome (35% and 20% respectively). In addition, half of those surveyed (47%) said they fear the spread of the disease. 16% of people consider this to be the most

important concern. To a lesser extent, respondents also express concerns related to daily economic life: they fear not having enough money for food (36%), health care (29%) or credit (27%). Finally, a sizable proportion of respondents have more general concerns, such as fearing that they will no longer be able to travel (24%) or that the economy will collapse (21%). While most respondents express only one or two concerns (12% and 33%, respectively), a significant proportion (10%) say they are concerned about all the concerns mentioned.

Table C5: Main concerns regarding the coronavirus crisis

	One concern		The most worrying concern	
	Obs.	Freq.	Obs.	Freq.
Contracting the disease	669	78.34	302	35.52
A family member contract the disease	499	58.43	175	20.11
The disease spread everywhere	403	47.19	138	16.18
Lack of money for food	305	35.71	72	8.44
Lack of money for health care	248	29.04	42	4.92
Lack of money for repay loans	230	26.93	58	6.67
Travel restrictions	201	23.54	32	3.75
The economy's collapse	175	20.49	28	3.28
Other	9	0.93	1	0.12

The impacts of Covid-19 on daily life

The coronavirus crisis in Burkina Faso has impacted respondents' daily economic conditions. 35% of respondents regularly faced difficulties in obtaining food (several times during the period or systematically). In addition, 6% mentioned frequent shortages of drinking water and 5% cited shortages of medicine or difficulties accessing medical care (Table C6). In addition, 54% of respondents reported frequent restrictions in their economic activities and 7% reported systematic restrictions. When we asked respondents to self-assess their current living conditions in comparison to those of other Burkinabe (Table C7), the majority of individuals consider themselves to be in a better (52%) or much better (12%) situation than the rest of the population. However, more than a quarter of the respondents think their living conditions are worse (27%) or much worse (5%) than the rest of the population. Besides, 42% and 21% of respondents anticipated the economic conditions to improve in the year following the survey.

Table C6: Impacts of Covid-19 on daily life

	Insufficient food	Lack of drinking water	Lack of medication or medical care	Restrictions on economic activities
Never	45.12	79.15	84.64	20.47
Just once or twice	20.45	14.25	10.81	18.12
Several times	32.90	4.27	2.99	54.63
Always	1.53	2.33	1.56	6.78
At least once	54.88	20.85	14.36	79.53
Obs.	851	772	768	767

Table C7: Self-assessment of respondents' living conditions

How would you describe your current living conditions compared to those of other Burkinabes?

	Obs.	Freq.
Much Worse	45	5.28
Slightly worse	233	27.35
Same	24	2.82
Slightly better	444	52.11
Much better	106	12.44

Appendix D. Robustness checks

Table D1: Temporal variation of preferences (Categorical variable)

	Short-term variation			Medium-term variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Risk preference (gain domain)						
Post	0.269***	0.274***	0.284***	0.291***	0.292***	0.276***
	(0.055)	(0.056)	(0.058)	(0.079)	(0.079)	(0.083)
Relative effect (%)	11.88	11.93	12.37	13.29	13.26	12.80
Nb. Observations	1710	1710	1604	1087	1087	1043
Risk preference (loss domain)						
Post	-0.931***	-0.929***	-0.899***	-0.781***	-0.784***	-0.803***
	(0.066)	(0.067)	(0.075)	(0.086)	(0.087)	(0.092)
Relative effect (%)	-50.01	-49.93	-48.32	-41.23	-41.20	-42.26
Nb. Observations	1701	1701	1596	1083	1083	1039
Time preference						
Post	0.284***	0.279***	0.245***	0.226***	0.226***	0.197**
	(0.045)	(0.045)	(0.051)	(0.059)	(0.059)	(0.064)
Relative effect (%)	12.42	12.26	10.51	9.57	9.74	8.47
Nb. Observations	1713	1713	1585	1085	1085	1032
Robust standard errors	✓	✓	✓	✓	✓	✓
Individual fixed-effect		✓	✓		✓	✓
Control			✓			✓
Nb. Observations	1710	1710	1604	1087	1087	1044

Notes: Short-term variation : on balanced panel between baseline and midline.

Medium-term variation: on balanced panel between baseline, midline and endline.

Mean risk preference (gain domain) in baseline = 2.264 for the short-term sample and 2.1873 for the medium-term sample.

Mean risk preference (loss domain) in baseline = 1.8627 for the short-term sample and 1.893 for the medium-term sample.

Mean time preference in baseline = 2.2831 for the short-term sample and 2.3619 for the medium-term sample.

Post is a dummy variable indicating the second wave and the third wave.

Controls include having a job the week before the survey, age, level of education, asset score, household size, subjective health status.

Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table D2: Temporal variation of preferences (Alternative specifications)

	Short-term variation			Medium-term variation		
	(1)	(2)	(3)	(4)	(5)	(6)
Risk preference (gain domain)						
Post	0.092***	0.088***	0.100***	0.069**	0.055**	0.091***
	(0.023)	(0.019)	(0.021)	(0.028)	(0.028)	(0.030)
Relative effect (%)	12.08	12.08	13.42	9.74	6.95	12.52
Nb. Observations	1604	1600	1517	1043	1043	994
Risk preference (loss domain)						
Post	-0.281***	-0.293***	-0.270***	-0.288***	-0.283***	-0.262***
	(0.023)	(0.024)	(0.027)	(0.031)	(0.030)	(0.032)
Relative effect (%)	-46.57	-48.24	-44.91	-47.44	-45.80	-42.53
Nb. Observations	1596	1596	1513	1039	1039	990
Time preference						
Post	0.133***	0.121***	0.121***	0.113***	0.101***	0.110***
	(0.022)	(0.022)	(0.024)	(0.028)	(0.028)	(0.030)
Relative effect (%)	20.18	18.63	18.63	16.43	14.94	16.43
Nb. Observations	1604	1604	1517	1043	1043	994
Robust standard errors		✓	✓		✓	✓
Bootstrapped standard errors	✓			✓		
Individual fixed-effect	✓		✓	✓		✓
Random fixed-effect		✓			✓	
Time-variant controls		✓			✓	
Sample: Non-anxious people			✓			✓

Notes: Short-term variation : on balanced panel between baseline and midline.

Medium-term variation: on balanced panel between baseline, midline and endline.

Mean risk aversion (gain domain) in baseline = 74.53% for the short-term sample and 71.90% for the medium-term sample.

Mean risk aversion (loss domain) in baseline = 60.12% for the short-term sample and 61.13% for the medium-term sample.

Mean impatience in baseline = 64.41% for the short-term sample and 66.94% for the medium-term sample.

Post is a dummy variable indicating the second wave and the third wave.

Controls include having a job the week before the survey, age, level of education, asset score, household size, subjective health status.

Robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.