Journal of the Economic Science Association (2024) 10:199–212
https://doi.org/10.1007/s40881-024-00169-3

ORIGINAL PAPER

Association between mindfulness and risk and time preferences

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Received: 2 May 2023 / Revised: 1 March 2024 / Accepted: 11 March 2024 /
Published online: 4 May 2024

Abstract

Many studies have investigated the role of socio-demographic factors (including gender, age, race), cognitive ability and cultural factors on time and risk preferences. Yet, research regarding the effect of mindfulness on risk and time preferences has been limited. This study investigates the association between mindfulness and time/risk preferences. We conducted a survey on a representative sample of the French adult population ($N = 1154$) in Spring 2020. We assessed individual mindfulness through the Mindful Attention Awareness Scale (MAAS), and measured time and risk preferences with incentive-compatible economic games as well as self-reported questionnaires. Our results suggest that a higher level of mindfulness is associated with higher risk aversion and patience for stated preferences, but we found no relationship for revealed ones. We also observe that a higher level of mindfulness is related to greater time consistency, as we found a negative and significant association between the MAAS and the present and future biases.

Keywords Mindfulness · Risk preferences · Time preferences · Revealed preferences · Stated preferences

JEL Classification C93 · C31 · D91

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1 Introduction

Prior research has proposed and tested a series of hypotheses on the factors that can influence time and risk preferences, such as sociodemographic factors; including gender, age or race; or cognitive ability. Falk et al. (2018) conducted the Global Preference Survey (GPS hereafter) from 80,000 respondents in 76 countries. The GPS measured not only conventional economic preferences; such as time preference, risk preference; and social preferences; including altruism, positive reciprocity and negative reciprocity; but also included measurements of trust, which is more a belief rather than an economic preference. Results of the GPS showed that people from different countries had different preferences: Europeans and people from English-speaking countries were the most patient, and risk taking was more common among people in Africa and the Middle East. Prosocial preferences were more typically prevalent in Asia and also quite common in sub-Saharan Africa. While cross-country variations partially explained the differences in preferences, individual characteristics were more prominent. Females were a bit less patient, substantially less risk-loving, more prosocial and trusted more than males. The elderlies were more risk averse and less negatively reciprocal, but age was not linearly associated with time preference or positive reciprocity. Instead, the authors found a hump-shaped pattern: the middle-aged people were the most patient and positively reciprocal. As for cognitive ability, it was positively correlated with all preferences and trust. Along with those sociodemographic factors, other hypotheses are that economic preferences are influenced by exogenous shocks like economic crises (Schildberg-Hörisch, 2018), parental preferences (Brown & Van der Pol, 2015) or language structure (Chen, 2013; Sutter, Angerer, Glätzle-Rützle & Lergetporer, 2015).

In this study, we propose to investigate the association between mindfulness and risk and time preferences. Indeed, a better understanding of the relationship between mindfulness and economic preferences can have practical implications in various domains, such as health or financial decision-making. Regarding health decisions, risk and time preferences have been found to be associated with various health behaviours such as smoking or drinking behaviors (Peretti-Watel et al., 2013), low vaccine uptake (Chapman & Coups, 1999), or participation in cancer screening programs (Picone et al., 2004). Thereby, understanding the determinants of those preferences is essential to understand how humans make decisions related to health in various situations. Moreover, a policy maker would be interested in finding a way to act on those preferences, to prevent unhealthy behaviours. Risk preferences were also shown to play a crucial role in financial decision-making (Noussair et al., 2014). Thus, identifying the role of mindfulness in shaping individuals' risk preferences could provide valuable insights to design interventions aiming at improving financial-decision making and decision outcomes. In recent years, the role of mindfulness on economic preferences has gained researchers' interests. As the attention to and awareness of the present is a key component of mindfulness and of many mindfulness scales, including the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the

enhanced present focus of mindful people will make them put more weight on the feasibility of a decision ("the ease or difficulty of attaining the end-state"), rather than its desirability ("the value of the end-state") (Liberman & Trope, 1998). Several studies have confirmed the effects of the present focus on risk preference. Sagristano, Trope and Liberman (2002) concluded from several gamble games that the present focus increases the effects of the probability of winning the payoffs (that is, the feasibility), and decreases the effects of payoffs (which can be interpreted as the desirability). Zhang et al. (2021) also found from a gamble experiment that the present focus and attention aspects of mindfulness were associated with more risk-averse monetary decisions. Mindfulness, by increasing the present focus, could then influence risk preferences. However, the literature has found mixed results regarding the relationship between mindfulness and risk preferences. From a sample of 525 German teenagers, Lima de Miranda (2019) found no association between mindfulness measured by the Mindfulness Attention Awareness Scale-Adolescents (MAAS-A) and risk preferences measured with a lottery task. In a study conducted later, Aumeboonsuke and Caplanova (2021) found a positive correlation between mindfulness (measured with the MAAS) and risk aversion, using a stock investment questionnaire with a sample of 100 adults in Thailand. Those diverging results might be linked to differences in the tools used to assess mindfulness and risk preferences across studies, but could also find roots in the heterogeneous cultural contexts in which those studies were conducted.

In economics, time preferences are defined in the standard exponential discounting model by the discount rate and a patient person will discount a future payoff less than an impatient person. Patience, defined as "something must unfold in its own time" (Kabat-Zinn, 2005), is also one of the seven fundamental attitudes that mindfulness practices intend to cultivate. Mindfulness has been shown to be positively associated with stated measures of patience. In a sample of 110 cardiovascular patients, Hashemi et al. (2018) found that mindfulness measured by the Five Facets Mindfulness Questionnaire (FFMQ) was positively related to a patience score. However, when the discount rate is elicited by economic experiments, the relationship between mindfulness and time preferences is less clear. Daly, Delaney and Harmon (2009) measured mindfulness with the Cognitive and Affective Mindfulness Scale (CAMS) and the discount rate with a Monetary Choice Task from around 150 college students. They found a negative correlation between mindfulness and discount rate though only significant at a 10% level. Moreover, Lima de Miranda (2019) did not find a significant association between mindfulness and time preferences measured with a binary choice task. The standard exponential discounting model has since been extended by behavioural economists. Unlike what is predicted by the standard model, the coherence of individuals' choices is not always preserved within a temporal sequence. The hyperbolic discounting model allows for time-inconsistent behaviours of individuals, especially the tendency to discount future rewards with a higher rate in the present than in the future, which can be referred as present bias, or "decreasing impatience" (Laibson, 1997). While mindfulness might affect the time consistency of individuals by improving the coherence of their choices through a better

focus, no study has yet investigated the association between hyperbolic discounting and mindfulness.

Previous literature on the association between time/risk preferences and mindfulness has highlighted contrasting results due to different preference elicitation methods, highly specific populations, and relatively small samples. We thus wish to address the potential weaknesses of these papers, by (1) offering a very large and representative sample of the French population and (2) providing both stated and revealed measures of economic preferences, the latter through incentivized economic games. To capture time preferences, we use both a simplified version of the convex time budget task (Andreoni & Sprenger, 2012) and a self-stated measure of patience using a 11-point Likert scale. Risk preferences are also measured in two ways: one is to elicit from the portfolio choice task (Gneezy & Potters, 1997), and the other is to assess from a risk attitude questionnaire (Dohmen, Falk, Huffma, Sunde, Schupp, & Wagner, 2011). Given evidence of domain specificity in risk preferences (Weber et al., 2002) we also assess self-stated risk attitude in several areas, namely in general, in the financial domain and in the health domain. This allows us to test whether the association between mindfulness and risk preferences varies across domains.

2 Methods

2.1 Data and survey

This study is based on a cross-sectional survey which is part of a comprehensive project that was conducted during the first national lockdown in France in Spring 2020. Respondents' recruitment was operated by an independent panellist (https://www.institut-viavoice.com/) between May 4th and May 16th, 2020. A sample of $N = 1154$ participants was recruited targeting representativeness of the metropolitan French adult population in terms of gender, age, professional and social categories (PCS, INSEE definition), geographical area (UDA-9) and size of their urban unit (INSEE definition). Information about the representativeness is available in Online Appendix A. Informed consent of participants was obtained before the start of the survey. The research was approved by the Institutional Review Board (IRB) of Aix-Marseille University.

2.2 Economic preferences

Risk and time preferences were measured both with incentive-compatible economic games (*revealed preferences*) and self-reported assessment on Likert-scales (*stated preferences*). We start by describing revealed preference measures. Participants were told that they have a chance over four for being selected for payment and would be paid based on the decisions made in one of the tasks (each task had the same probability of being selected).

Risk preferences were revealed by the portfolio choice task (Gneezy & Potters, 1997). Participants were endowed with 20€ they could invest in a risky asset with half the probability of losing or tripling their investment. Participants could invest amounts of two in two (0, 2, 4, …, 20€). The non-invested endowment being earned for sure. Time preferences were revealed by a simplified version of Andreoni and Sprenger (2012) convex time budget task. Participants faced two allocation decisions. In each decision, they allocated an endowment of 40€ between two dates that were a month apart, knowing that the money allocated to the later date will be multiplied by 1.2. In the first decision, the endowment had to be allocated between a date chosen to be soon after the survey completion (i.e. May 18th) and a second date a month later (June 18th). In the second decision, the endowment had to be shared between a first date, which corresponded to the later date of the first decision (June 18th), and a second date a month later (July 18th). Time consistency is measured by the difference in the endowment allocated to the sooner date in both decisions. Time-consistent individuals should allocate the same amount on the sooner date in both decisions. Respondents who allocated a higher (lower) share of their endowment on the sooner date in the first decision compared to the second decision were classified as present biased (future biased). The portfolio choice task and the simplified convex time budget task are presented in Online Appendix B.

Stated risk preferences were measured on an 11-point Likert scale using similar questions as in Dohmen, Falk, Huffma, Sunde, Schupp, and Wagner (2011). Participants were asked "how willing to take risk" they are (a) in general, (b) in the health domain and (c) in the financial domain. Stated time preferences were also measured on an 11-point Likert scale asking respondents to state "how patient" they are (in general). Table 1 presents an overview of the quantitative economic preferences collected.

Table 1 Revealed and stated preferences

Variable	Definition	Incentivized	Mean (SD)/*N* (%)
Risky money	Amount invested in the risky asset in the portfolio choice task	Yes	5.44 (7.62)
General	Self-declared willingness to take risk in general (0–10)	No	3.93 (2.70)
Health	Self-declared willingness to take risk in health (0–10)	No	2.34 (2.53)
Financial	Self-declared willingness to take risk in the financial domain (0–10)	No	2.65 (2.53)
Later share	Average amount allocated to the later date in the two CTB decisions	Yes	26.09 (12.36)
Patience	Self-declared patience level in general (0–10)	No	5.92 (2.75)
Present bias	Respondents are present-biased if the amount they allocated to the sooner date in the first decision is higher than in the second decision in the CTB task	Yes	268 (23.22%)
Future bias	Respondents are future-biased if the amount they allocated to the sooner date in the first decision is lower than in the second decision in the CTB task	Yes	248 (21.49%)

2.3 Mindfulness attention awareness scale

The Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is the first psychometric measure of dispositional mindfulness. The MAAS scale assesses a core characteristic of dispositional mindfulness, namely open or receptive awareness of and attention to what is taking place in the present. The questionnaire consists of 15 items measured by a 6-point Likert scale ranging from 1 (*Almost always*) to 6 (*Almost never*) capturing respondents' daily mental state and bodily sensations. The MAAS score is the mean of all the 15 items and the higher score indicates a higher level of mindfulness (Cronbach $\alpha = 0.8419$). The French-translated MAAS questionnaire is available in Online Appendix C.

2.4 Control variables

Some socio-demographic characteristics were also included in regression analyses as control variables: gender, age, total household income (two dummy variables, *low income* and *high income* which indicate that monthly household income is lower or equal to 1000€ and no less than 4000€, respectively), and education level (categorical variable indicating the level of diploma).

2.5 Regression methods

In our study, revealed preferences were continuous data, so we regressed them, respectively, on the MAAS score and control variables using Ordinary Least Squares models (OLS model). As stated preferences were ordered data, ordered probit regression models (OP model) were used to regress those preferences on the MAAS score and control variables. A multinomial probit regression model (MP model), using time consistency as the base category, was used to study how MAAS and control variables were associated with present bias and future bias. Alternative econometric specifications (e.g. ordered probit models for revealed time and risk preferences after the creation of categorical variables based on the distribution of the amounts reported, Poisson and negative binomial models for self-stated willingness to take risk in the health and financial domains) were tested for robustness analyses, all producing the same results as baseline models.

3 Results

We first present the distributions of all preference variables before assessing the explanatory power of the MAAS.

3.1 Variable distributions

The distributions of dependent variables and MAAS are presented in Fig. 1. In the incentivized tasks, the tri-modal distribution around the minimum (0%), medium

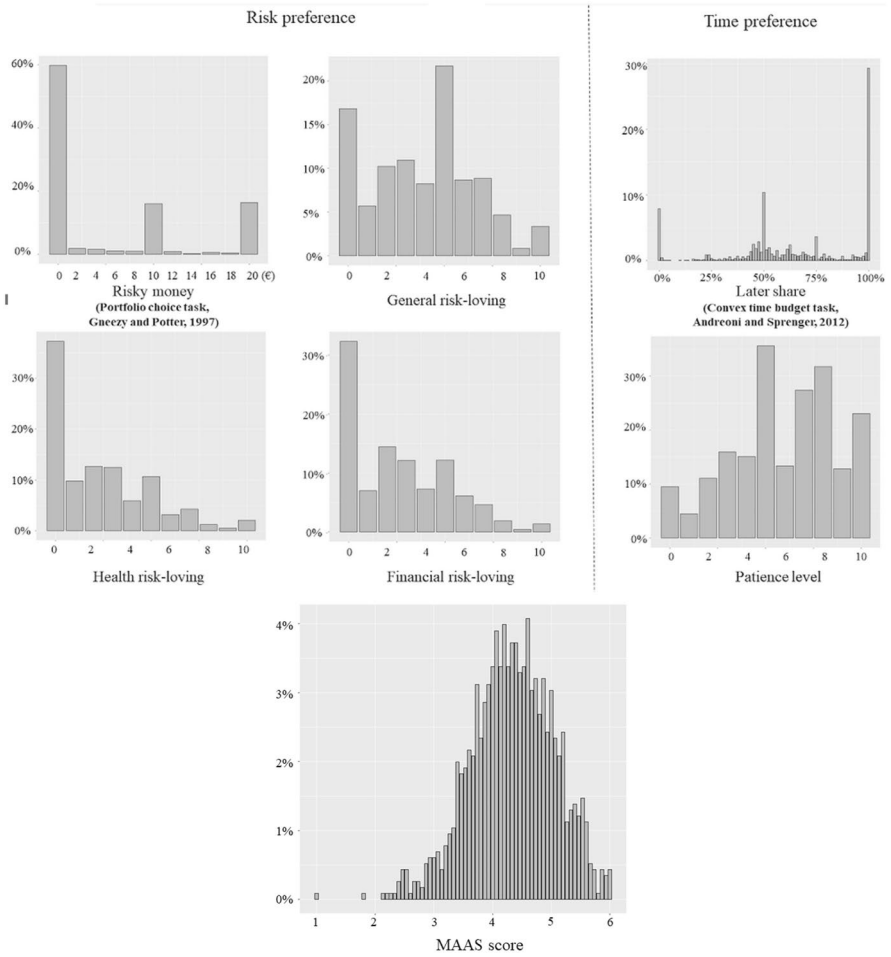

Fig. 1 Variable empirical distribution

(50%) and maximum (100%) possible investments indicate possible focal points for the participants.

Concerning stated preferences, participants were more conservative in terms of risk taking in health and financial domains compared to general risk attitude. We calculated Spearman's correlations between the risk preference measures and between time preference measures. The revealed willingness to take risk was significantly and positively correlated with stated risk attitudes in general (r (1152) = 0.13, $p < 0.001$) and in the financial domain (r (1152) = 0.18, $p < 0.001$), but not in the health domain (r (1152) = 0.046, $p = 0.118$). Stated measures of risk preferences were well correlated across domains, ranging from r (1152) = 0.40 to r (1152) = 0.55. Concerning time preferences, we found no significant correlation between stated and revealed patience (r (1152) = 0.05, $p = 0.105$). Concerning the MAAS score, we obtain a

mean MAAS score of 4.33 (SD = 0.71). Online Appendix D presents the sample characteristics for control variables.

3.2 Association between mindfulness and preferences

Table 2 Presents the results of our regression analyses.

For risk preferences, we found no significant association between the MAAS score and the amount of money invested in the risky asset in the portfolio choice task (*revealed risk preference*). We also found that the MAAS score was not a significant predictor of general self-declared risk preference. However, we found negative and significant associations between the MAAS score and the self-declared willingness to take risks in the health and financial domains.

For time preferences, the results of regression analyses indicated that the MAAS score was not significantly associated with the average amount invested in the later date in the two CTB decisions (*revealed time preference*) while we found a positive and significant association between the MAAS score and self-stated patience. Mindfulness also appeared to enhance time consistency since in the OP model we found a negative and significant association between the MAAS and the present bias and the future bias categorization, although for the latter only at a 10% significance level.

4 Discussion

This paper investigated the relationship between mindfulness, and (1) stated, as well as (2) elicited economic preferences, mobilizing a large representative sample of the French adult in Spring 2020 in France.

The relationship between risk and mindfulness is not well established and the literature available provides mixed results. Lakey et al. (2007) observed an association between mindfulness and lower pathological gambling, while Zhang et al. (2020) suggested that present focus could reduce risk-taking in a gambling experiment. Zhang et al. (2021) showed that mindfulness traits were associated with lower risk preferences and that individuals who had meditated were more risk averse, while Lima de Miranda (2019) observed no association. We contribute to this literature by providing a very large and representative sample of the French population and offering two ways to assess risk preferences through stated and revealed elicitation methods. Our results indicate a significant negative relationship between mindfulness and self-declared risk-taking, but no relation with the investment task. This points out that stated risk preferences (but not revealed one) are correlated with a stated evaluation of mindfulness. In the same way, using multiple risk assessment methods to predict self-declared health behaviors, Szrek et al. (2012) demonstrated that a general question (a la Dohmen et al.) is a better predictor than the experimental lottery proposed by Holt and Laury (2002), or the Balloon Analog Risk Task of Lejuez et al. (2002). The comparisons and discussions regarding stated and revealed preferences are the source of extensive literature among experimental economists and psychologists (Beranek et al., 2015; Mark & Swait, 2004; for a recent review,

Table 2 Results of regression analyses

	Risk preferences				Time preferences			
	Risk money	Risk general	Risk health	Risk financial	Later share	Patience	Present bias	Future bias
MAAS	0.198 (0.317)	−0.0572 (0.0436)	−0.226*** (0.0457)	−0.143** (0.0450)	−0.885 (0.514)	0.396*** (0.0440)	−0.174* (0.0818)	−0.152 (0.0833)
Male (Ref: Female)	0.938* (0.453)	0.249*** (0.0619)	0.329*** (0.0646)	0.497*** (0.0642)	0.791 (0.735)	−0.00865 (0.0613)	−0.360** (0.118)	−0.152 (0.119)
Age	0.0232 (0.0138)	−0.00798*** (0.00188)	−0.00712*** (0.00195)	−0.00551** (0.00193)	0.0159 (0.0223)	0.00628*** (0.00187)	0.00959** (0.00359)	0.00962** (0.00362)
Income: < 1000€	−0.158 (0.881)	0.174 (0.121)	0.214 (0.126)	0.0303 (0.127)	0.567 (1.428)	0.266* (0.120)	−0.343 (0.238)	−0.136 (0.233)
Income: > 4000€	1.270* (0.526)	0.168* (0.0713)	0.127 (0.0739)	0.337*** (0.0728)	2.289** (0.853)	−0.0264 (0.0711)	−0.0952 (0.138)	−0.0764 (0.139)
A-Level to bachelor (Ref: < A-Level)	0.327 (0.626)	0.286*** (0.0866)	0.240** (0.0910)	0.203* (0.0914)	0.218 (1.016)	0.178* (0.0852)	−0.0167 (0.160)	0.154 (0.165)
> Bachelor (Ref: < A-level)	1.438* (0.672)	0.449*** (0.0925)	0.263** (0.0968)	0.551*** (0.0966)	2.648* (1.089)	0.0439 (0.0910)	−0.314 (0.174)	−0.164 (0.178)
Constant	1.911 (1.552)				26.95*** (2.516)		−0.0909 (0.399)	−0.489 (0.407)
Observations	1154	1154	1154	1154	1154	1154	1154	1154

Standard errors in parenthesis

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

see Rafaï et al., 2023). While several papers indicated that stated methods would tend to better perform than revealed ones in predicting behaviour outside the laboratory (Charness et al., 2020; Frey et al., 2017; Hertwig et al., 2019), other studies considered, on the other hand, that stated preferences would be highly questionable (no monetary incentive, hypothetical bias), and would not reveal individuals' true preferences (Fifer et al., 2014; List & Gallet, 2001). In light of our results and those of the literature, it would be very valuable, in some future steps, to assess risk preferences and mindfulness through real-world behaviours, to investigate whether these relationships remain valid in a realistic context.

Regarding patience, while only a few studies on small samples reported that mindfulness was positively correlated with it when self-declared (Azizi Ziabari et al., 2019), the links between revealed patience and mindfulness found in the literature were mixed (Daly et al., 2009; Lima de Miranda, 2019). In our representative study of the French population, we also do support this positive and significant relationship between self-reported patience and mindfulness but do not identify any link with a well-known patience experimental task, despite a sample size of over 1100 individuals. These results therefore reinforce our observations regarding risks and suggest, in future steps, new investigations to determine the relation between real patience and real mindfulness behaviours, while going beyond correlations by experimentally testing potential causal links.

But our most innovative finding concerns temporal consistency. We are to the best of our knowledge the first to find that a higher MAAS score is negatively correlated with present bias and to a lesser extent with future bias. This result, which requires confirmation by experimental causal studies, suggests that meditation (or a higher level of mindfulness) might not only alter specific preferences but also provide individuals with more cognitive consistency. While the literature documented that mindfulness reduced many biases, e.g., the negativity bias (Kiken & Shook, 2011), the sunk cost bias (Hafenbrack et al., 2014), or the intergroup bias (for a review, see Oyler et al., 2022), our study indicates that mindfulness might help individuals to be more rational (in the sense of classical decision theories), and invites a deeper theoretical understanding of the mediators by which mindfulness might affect individuals' temporal consistency. Other biases, such as those producing violations of expected utility theory, could be explored in relation to mindfulness and open up a new field of potential effects of meditation.

This study opens the way to exploring the mechanisms by which mindfulness influences economic preferences. Although the investigation of these mechanisms is beyond the scope of this research, we can assume, based on the existing literature, that mindfulness can enhance individuals' lifelong decision-making processes and well-being through physiological and cognitive changes (see Sun et al., 2015 for a review). Indeed, studies have demonstrated the beneficial effects of mindfulness meditation on cognitive abilities, memory, decision-making, attention, stress mitigation, emotional regulation, and brain functionality, as well as promoting prosocial behavior through long-term practice (Boccia et al., 2015; Hölzel et al., 2011; Levenson et al., 2012; Luberto et al., 2018; Newberg et al., 2010; Tang et al., 2007, 2009, 2010). All these cognitive and psychological modifications could lead to more deliberate and thoughtful choices, reflected in the

observed risk aversion and temporal consistency. Future research could empirically and experimentally test these pathways, shedding further light on how mindfulness shapes individual preferences and decision outcomes. This knowledge could be essential for designing interventions to improve decision quality, by encouraging mindfulness to leverage its positive impact on decision-making behaviors.

Some limitations must be discussed. First, this work deals with cross-sectional data and only identifies correlations. To establish causality, it would be appropriate, for example, to conduct experimental studies by manipulating the mindfulness (meditation) parameter, to investigate its impact on risk and time preferences. In our case, potential causality could result from confounding or hidden variables (even though we included multiple control variables in regression analyses), or even be reversed, with risk or time preferences impacting the level of mindfulness. Second, although the MAAS is a very broadly used measurement of mindfulness, this questionnaire is much debated because it would not capture all the dimensions of mindfulness (Brown et al., 2011; Grossman, 2011; Van Dam et al., 2010; Van Dam et al., 2010). Despite these limitations, our paper contributes to the literature by providing additional evidence, among a large representative sample, that mindfulness can influence (health) behaviours through increased risk-aversion and greater patience but even suggests that mindfulness might be a possible source of better consistency in individual decision-making.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40881-024-00169-3.

Author contributions SD: conception or design; collection, analysis or interpretation of data; drafting the article or revising it critically for important intellectual content. MG: collection, analysis or interpretation of data; drafting the article or revising it critically for important intellectual content. IR: conception or design; collection, analysis or interpretation of data; drafting the article or revising it critically for important intellectual content.

Funding This work was supported by the French National Research Agency, by Grant ANR-17-EURE-0020 and by Grant ANR-21-COVR-0041-01. The funding source had no role in the study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

Data availability The data that support the findings and the code to replicate the analyses of this study are available as supplementary material.

Declarations

Conflict of interest The authors declare they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional Review Board (IRB) of Aix Marseille University and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual adult participants included in the study.

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