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Received: 7 December 2021 | Accepted: 31 August 2023

DOI: 10.1002/soej.12662

RESEARCH ARTICLE

Southern Economic Journal WILEY

Does age affect the relation between risk and time preferences? Evidence from a representative sample

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Funding information
French National Research Agency (ANR); Occitanie region

Abstract

We examine the links between age, risk tolerance, and impatience in a large French representative sample. We combine elicited preferences data based on an incentivized web experiment and stated preferences data based on self-reported surveys. Our findings highlight distinct patterns: when considering stated preferences, both risk tolerance and impatience exhibit a decline with age. Higher risk tolerance is associated with higher impatience, and this relationship strengthens with age in the financial domain. In contrast, our analysis of elicited measures uncovers a different dynamic. Specifically, risk tolerance tends to increase with age, while age exhibits no significant influence on impatience. Furthermore, individuals endowed with higher risk tolerance tend to demonstrate lower levels of impatience, irrespective of their age.

KEYWORDS

age, elicited preferences, risk preferences, stated preferences, time preferences

JEL CLASSIFICATION

C83, C91, D15, D81

1 | INTRODUCTION

Most economic decisions encompass elements of risk and delayed outcomes, rendering risk and time preferences pivotal in comprehending individual behavioral patterns. These two preferences are intricately interwoven, as evidenced by an array of studies (Abdellaoui et al., 2013; Anderhub & Güth, 2001; Andersen et al., 2008; Brown & Van der Pol, 2015; Burks et al., 2009; Carpenter et al., 2011; Chuang & Schechter, 2015; Clot et al., 2017; Dean & Ortoleva, 2019; Dohmen et al., 2010; Epper & Fehr-Duda, 2015; Ferecatu & Önçüler, 2016; Ida & Goto, 2016). Studying these preferences together is crucial given their interconnected determinants, which encompass gender, age, genetics, health, education, social status, cultural background, and ethnicity (Ackert et al., 2009; Banks et al., 2019; Bettinger & Slonim, 2007; Burro et al., 2022; Charness et al., 2007; Daly et al., 2009; Dohmen et al., 2010, 2011; Falk et al., 2018; Grubb et al., 2016; Kureishi et al., 2020, 2021; Meissner et al., 2023; Niederle & Vesterlund, 2007; Park, 2019; Rieger et al., 2015; Shachat et al., 2020; Van der Pol, 2011). Although a substantial body of research delves into gender disparities concerning risk and time preferences, our understanding of how these preferences and their interplay are influenced by age remains limited. This paper seeks to bridge this gap by concentrating on the impact of age on these preferences.

The existing body of literature concerning the interplay between economic preferences and age reveals outcomes heavily contingent on the assessment methodologies employed. Notably, disparities arise when comparing stated preferences techniques with elicited preferences methods based on incentivized tasks. This discordance poses a significant challenge by breeding a lack of consensus regarding the influence of age on preferences. Consequently, the difficulty lies in the ability to harmonize studies and disentangle genuine population effects from potential methodological biases.

Moreover, the complexity of understanding how age relates to economic preferences becomes more difficult due to interactions with many other variables. Dynamic factors such as education and income, which undergo transformations as individuals age, are apt to exert influence over and moderate or mediate the effect of age on preferences. Overlooking the impact of these variables can distort conclusions drawn regarding the natural evolution of risk and time preferences over time. Furthermore, these variables also serve as potential explanatory factors for the observed correlation between patience and risk tolerance. To fully understand how economic preferences change with age and their connection, it is crucial to compare alternative methods for measuring preferences within a representative sample of the general population, where important confounding factors can be controlled.

Our research adds to the empirical literature on economic preferences by highlighting the significance of age in shaping risk and time preferences. We investigate how the correlation between time and risk preferences varies with age, utilizing both stated preferences and experimentally elicited preferences from a representative sample. Furthermore, we examine the differences in these correlations between stated and elicited methods, offering valuable insights into the implications of each approach.

Our study utilizes a within-subject set-up with a sample representative of the (mainland) French adult population in terms of age, gender, and living area. Participants answered both survey questions and incentivized experimental tasks to assess their time and risk preferences. To measure risk preferences, we adopt the portfolio choice task by Gneezy and Potters (1997), while for time preferences, we rely on the Convex Time Budget (CTB) method introduced by Andreoni and Sprenger (2012a, 2012b). We compare these experimental measures to self-reported data using established and validated questions on patience (based on Vischer et al., 2013) and risk attitudes, including general attitudes and those specifically pertaining to health and finance (Dohmen et al., 2011).

Our main findings are as follows: Based on survey measures, risk tolerance and impatience decline with age. However, using elicited measures, we observe that risk tolerance increases with age, while age has no significant effect on impatience. In the experimental tasks, we confirm that higher risk-tolerant individuals display lower impatience, consistent with previous research, and this relationship remains unaffected by age. However, our stated preferences show a positive correlation between risk tolerance and impatience, which weakens with age, particularly in the financial domain. These results differ from Dohmen et al. (2010)'s study, where they found a negative relation between age and stated risk tolerance, but no relation between age and revealed risk tolerance. We are also offering new evidence concerning the relationship between time and risk preferences.

The remaining sections of the paper are structured as follows: Section 2 presents a survey of existing studies that investigate the connections between age and individual preferences, and outlines our hypotheses. Section 3 elaborates on the methodologies we have employed and our empirical strategy. Section 4 presents our primary findings, which are subsequently discussed in greater detail in Section 5. Finally, Section 6 offers a conclusion summarizing our research findings and implications.

2 | BACKGROUND AND HYPOTHESES

In this section we state our main hypotheses, based on existing literature, about age and risk preference (2.1), age and time preference (2.2) and age and the interaction between risk tolerance and impatience (2.3).

2.1 | Age and risk preference

2.1.1 | R-hypothesis: Risk tolerance is related with age

Numerous studies using stated preference methods (Ackert et al., 2002; Banks et al., 2019; Dohmen et al., 2010, 2011, 2017; Falk et al., 2015, 2018; Sahm, 2012), as well as experimentally elicited methods (Ackert et al., 2009; Grubb et al., 2016; Heinrich & Shachat, 2020; Mather et al., 2012; Meissner et al., 2023), along with a handful of available longitudinal studies (Dohmen et al., 2017; Josef et al., 2016) and neuroscience investigations (for instance, Grubb et al., 2016; Rudolph et al., 2017), have consistently identified a negative relationship between risk tolerance and age. In general, when relying on elicited measures, discrepancies are rare: Piovesan and Willadsen (2021) reported contradictory evidence, while Dohmen et al. (2010) and Horn et al. (2021) presented null results using Multiple Price Lists methods and the Bomb Risk Elicitation Task, respectively. Mather et al. (2012) used a binary lottery choice task and noted that older individuals tend to opt for the safe option when presented with a risky and a safe option, indicating a more pronounced certainty effect with age. However, they observed no age effect when the choice was between two risky options. Mata et al. (2011) conducted a meta-analysis and found mixed evidence regarding age-related risk preferences. Most studies investigating the R-hypothesis assume a linear relationship between age and risk tolerance. Nonetheless, Ackert et al. (2009) reported that the degree of risk aversion increases with age at a decreasing rate. Hence, we will also explore second-order effects.

2.2 | Age and time preference

2.2.1 | T-hypothesis: Impatience is related with age

A conventional hypothesis is that impatience declines with age (e.g., Andreoni et al., 2019; Castillo et al., 2019, 2020; Chao et al., 2009; Falk et al., 2015, 2018), rooted in evolutionary theory. Evolutionary models link discount rates to survival probabilities (Fisher, 1930) and reproductive fitness, typically predicting that impatience declines with age (Robson et al., 2012; Rogers, 1994). Numerous studies based on stated preferences tend to support that impatience diminishes with age (Bishai, 2004; Burro et al., 2022; Falk et al., 2015, 2018; Green et al., 1994; Heimer et al., 2019; Kureishi et al., 2020, 2021). Nevertheless, Park (2019) reported no such effect in a South Korean sample. Moreover, a notable observation is that impatience appears to increase after the age of 70 (Huffman et al., 2019). In a comprehensive study, Burro et al. (2022) found that impatience escalates with age only among low-income participants, while age seems to have no influence on impatience for individuals in the highest income quintile. Research employing experimentally elicited time preferences also presents conflicting outcomes. Studies relying on Multiple Price Lists (MPL) have documented declining impatience with age in a representative Danish sample (Harrison et al., 2002) and a global sample (Bettinger & Slonim, 2007; Meissner et al., 2023). Angerer et al. (2015), Deckers et al. (2015), and Sutter et al. (2015) have similarly observed such trends. Conversely, others like Daly et al. (2009), Dohmen et al. (2010), and Horn et al. (2021) have concluded that age and impatience are unrelated. Lastly, Percoco and NiklaNijkamp (2006) discovered that time preferences do not correlate with life expectancy in their meta-analysis of over 40 studies.

While numerous papers offer supportive evidence for the T-hypothesis, the empirical literature lacks a unified agreement regarding the trajectory of how time preferences change with age. Some studies indicate diminishing impatience, while others note a rise in impatience. Additionally, certain research identifies no discernible effect or highlights non-linear patterns. In essence, further data is essential to substantiate or refute the T-hypothesis.

2.2.2 | TC-hypothesis: Time consistency is related with age

The issue of time consistency arises when eliciting time preferences. A time-consistent individual's optimal consumption pattern remains unchanged as time passes and if future is certain (Strotz, 1956). This implies that their discounting should adhere to a fixed exponential function over time, resulting in a constant impatience level. Deviations from this behavior suggest present-bias (decreasing impatience) or future-bias (increasing impatience) among individuals who alter their optimal plan at future dates. Loewenstein and Prelec's influential work in 1992 has sparked extensive discourse on decreasing impatience, which challenges the exponential discounting model (e.g., Noor, 2009). A question persists: does the likelihood of time inconsistency change with age, and does the occurrence of decreasing impatience vary with age? Older individuals, enriched by experience, may be more prone to avoiding inconsistencies. Yet, cognitive abilities often diminish with age, potentially heightening the risk of errors and inconsistent choices among older individuals (as explored by Huffman et al., 2019). Moreover, individual traits and traits evolve over time (like education, income, self-control, risk of fatality, family circumstances, etc.). Consequently, the impact of age on time consistency remains uncertain.

2.3 | Age and interaction between risk tolerance and impatience

2.3.1 | RT-hypothesis: The relationship between risk tolerance and patience is affected by age

Patience and risk tolerance exhibit a positive correlation, as evidenced by a substantial body of experimental research (Abdellaoui et al., 2013; Anderhub & Güth, 2001; Andersen et al., 2008; Burks et al., 2009; Clot et al., 2017; Dean & Ortoleva, 2019; Dohmen et al., 2010; Ferecatu & Önçüler, 2016; Ida & Goto, 2016). Despite this recurrent observation, a comprehensive theoretical framework has yet to be proposed to explain why individuals who display greater patience also tend to exhibit higher risk tolerance. Standard conjectures suggest that risk tolerance wanes while patience flourishes with advancing age. However, the interplay between these two effects and its potential neutrality remains ambiguous. In contrast, Dohmen et al. (2010) revealed that cognitive ability maintains a correlation with both risk tolerance and patience, indicating that individuals with higher cognitive ability are inclined towards greater patience and risk tolerance. Given the typical decline in cognitive capabilities over time, it is plausible that as people age, their inclination towards impatience might intensify, accompanied by diminished risk tolerance. Nonetheless, the intricacies of the connection between age and the relationship between risk tolerance and patience warrant further exploration. To our knowledge, our study represents the first attempt to scrutinize the influence of age on the relationship between risk tolerance and impatience.

3 | MATERIALS AND METHODS

In this section, we outline the methods and survey questions. We detail our data set, confounding factors, and the control variables utilized in our data analyses.

3.1 | Overall design

We utilized a dataset collected during the initial COVID-19 lockdown in France (April–May 2020).[1] The study involved $N = 1154$ participants, selected to mirror the demographics of the French adult population in terms of age, gender, and living area, courtesy of the Viavoice polling institute. On average, participants were 50.21 years old (SD = 16.9). About 20% of the sample comprised individuals under 35, with an additional 40% falling under 55 years of age.

The experimental tasks and questionnaires were executed via a web-based platform. Each participant engaged in two incentivized tasks: the portfolio choice task and the CTB task. Additionally, participants completed three self-reported questionnaires to gauge their risk attitudes in general and in the domains of finance and health. They also self-reported their own

[1]This dataset was used in other papers investigating other research questions related to the COVID-19 crisis (Blayac et al., 2022a). For instance, Blayac et al. (2021, 2022b) study population preferences in term of restrictive health policy with a Discrete Choice Experiment; Blayac et al. (2022c) study the effectiveness of a social norm nudge to increases intention to comply with lockdown; Rafaï et al. (2023) study the determinants of compliance with sanitary measures; Wen et al. (2022) study the protecting role of mindfulness in the crisis.

TABLE 1 Summary of the elicited and self-reported preferences measures.

Preferences	Variable names	Definition	Incentives	Median	Mean (std)
Risk preference	Risky money	Level of investment in the risky asset in the portfolio choice task (Gneezy & Potters, 1997)	Yes ($M =$ €22.17)	0 €	5.44 € (7.62 €)
	General risk-loving	Stated willingness to take risk in general, 0–10 Likert-scaled questionnaire	No	4	3.93 (2.70)
	Health risk-loving	Stated willingness to take risk in health domain, 0–10 Likert-scaled questionnaire	No	2	2.34 (2.53)
	Financial risk-loving	Stated willingness to take risk in financial domain, 0–10 Likert-scaled questionnaire	No	2	2.65 (2.53)
Time preference	Later share	Amount allocated to the later date in the convex time budget task (Andreoni & Sprenger, 2012a, 2012b)	Yes ($M =$ €31.24 + €13.97)	62.50%	65.22% (30.91%)
	Patience level	Stated patience level in general, 0–10 Likert-scaled questionnaire	No	6	5.92 (2.75)

Note: Incentivized preferences are highlighted in dark gray.

level of patience and provided responses to a comprehensive socio-demographic questionnaire. For every four participants, one was chosen at random to receive compensation for a task chosen randomly from the incentivized games. A summary of the tasks employed to elicit risk and time preferences is presented in Table 1.

3.2 | Elicitation of risk preferences

3.2.1 | Experimental method: Portfolio choice task

We relied on Gneezy and Potters (1997)'s portfolio choice task to elicit risk preferences. Each participant received an initial endowment of 20 euros, which they were required to allocate between two options: a safe asset (keeping the money) and a risky asset (a 50% chance of earning three times the amount invested or losing the investment). The risky asset allowed investments in units of 2 €, ranging from 0 to 20 €. Participants solely determined the investment amount for the risky asset, while the residual sum was automatically allocated to the safe asset.[2] Participants' risk tolerance can be measured by their investment in risky asset. More risk tolerant participants invest more in the risky asset. Define $x \in \{0, 2, ..., 20\}$, the level of investment in the risky asset and $u(x)$ the corresponding utility level. Assuming expected utility (EU thereafter) maximization, with CRRA preferences, that is, $u(x) = x^{1-r}/(1-r)$, we can estimate an individual's risk aversion parameter r with the following equation as shown in Appendix B:

$$r = \frac{\log(0.5)}{\log(20-x) - \log(20+2x)}.$$

Table 2 illustrates the distribution of participants' investments in the risky asset across distinct CRRA intervals, alongside the associated estimated CRRA parameter (r). The data exhibits a clear trimodal pattern: roughly 60% ($n = 690$) of participants opted not to invest any euros in the risky asset (indicative of extreme risk aversion). Approximately 16% ($n = 189$) allocated their whole endowment, suggesting risk neutrality or risk loving, while an equivalent 16% ($n = 185$) invested half of their endowment.

3.2.2 | Stated risk preference

We employed the questionnaire introduced by Dohmen et al. (2011) to obtain a self-reported measure of risk preference. The general risk question is, "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Select your answer on a scale from 0 to 10, where 0 corresponds to 'not at all willing to take risks' and the value 10 means: 'very willing to take risks'." As the question was also duplicated for the finance

TABLE 2 CRRA parameter estimates (r).

Invested (x)	**CRRA interval**	**CRRA parameter (r)**	***N***
0	$[4.728; +\infty]$	4.728	690 (59.8%)
2	$[1.631; 4.728]$	2.409	22 (1.9%)
4	$[1.631; 4.728]$	1.239	18 (1.6%)
6	$[1.631; 4.728]$	0.838	13 (1.1%)
8	$[0.559; 0.721]$	0.631	12 (1%)
10	$[0.450; 0.559]$	0.500	185 (16%)
12	$[0.368; 0.450]$	0.407	10 (0.9%)
14	$[0.301; 0.368]$	0.333	3 (0.3%)
16	$[0.240; 0.301]$	0.270	7 (0.6%)
18	$[0.171; 0.240]$	0.208	5 (0.4%)
20	$[-\infty; 0.171]$	0.171	189 (16.4%)

Note: $r > 0$ implies risk aversion, and $r < 0$ implies risk loving. Extreme values: an investment of 0, might reflect an arbitrarily large r; an investment of 20 might reflect an arbitrarily small (negative) r.

[2]A translation of the detailed instructions is provided in Appendix A.

and health domains, akin to Dohmen et al. (2011), we exclusively present results pertaining to general risk preferences, when similar between domains and detail the findings for other domains in Appendix E.[3]

3.3 | Elicitation of time preferences

3.3.1 | Convex Time Budget method (CTB)

We utilized the Convex Time Budget (CTB) method to elicit time preferences. Participants were tasked with allocating 40 € between two distinct dates: an earlier and a later date. Each euro allocated to the earlier date held a value of 1 euro, while for the later date, its value was 1.20 euros. This allocation task was reiterated with two sets of distinct date pairs. Within each pair, the interval (k) remained fixed at 30 days. The second set of dates corresponded to the first set but was staggered by 1 month.[4] Patience is measured by the amount allocated to the later date for each pair of dates. Assuming discounted EU (DEU thereafter) and noting c_t the amount allocated to the sooner date, we can provide an estimate of the daily discount factor (δ) for each participant, by using his corresponding estimated CRRA parameter r (the proof is given in Appendix C):

$$\delta = \left(1.2^{r-1} \times \left(\frac{40 - c_t}{c_t}\right)^r\right)^{1/30}.$$

Figure 1 depicts the density distribution of estimated daily discount factors within our participant pool. Approximately 59% ($n = 668$) of individuals exhibit daily discount factors ranging from 0.9 to 1.1. For 19% of participants ($n = 222$), the discount factor exceeds 2.

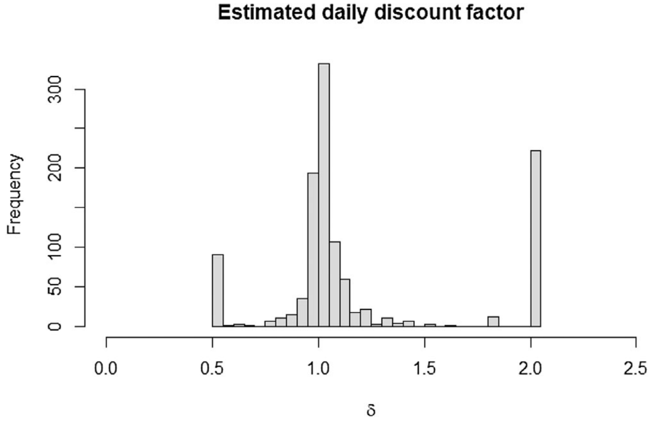

FIGURE 1 Density distribution of the estimated daily discount factors.

[3]In addition to general risk preference, Dohmen et al. (2011)'s stated preference question covers five additional domains: Car driving, Finance, Sports/Leisure, Professional Career, and Health. They established that risk tolerance is not only correlated across domains but also with respect to risky behavior (holding stocks, being self-employed, participating in sports, and smoking) and with respect to elicited risk tolerance using a lottery choice task. These findings suggest that the stated preference questions capture a common underlying behavioral trait.
[4]A translation of the detailed instructions is provided in Appendix A.

The DEU model relies on the assumption of time consistency (TC). An individual is considered time consistent if they assign identical amounts to the later date for date pairs with the same delay and budget. Among our respondents, 55.3% ($n = 638$) can be classified as exhibiting TC.

3.3.2 | Stated patience

Building upon the approach outlined by Vischer et al. (2013), participants engaged with a stated time preference query: "How do you perceive yourself: would you describe yourself as impatient or patient? Provide your response on a scale ranging from 0 to 10, with 0 indicating 'very impatient' and 10 indicating 'very patient'."

3.4 | Confounding factors and control variables

To ensure a precise evaluation of age's influence on risk tolerance and patience, we incorporate control measures for various confounding factors. These factors, often correlated with age, can potentially enhance, or diminish, the observed impact of age on risk and time preferences.[5] Primarily, we account for education, as it might exert an influence on economic preferences. Existing research indicates a positive correlation between higher education and greater risk tolerance (Dohmen et al., 2010; Falk et al., 2018; Meissner et al., 2023) as well as heightened patience (Dohmen et al., 2010; Falk et al., 2018; Meissner et al., 2023; Viscusi & Moore, 1989).

Additionally, we acknowledge the positive connection between wealth and risk tolerance (Dohmen et al., 2010; Meissner et al., 2023) as well as patience (Burro et al., 2022; Dohmen et al., 2010, 2018; Falk et al., 2018; Tanaka et al., 2010). To control for wealth, we encompass participants' family income and the percentage of their income contribution to the family, which allows the computation of their personal income.

Furthermore, although gender tends to remain stable with age, we account for potential gender-related effects. Women's extended life expectancy relative to men is considered. Research suggests that men tend to be more risk tolerant than women (Borghans et al., 2009; Charness & Gneezy, 2012; Croson & Gneezy, 2009; Dohmen et al., 2011; Eckel & Grossman, 2002, 2008; Falk et al., 2018; Filippin & Crosetto, 2016). Additionally, gender differences exist in terms of patience, with women often displaying either greater (Andreoni et al., 2019; Bettinger & Slonim, 2007; Dittrich & Leipold, 2014; Meissner et al., 2023) or lesser (Falk et al., 2018; Falk & Hermle, 2018) patience compared to men.

We consider additional control variables that have also been previously recognized in the literature as factors influencing risk and/or time preferences: occupational status (Charness et al., 2007; Falk et al., 2018), urban area size (Bigoni et al., 2022), and parental responsibilities (Cicchelli & Maunaye, 2001; Meissner et al., 2023; Sundén & Surette, 1998). Details about these control variables are presented in Table 3.

[5]The interaction of each factor with age is extensively discussed in a former unpublished version of this paper (Wang et al., 2023).

TABLE 3 Distribution of control variables.

Variable	Description	Mean (std)
Age	Age of the participant (in year)	50.21 (16.9)
Young	= 1 if the age of the participant is lower than 35	22%
Intermediate	= 1 if the age of the participant is between 35 and 55	35%
Old	= 1 if the age of the participant is greater than 55	43%
Man	= 0 if the participant reports being a woman	48.44%
	= 1 if the participant reports being a man	50.61%
	= NA if the participant does not report the gender	0.95%
Education	*Years of study from highschool (from 0 = "No highschool" to 9 = "PhD")*	5.20 (2.51)
Family income	*Range of monthly household income (in euro). Possible answers:*	3.94 (3.50)
	"between 0 and 1000 €" (estimated = 500 €);	7%
	"between 1001 and 2000 €" (estimated = 1500 €);	17%
	"between 2001 and 3000 €" (estimated = 2500 €);	19%
	"between 3001 and 4000 €" (estimated = 3500 €);	17%
	"between 4001 and 5000 €" (estimated = 4500 €);	13%
	"between 5001 and 6000 €" (estimated = 5500 €);	7%
	"between 6001 and 7000 €" (estimated = 6500 €);	3%
	"between 7001 and 8000 €" (estimated = 7500 €);	2%
	"between 8001 and 9000 €" (estimated = 8500 €);	1%
	"between 9001 and 10,000 €" (estimated = 9500 €);	1%
	"between 10,001 and 15,000 €" (estimated = 12,500 €);	1%
	"More than 15,000 €" (estimated = 20,000 €).	2%
	NA	10.49%
%Family income	*Percentage of contribution of the participant to the household income (in percent). Discrete answers from 0% to 100%, with a 10% increment.*	52.97 (32.71)
Income	= *Family income * %Family income*	1791 (1674)
Professional status	*Possible answers:*	
	Self employed	7.71%
	Retired	29.81%
	Inactive/Unemployed	9.19%
	Private sector	37.00%
	Public sector	15.94%
	NA	0.35%

TABLE 3 (Continued)

Variable	Description	Mean (std)
City size	*Possible answer:*	
	A = "Rural communities (less than 2000 inhabitants)"	21.92%
	B = "between 2000 and 20,000 inhabitants"	17.94%
	C = "between 20,000 and 100,000 inhabitants"	13.52%
	D = "More than 100,000 inhabitants"	31.20%
	E = "Parisian area"	15.16%
	NA	0.26%
Parent	*= 1 if the participant has one child or more*	58.93%

3.5 | Statistical methodology

Regarding risk preference, we employ two indicators of elicited risk tolerance: the amount invested in the risky asset and the risk tolerance parameter $1/r$, which is the reciprocal of the CRRA parameter calculated in Section 3.2. Additionally, we utilize a measure of stated risk preference: the self-reported willingness to undertake risks in general.[6]

In relation to time preference, we draw upon several variables. Initially, we employ two indicators of elicited patience: (i) the non-parametric measure c_t, characterized as the mean allocation to the later date across the two CTB questions, and (ii) the parametric discount factor δ, computed as exposed in Section 3.3. Subsequently, we consider the binary variable TC, signifying whether a participant exhibits time consistency or not. Lastly, we utilize the self-reported degree of patience as an indicator of stated patience.

Our primary independent variable is age. To account for potential nonlinear effects of age on preferences, we introduce second-order terms. In all our models, we incorporate the variables education, income, and gender (male). Additionally, we include supplementary controls such as parental responsibilities, occupational status, and urban area size for the purpose of robustness checks. For each preference measurement, we compute the following model:

$$Y = \beta_0 + \beta_{age} \times age + \beta_{age2} \times age^2 + \beta_{edu} education + \beta_{income} \times income + \beta_{male} \times male + \beta_C \times Controls + \epsilon.$$

Given that the investment in the risky asset frequently reaches the choice set's boundary for most participants, we employ censored "Tobit" regressions to account for both left and right censoring. This approach is also applied to elicited patience measures and self-reported evaluations of participants' risk tolerance and patience. The latter measurement spans from 0 to 10 in general. We resort to a probit regression for TC.

For models excluding the supplementary controls, we omit data from 90 participants who did not provide income or gender information. For models encompassing the additional controls, we exclude data from 93 participants who left those questions unanswered.

[6]Results on stated willingness to take risk in the health and financial domains are presented in Appendices E and F.

4 | RESULTS

4.1 | Result 1: Elicited risk tolerance increases with age at a decreasing rate. Conversely, stated risk tolerance decreases with age at an increasing rate

Figure 2 depicts histograms divided into three intervals of investments in the risky asset ([0, 5], [5, 15], and [15, 20]) across three distinct age categories: the younger age group (age < 35, $n = 256$); the intermediate age group (34 years $<$ age $<$ 56 years, $n = 405$); and the older age group (age $>$ 55 years, $n = 493$).

On average, the younger age group invested 4.55 € (SD = 6.84 €), the intermediate age group invested 5.08 € (SD = 7.54 €), and the older age group invested 6.21 € (SD = 8.00 €) in the risky asset. The average investment of the older group is significantly greater than that of the intermediate ($p = .030$) and younger age groups ($p = .003$). However, the distinction between the younger and intermediate age groups is not statistically significant ($p = .348$).

Figure 3 illustrates the empirical cumulative distribution functions (CDF) of general stated risk tolerance for each of the three age categories.

On average, participants in the younger age group report higher risk tolerance in general ($M = 4.62$, SD = 2.69) than those in the intermediate ($M = 3.75$, SD = 2.60) and older ($M = 3.72$, SD = 2.72) age groups ($p < .001$). The difference between the intermediate and the older age groups is not significant. We found similar patterns for the finance and health domains (see online Appendix E).

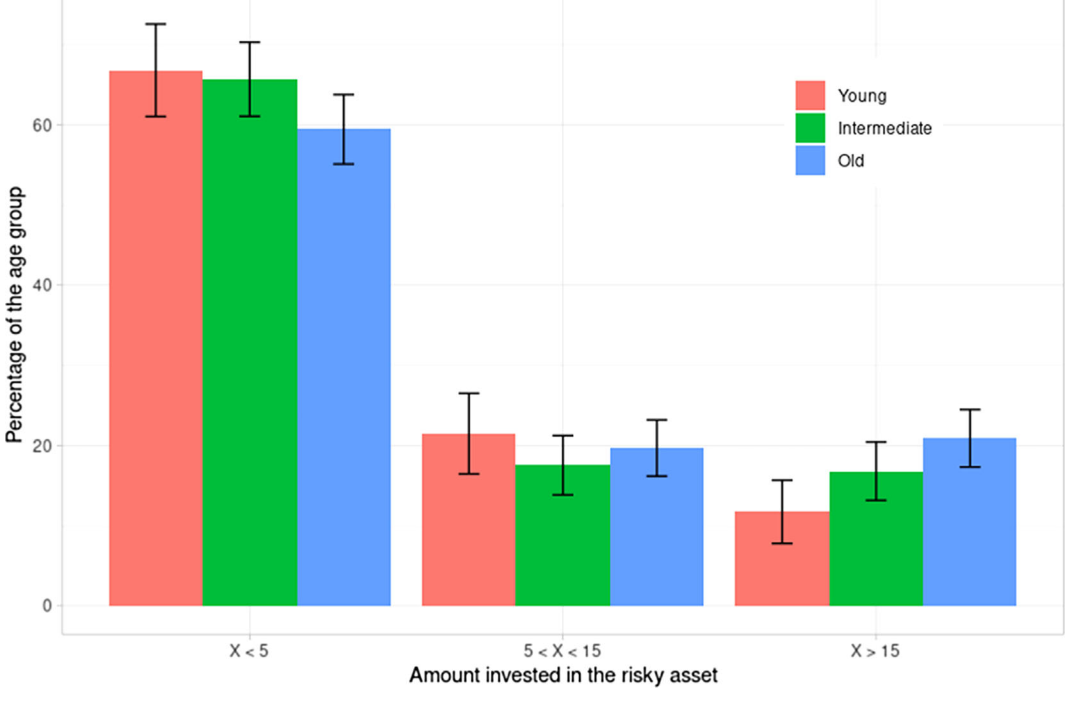

FIGURE 2 Investment by age group over three investment intervals. The percentages represent the proportion of each age group that invested X € in the risky asset. Error bars denote the confidence interval at the 5% significance level. [Color figure can be viewed at wileyonlinelibrary.com]

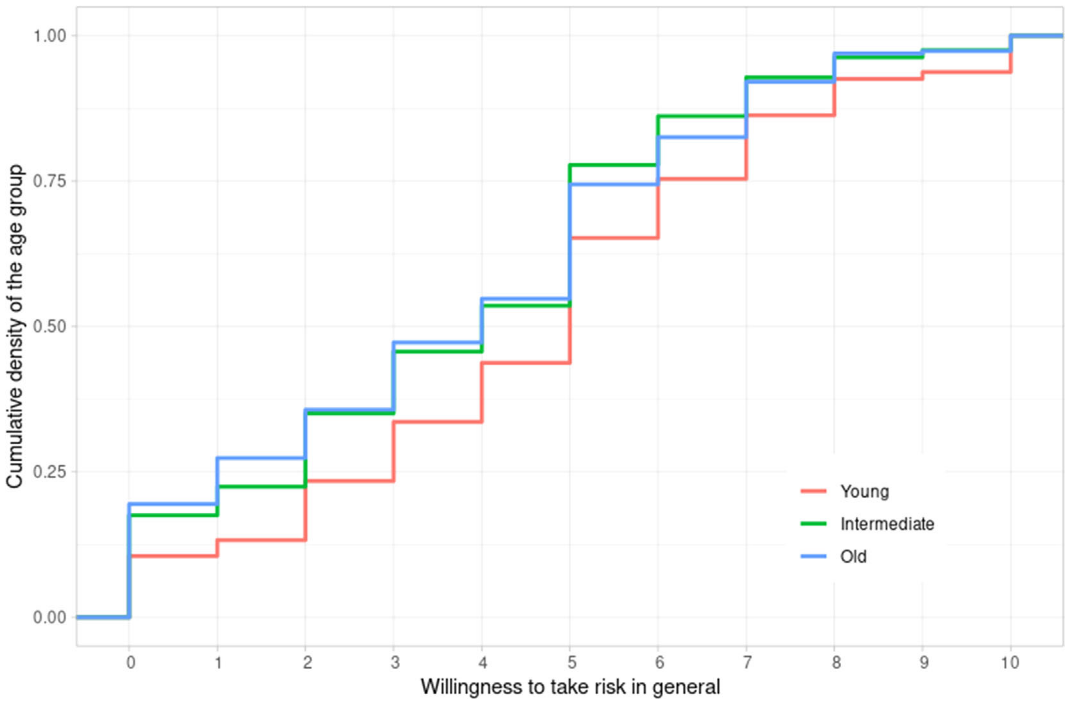

FIGURE 3 Cumulative density functions (CDF) of stated general risk tolerance, by age category. [Color figure can be viewed at wileyonlinelibrary.com]

Based on the regression outcomes depicted in Table 4, we find that elicited risk tolerance, measured by the amount invested in the risky asset, increases with age at a decreasing rate (model 1). This finding remains robust if we consider $1/r$ instead, where $1/r$ represents the reciprocal of the estimated CRRA parameter (models 3–4).

Unlike elicited risk tolerance, self-reported risk tolerance (in general) demonstrates a negative correlation with age. We establish that the self-reported tolerance to risks in general diminishes with age, and this reduction intensifies as age increases (model 5). This outcome remains consistent when introducing control variables and spans across various domains. Therefore, our findings regarding stated risk preferences align with those of Dohmen et al. (2011), Falk et al. (2018), and Banks et al. (2019).

Furthermore, our analysis corroborates earlier findings that risk tolerance increases with higher education levels, and that men manifest greater risk tolerance compared to women. Importantly, these patterns persist irrespective of the elicitation method or model specifications employed. With respect to income, we establish a noteworthy positive correlation solely within the context of self-reported willingness to take risks. This finding is robust across the domains of health and finance.

Figure 4 showcases the marginal effect of age on elicited risk tolerance (left) and stated risk tolerance (right), computed through model 2 (model 6) for each participant and illustrated as a function of their age. This visual representation illustrates the divergent trends in the development of stated and elicited risk tolerance with advancing age. On average, the marginal effect of age on the invested amount in the risky asset is estimated at 0.049, while the corresponding marginal effect of age on self-reported general willingness to take risks is estimated at −0.021.

TABLE 4 Regression results for risk preferences.

	Dependent variable					
	Investment in risky asset Tobit		1/*r* Tobit		General Tobit	
	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.739*	0.897*	0.207*	0.243*	−0.144***	−0.135**
	(0.351)	(0.429)	(0.093)	(0.114)	(0.036)	(0.043)
Age^2	−0.007	−0.007	−0.002*	−0.002	0.001**	0.001*
	(0.004)	(0.005)	(0.001)	(0.001)	(0.0004)	(0.0005)
Education	1.165**	1.086**	0.309**	0.287**	0.200***	0.204***
	(0.390)	(0.399)	(0.103)	(0.106)	(0.040)	(0.041)
Income	0.639	0.782	0.157	0.195	0.163***	0.165***
	(0.399)	(0.404)	(0.106)	(0.107)	(0.043)	(0.044)
Man	4.750*	5.187**	1.266*	1.388**	0.556**	0.526**
	(1.929)	(1.936)	(0.512)	(0.513)	(0.200)	(0.200)
Constant	−34.213***	−32.386***	−9.303***	−8.671***	6.034***	5.634***
	(8.619)	(9.519)	(2.289)	(2.527)	(0.849)	(0.940)
Controls	No	Yes	No	Yes	No	Yes
	Elicited	Elicited	Elicited	Elicited	Stated	Stated
Observations	1064	1061	1064	1061	1064	1061
Log. Lik	−1760.485	−1749.125	−1416.928	−1406.839	−2420.895	−2405.541
Wald	28.275***	38.368***	28.260***	38.662***	90.738***	109.535***

Note: Tobit regressions. Standard error in parenthesis: $\cdot p < .1$; $*p < .05$; $**p < .01$; $***p < .001$. Control variables: Professional Status; City Size; Parental Responsibility.

4.2 | Result 2: Elicited patience remains unaffected by age. The evidence regarding the impact of age on time consistency is inconclusive. Stated patience increases with age at a decreasing rate

Figure 5 illustrates the empirical CDF of the average amount of euros allocated to the later date per age category. On average, individuals in the younger age group allocated 26.52 € (SD = 12.04 €) to the later date, while the intermediate age group allocated 25.51 € (SD = 12.89 €), and the older participants allocated an average of 26.34 € (SD = 12.09 €), with no statistically significant differences observed between age groups.

Figure 6 shows the CDFs of stated patience per age category. On average, participants in the younger age group indicated a lower level of patience ($M = 5.25$, SD = 2.94), than participants of the intermediate age group ($M = 5.80$, SD = 2.77) ($p = .016$), and as those of the older age group ($M = 6.37$, SD = 2.55) ($p < .001$). Similarly, the average patience level reported by participants in the intermediate age group is lower than that of older participants ($p = .02$).

Table 5 presents the outcomes of censored regressions to estimate the patience measures, and probit regression regarding time consistency. Our analysis reveals that age does not affect individuals' allocation decisions, as evidenced by model 1–2. This finding maintains its

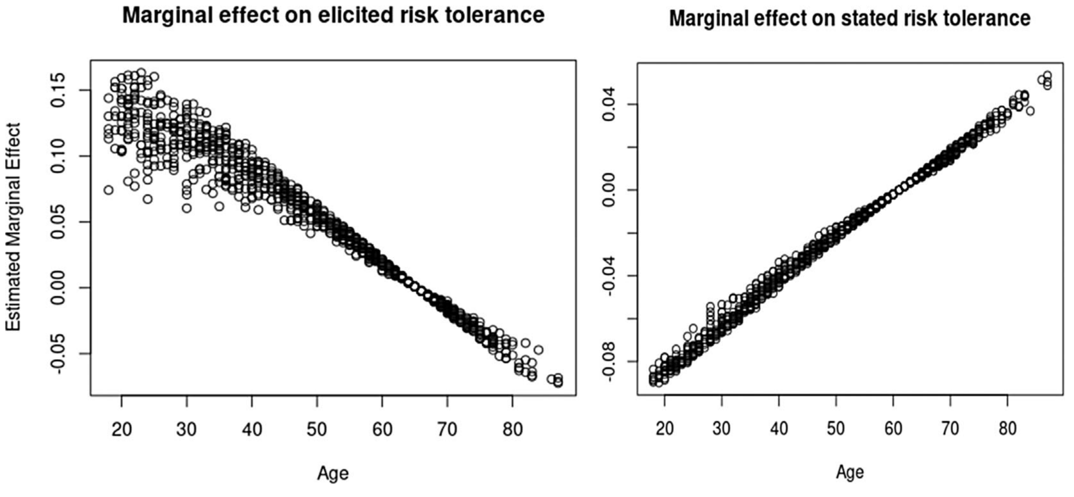

FIGURE 4 Estimated marginal effect of age on elicited (left) and stated risk tolerance (right). The left (right) figure illustrates, for each participant, the estimated marginal effect of an extra year on the invested amount in the risky asset (on the self-reported willingness to take risks in general).

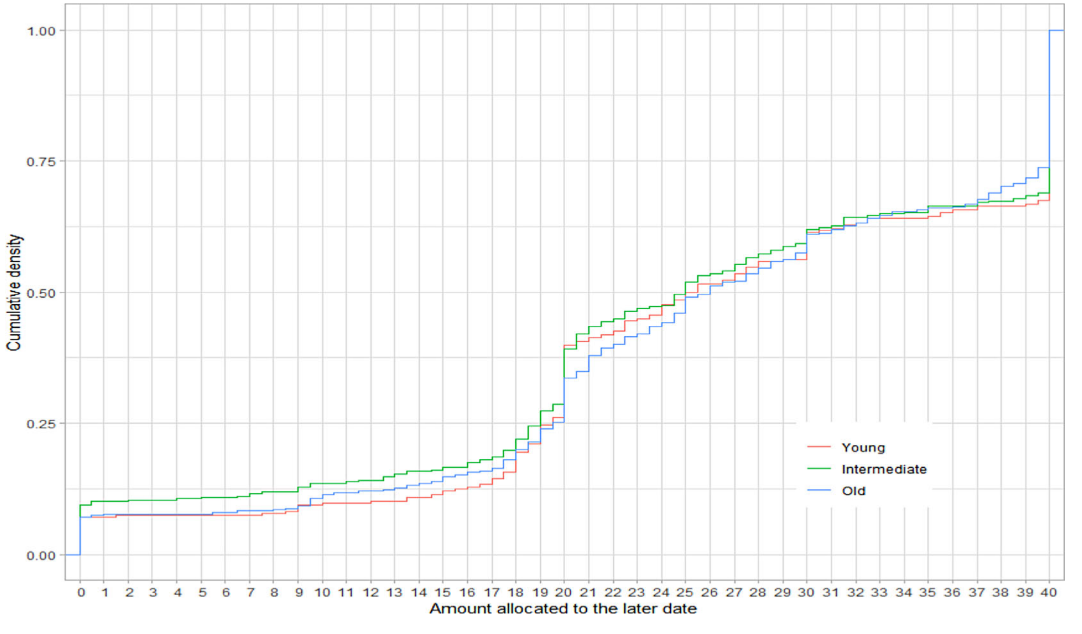

FIGURE 5 CDFs of the average amount of euros allocated to the later date per age category. [Color figure can be viewed at wileyonlinelibrary.com]

robustness when considering the parametric discount factor, as observed in models 3–4. Therefore, we replicate the findings of Dohmen et al. (2010) and Park (2019). We identify a positive correlation between education and the amount allocated to the later date, as seen in models 1–2. However, this correlation loses its robustness when the estimated discount factor is considered, as indicated in model 3–4. Regarding TC, our results exhibit a degree of variation. Age

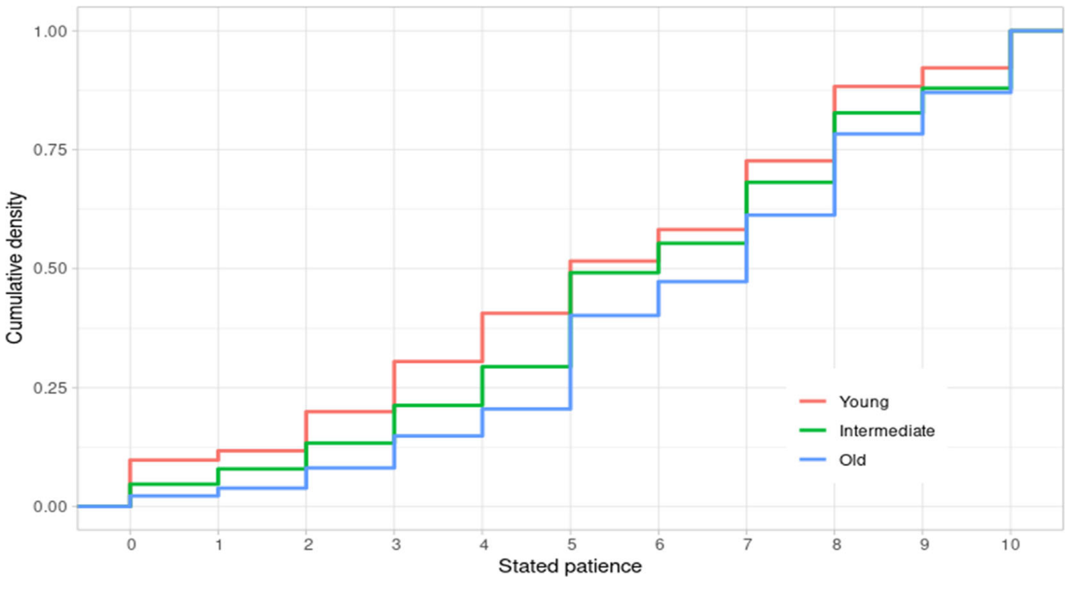

FIGURE 6 CDFs of stated patience per age category. [Color figure can be viewed at wileyonlinelibrary.com]

displays a negative correlation with time consistency, albeit exclusively in the model that excludes control variables, namely model 5. On the other hand, male participants and those with higher levels of education are more likely to exhibit TC, a pattern evident in model 5–6. Lastly, self-reported patience reveals a noteworthy trend: patience tends to increase with age, albeit at a decreasing rate, as illuminated in model 7. This reaffirms the findings of Falk et al. (2018, 2019) and Kureishi et al. (2020, 2021).

Figure 7 presents the marginal effect of age on elicited (left) and stated (right) patience, estimated with model 1 (model 7) for every individual and are graphed as a function of their age. On average, the calculated marginal effect of age on the allocation made for the later date stands at −0.0016. Furthermore, the estimated marginal effect of age on self-reported patience is estimated at 0.024.

4.3 | Result 3: Risk tolerance and impatience are negatively (positively) correlated according to elicited (stated) preferences. This association remains consistent across different age groups when considering elicited preferences and stated risk tolerance in general and in the health domain. However, this correlation strengthens with age specifically for stated risk tolerance in the domain of finance

Figures 8 and 9 picture the relation between risk tolerance and impatience, overall and by age group respectively. Panel (a) showcases the trend based on stated preferences, while panel (b) focuses on elicited preferences. Notably, the two panels depict contrasting patterns. Figure 9 specifically highlights the role of age groups in influencing this relationship. Particularly noteworthy is the divergence in behavior observed within the younger group, which appears to differ from the other age groups. Preferences within the younger group exhibit a lower level of correlation for stated methods, yet a higher level of correlation for elicited methods, when compared to the other age groups.

TABLE 5 Time preferences.

	Dependent variable							
	Allocated to later date Tobit		δ Tobit		Time consistent Probit		Stated patience Tobit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	−0.007	0.093	0.0005	0.003	−0.007**	−0.005	0.025***	0.017
	(0.035)	(0.061)	(0.001)	(0.002)	(0.002)	(0.004)	(0.006)	(0.010)
Age^2	0.001	0.001	0.00005	0.0001	−0.0002	−0.0001	−0.001**	−0.002***
	(0.002)	(0.003)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0004)	(0.0005)
Education	1.060***	1.012***	0.010	0.009	0.036*	0.033*	−0.007	0.014
	(0.239)	(0.244)	(0.008)	(0.008)	(0.016)	(0.016)	(0.041)	(0.042)
Income	0.262	0.310	−0.006	−0.005	0.023	0.025	−0.063	−0.039
	(0.263)	(0.265)	(0.008)	(0.008)	(0.018)	(0.018)	(0.044)	(0.044)
Man	1.480	1.771	0.003	0.012	0.222***	0.232**	0.103	0.139
	(1.183)	(1.183)	(0.038)	(0.038)	(0.080)	(0.080)	(0.202)	(0.202)
Constant	21.945***	25.893***	1.174***	1.256***	−0.181	−0.066	6.449***	7.263***
	(1.563)	(2.743)	(0.051)	(0.090)	(0.105)	(0.186)	(0.269)	(0.474)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Elicited	Elicited	Elicited	Elicited	Stated	Stated	Stated	Stated
Observations	1064	1061	1064	1061	1064	1061	1064	1061
Log. Lik	−3287.235	−3270.112	−1041.846	−1034.196	−719.560	−711.336	−2500.610	−2486.716
Wald	26.657***	39.630***	2.587	11.783			28.901***	41.785***

Note: Standard error in parenthesis: $\cdot p < .1$; $^*p < .05$; $^{**}p < .01$; $^{***}p < .001$. "Allocated to later date" refers to the average amount of euros allocated to the later date during the CTB task. Control variables: Professional Status; City Size; Parental Responsibility.

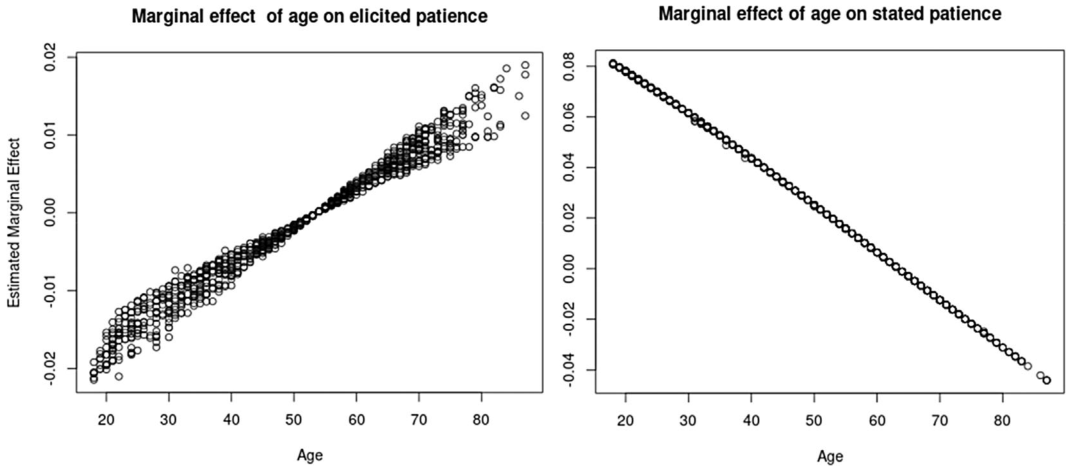

FIGURE 7 Estimated marginal effect of age on elicited and stated patience. The left (right) figure shows, for each participant the estimated marginal effect of an additional year on the average amount allocated in the later date (on the stated level of patience).

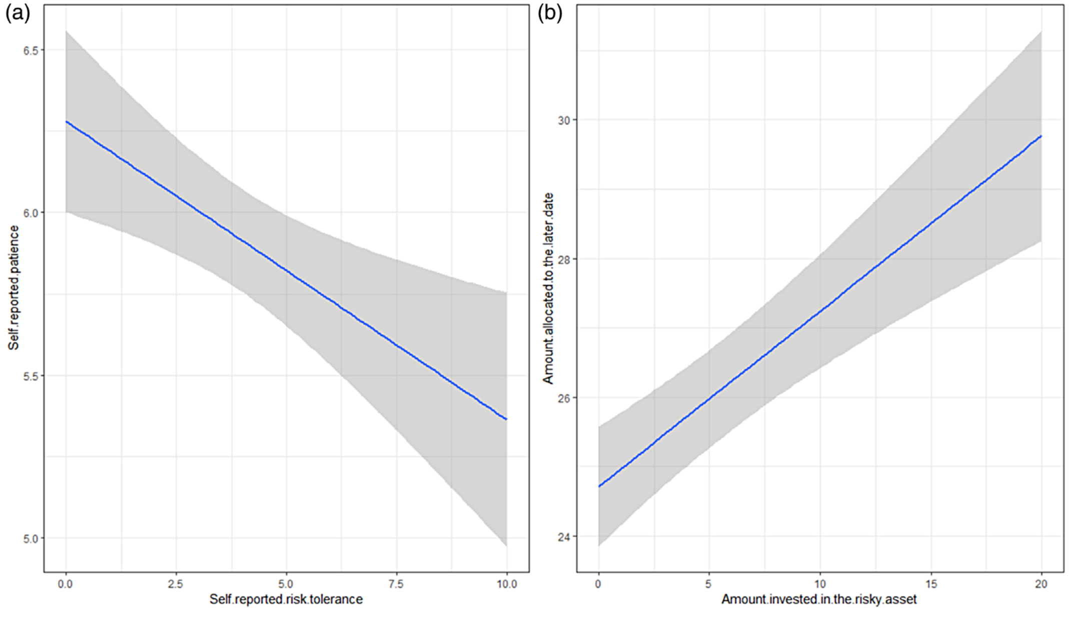

FIGURE 8 Relation between risk tolerance and patience. (a) Relation between stated risk tolerance and stated patience and (b) relation between elicited risk tolerance and elicited patience. [Color figure can be viewed at wileyonlinelibrary.com]

Nonetheless, the graphical insight does not align with the outcomes of the regression analyses. Tables 6 and 7 summarize the regression results, spotlighting the interplay between impatience (the dependent variable) and risk tolerance. The coefficients presented are derived from tobit regression models, chosen due to the censored nature of the dependent variables: c_t indicates the mean allocation for the earlier date within the CTB task, while δ denotes the daily

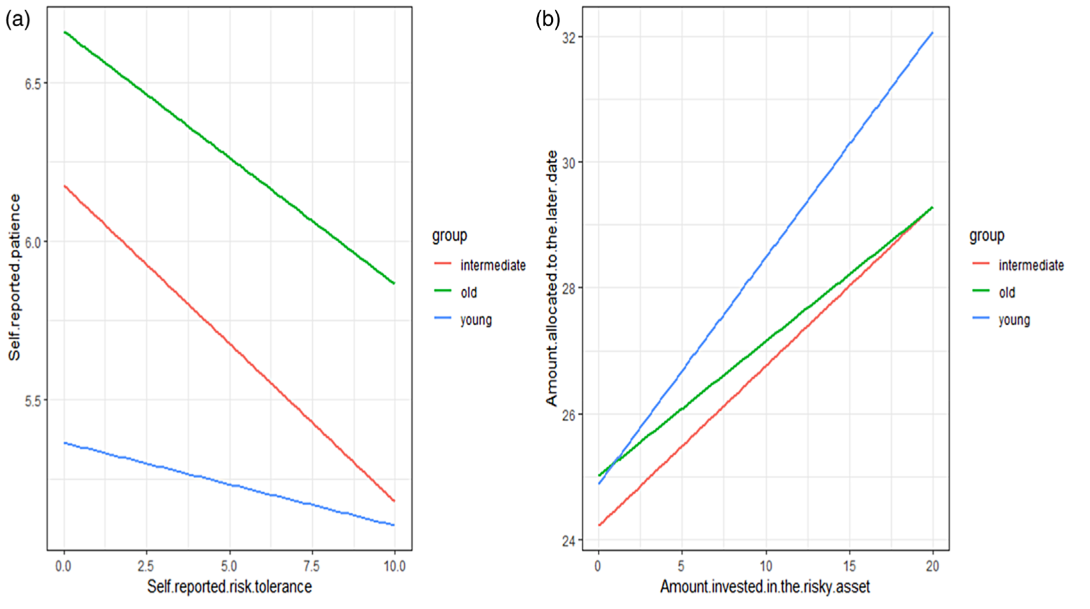

FIGURE 9 Relation between risk-tolerance and patience by age group. (a) Relation between self-reported risk tolerance and stated patience and (b) relation between elicited risk tolerance and elicited patience. [Color figure can be viewed at wileyonlinelibrary.com]

discount factor. The variable "stated impatience" is essentially the difference between 10 and the stated patience. For consistency and to sidestep any threshold effects, both the independent and dependent variables have been normalized.

The amount invested in the risky asset within the portfolio choice task displays a negative correlation with the mean allocation for the earlier date within the CTB task, as demonstrated in Table 6, specifically in model 1. This indicates that for elicited preferences, higher risk tolerance is correlated to lower (higher) impatience (patience). Critically, this relationship remains unaffected by age, as indicated in Table 6, model 2. Parallel findings are obtained for the risk tolerance parameter $1/r$ and the estimated discount factor d, as expounded upon in Table 6, encompassing models 3–6. Interestingly, for individuals for whom $\delta < 1$, higher risk tolerance results in reduced discounting, as depicted in models 3–4. Conversely, the opposite trend is observed when $\delta > 1$ (models 5–6), that is, higher risk tolerance leads to lower compounding. It seems therefore that risk-tolerance tends to mitigate both discounting and compounding.

Regarding self-reported assessments, it is worth noting that stated risk tolerance, irrespective of whether it pertains to the general context, health, or finance domains, exhibits a positive correlation with stated impatience. This observation is supported by the results presented in Table 7, specifically in models 1, 3, and 5. Essentially, these findings suggest that there exists a direct relationship: greater levels of risk tolerance are associated with higher levels of impatience.

Lastly, note that the relation between the willingness to take risks in general and stated impatience remains unaltered by age, as evidenced in Table 7, model 2. This same observation holds true when considering the health domain, as elaborated in Table 7, model 4. However, for the domain of finance, an intriguing pattern emerges. The correlation between impatience and the willingness to take risks appears to intensify with the addition of each passing year,

TABLE 6 Age and the relationship between elicited impatience and elicited risk tolerance.

	Dependent variable					
	Impatience Tobit					
	C_t (1)	C_t (2)	$\delta < 1$ (3)	$\delta < 1$ (4)	$\delta > 1$ (5)	$\delta > 1$ (6)
IRA	−0.213***	−0.219***				
	(0.048)	(0.048)				
$1/r$			0.621***	0.620***	−0.561***	−0.565***
			(0.062)	(0.062)	(0.045)	(0.046)
Age		0.030		0.058		0.038
		(0.047)		(0.064)		(0.045)
IRA * Age		0.040				
		(0.051)				
$1/r$ * Age				−0.051		0.010
				(0.069)		(0.047)
Constant	−0.221***	−0.224***	−0.136*	−0.134*	0.187***	0.187***
	(0.048)	(0.048)	(0.063)	(0.063)	(0.047)	(0.047)
Observations	1064	1064	330	330	734	734
Log. Lik	−1603.526	−1603.059	−464.255	−463.522	−1056.163	−1055.798
Wald	20.000***	20.919***	100.506***	102.196***	153.039***	153.919***

Note: Standard error in parenthesis: $\cdot p < .1$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.
Abbreviation: IRA, investment in the risky asset.

thus strengthening this connection. This phenomenon becomes particularly prominent in the presence of one more year of age, as delineated in model 6 of Table 7.

Result 3 sheds light on a significant contrast between the two methods of elicitation. Based on our elicited measures of preferences, participants who display greater risk tolerance tend to exhibit less impatience. This aligns with most observations within the experimental literature, corroborated by studies such as Anderhub and Güth (2001), Andersen et al. (2008), Burks et al. (2009), Dohmen et al. (2010), Abdellaoui et al. (2013), and Clot et al. (2017). However, when relying on survey measures, a divergent pattern emerges: subjects with higher risk tolerance levels tend to display greater impatience. Notably, some papers also uncovered a negative correlation, indicating that individuals with higher levels of patience exhibit lower risk tolerance, as seen in studies like Ida and Goto (2016) and Ferecatu and Önçüler (2016). A plausible explanation for this mixed evidence may be the methodology employed. Notably, studies demonstrating a negative correlation between impatience and risk tolerance predominantly utilized experimentally elicited preferences. Conversely, studies like Ida and Goto (2016), which relied on stated preferences, and Ferecatu and Önçüler (2016), which employed non-incentivized tasks, yielded different results. Moreover, our investigation reveals that age does not exert any influence on the relationship between risk tolerance and impatience, regardless of whether elicited preferences or stated preferences are considered.

TABLE 7 Age and the relationship between stated impatience and stated risk tolerance.

	Dependent variable					
	Impatience Tobit					
	(1)	(2)	(3)	(4)	(5)	(6)
General	0.111**	0.089*				
	(0.036)	(0.037)				
Health			0.115**	0.090*		
			(0.036)	(0.037)		
Finance					0.068	0.062
					(0.036)	(0.036)
Age		−0.152***		−0.147***		−0.166***
		(0.036)		(0.036)		(0.036)
General * Age		0.027				
		(0.036)				
Health * Age				−0.017		
				(0.035)		
Finance * Age						0.072*
						(0.034)
Constant	−0.044	−0.038	−0.044	−0.044	−0.044	−0.036
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Observations	1064	1064	1064	1064	1064	1064
Log. Lik	−1609.511	−1600.680	−1609.152	−1600.647	−1612.353	−1600.648
Wald	9.211**	27.100***	9.939**	27.171***	3.501	27.171***

Note: Standard error in parenthesis: $\cdot p < .1$; $*p < .05$; $**p < .01$; $***p < .001$.

5 | DISCUSSION

Two approaches are frequently employed to measure individual preferences within economic studies: survey-based, also known as stated preferences, and incentivized experimental measures, commonly referred to as elicited preferences. Stated preferences, owing to their simplicity and cost-effectiveness, are straightforward to implement. However, they do possess a susceptibility to hypothetical bias despite creative techniques applied to mitigate it. On the other hand, elicited preferences, grounded in incentivized tasks, tend to align more closely with revealed preferences and are thus often favored. However, they frequently necessitate intricate setups and carry potential high monetary expenses. Given the strengths and weaknesses intrinsic to each method, the combination of both within a single study can yield compelling insights. This amalgamation characterizes the approach we have undertaken in this present study. Notably, a significant portion of individual preference studies generally lean on a singular method. In this context, the work of Dohmen et al. (2010) on risk preferences stands out as an exception. They revealed that, based on experimentally elicited preferences, age is not correlated with risk tolerance; however, stated risk tolerance decreases with age. This underscores the impact of their chosen methodologies on their conclusions. Our paper brings together both methods to delve into the intricate relationships linking age, risk preferences, and time preferences. Our findings depend on the chosen methodology. Given the sensitivity of our results to the methodology, drawing definitive conclusions about the influence of age on risk and time preferences becomes challenging. Hence, we undertake a comparative analysis, juxtaposing our findings against those from several studies operating under equivalent methodologies.

Regarding risk preferences, researchers relying on stated preferences studies have generally concurred that risk tolerance tends to decrease with age. This consensus is evident in studies such as those by Vroom and Pahl (1971), Ackert et al. (2002), Dohmen et al. (2010, 2011, 2017), Sahm (2012), Falk et al. (2015, 2018), and Banks et al. (2019). In contrast, investigations grounded in experimentally elicited preferences have yielded a more varied set of outcomes. While some studies observed a decline in risk tolerance with age (e.g., Ackert et al., 2009; Grubb et al., 2016; Heinrich & Shachat, 2020; Mather et al., 2012; Meissner et al., 2023), others reached the opposite conclusion (Piovesan & Willadsen, 2021; Wang & Hanna, 1997), and still others found no discernible effect (Dohmen et al., 2010; Horn et al., 2021). The diversity in results among elicited preferences studies can be attributed to a range of factors. Variations in experimental tasks, such as portfolio choice tasks, MPL methods, lottery choice tasks, or BRET, play a role. Differences in sample composition, spanning children, students, and the general population, also contribute. Furthermore, cultural disparities are noteworthy, as evidenced in studies like Heinrich and Shachat (2020) and Piovesan and Willadsen (2021). However, we hold the belief that the primary factor contributing to the diversity in findings can be attributed to the diversity in experimental tasks. This disparity becomes particularly evident when comparing studies that employ risk preferences questionnaires, which tend to yield more consistent outcomes. This coherence is likely due to the high standardization of these questionnaires, ensuring a uniform approach across different studies. In contrast, the multiplicity of experimental tasks in elicited preferences studies can introduce variability, as participants' reactions might be influenced by the distinct attributes and complexities of each task.

When it comes to time preferences, studies relying on stated preferences methods have not reached a unanimous agreement concerning the correlation between age and patience. Several papers have noted a trend of patience increasing with age throughout an individual's life cycle (e.g., Falk et al., 2015, 2018; Heimer et al., 2019; Kureishi et al., 2020, 2021). However, certain investigations have indicated a U-shaped pattern, with individuals in middle age exhibiting the highest levels of patience (e.g., Chao et al., 2009; Falk et al., 2018). In contrast, Park (2019) did not find any age-related effect on patience. Huffman et al. (2019) demonstrated that patience tends to decline beyond the age of 70.

Likewise, studies grounded in elicited preferences have also yielded mixed results. Some studies have discovered a positive correlation between patience and age (e.g., Bettinger & Slonim, 2007; Harrison et al., 2002; Meissner et al., 2023), while others have found no significant effect (e.g., Daly et al., 2009; Dohmen et al., 2010; Horn et al., 2021). Consequently, consensus remains elusive regarding whether and how age impacts patience, regardless of whether stated preferences or elicited preferences methods are utilized. This points to the necessity for more extensive empirical and longitudinal studies to comprehensively understand the intricate relationship between age and time preferences.

We acknowledge several limitations in our research. First, our study was conducted online, and this approach is not without its drawbacks. One prevalent concern with web-based experiments and surveys is the potential lack of a controlled environment. This absence of control might introduce biases in the measurement of participants' genuine preferences. For instance, distractions in a noisy online environment could diminish participants' focus, possibly leading to errors during the experiments. However, it is noteworthy that existing literature has not conclusively shown whether these biases are more pronounced in the context of elicited or stated preferences measurements. Nevertheless, it is worth considering the possibility that studies relying on incentivized tasks could introduce a participation bias due to the allure of monetary rewards. This incentive might prompt individuals to repeatedly participate in an attempt to increase their potential payoff, potentially skewing the sample composition and resulting in an unrepresentative participant group. This bias could influence the findings, and it is important to acknowledge this potential limitation.

Second, we recognize another significant limitation in our research related to elicited risk tolerance, which is the potential impact of background risk (BR). Our data collection took place during the initial Covid-19 pandemic lockdown (April–May 2020) in France, and the pandemic introduced a substantial health BR. This type of risk is unavoidable and uninsurable, and given that older individuals were more susceptible to the effects of Covid-19, their actual risk tolerance might be higher than what our elicited risk tolerance measures captured. This consideration is particularly relevant because the presence of a BR, as demonstrated by Beaud and Willinger (2015) in a student sample of 279 individuals, can lead to a substantial proportion of participants (80%) exhibiting risk vulnerability—meaning their risk tolerance decreases significantly when exposed to a BR. Consequently, our risk preference measurements are likely to reflect an increased degree of risk aversion resulting from the presence of the health BR. Moreover, given that older individuals are particularly exposed to the consequences of this health BR, the potential for this bias could be even more pronounced in their case when compared to younger participants. Furthermore, it is feasible that older individuals might perceive social expectations to take fewer risks than their younger counterparts, particularly in the health domain. This perception could prompt them to report a lower risk tolerance than their actual tolerance to align with social desirability considerations. While these biases are plausible, their precise magnitude remains uncertain, as we currently lack an assessment of their extent.

A third limitation pertains to the age distribution within our sample, with a significant majority of participants being older than 50 years ($n = 596$, 52%). This skewed age distribution might impact the interpretation of certain findings. For instance, the observed pattern of risk tolerance being notably lower in health and finance domains in comparison to the general domain could be influenced by the prevalence of older individuals in our sample. Concerning time preferences, while numerous studies have established that time discounting generally decreases with age (e.g., Falk et al., 2015, 2018; Green et al., 1994; Heimer et al., 2019; Kureishi et al., 2020, 2021), our study's findings diverged in one aspect. We observed that age did not significantly affect discounting in the financial domain. This result might be attributed to the substantial proportion of older individuals in our sample. Notably, the majority of participants associated with an estimated discount factor ranging between 0.5 and 1.5 were over 55 years old. As a result, the evolution of the estimated discount factor predominantly stemmed from the older age group within our study. It is important to acknowledge that, ideally, gaining a comprehensive understanding of the evolution of individuals' financial discounting would necessitate a longitudinal study founded on revealed preferences, analyzing actual financial decisions (Kureishi et al., 2020, 2021). Such an approach could provide a more accurate representation of how financial discounting changes over time.

Finally, it is essential to emphasize that our study's objective is to highlight a connection between age and preferences, rather than to pinpoint the underlying reasons for this relationship. An inherent limitation is that we cannot manipulate age, and controlling for all conceivable confounding variables and higher-order effects is practically unfeasible. Consequently, while we observe an association between age and preferences, we must exercise caution in inferring causality from age to preferences, especially considering that the reverse causality seems less plausible. Notably, we acknowledge that our study lacks the measurement of cognitive ability, a factor known to be correlated both with elicited preferences methods and with age-related decline. The absence of cognitive ability data means that we cannot definitively ascertain whether the age-preference relationship is influenced by cognitive decline or if other factors contribute. This further highlights the complexity of drawing causal conclusions from observational studies in which multifaceted variables intertwine.

6 | CONCLUSION

We implement both the stated preferences and elicited preferences methods to investigate the interactions between age, risk tolerance, and impatience. We find that for stated preferences measures, both risk tolerance and impatience tend to decline with age. In contrast, elicited preferences measures (i.e., based on incentivized tasks) reveal that age increases risk tolerance and has an insignificant effect on impatience. In addition, we found that individuals who are more risk-tolerant are less impatient according to their elicited preferences and that this relationship is not affected by age. However, according to our stated preferences measures, risk tolerance is positively related to impatience, and the relationship is independent of age in general and in the health domain but is strengthened by age in the financial domain. Indeed, one additional year of age leads to a greater increase in impatience in people with a higher willingness to take risks than in people with a lower willingness to take risks in the financial domain. To our knowledge, this paper is the first to address the issue of how the relationship between risk and time preferences evolves with age.

Few studies have considered the effect of age when analyzing the relationship between economic preferences and certain individual characteristics (e.g., education, income, and gender). The underlying difficulty of analyzing the effect of age on economic preferences is the interaction between age and some important confounding factors: education, income, and gender. In our study, we systematically attempted to address the attenuation or amplification effects of these confounding factors to disentangle the influence of age from that of other covariates. By doing so, we fill an important gap in the growing literature on economic preferences that has neglected these confounding factors. For example, some studies showed that education increases risk tolerance (e.g., Falk et al., 2018; Meissner et al., 2023, etc.), while some reveal that men are more impatient than women (e.g., Bettinger & Slonim, 2007; Dittrich & Leipold, 2014; Meissner et al., 2023). We find that stated risk tolerance decreases with age but at a slower pace for highly educated individuals, and patience increases with age but at a slower pace for men.

Overall, our study contributes valuable insights into the complex interplay between age, risk tolerance, and impatience, highlighting the importance of considering multiple methods and confounding factors to better understand the nuanced relationships within economic preferences.

ACKNOWLEDGMENTS

The authors are thankful to Thierry Blayac, Dimitri Dubois, Sébastien Duchêne, Phu Nguyen-Van, and Bruno Ventelou for their contribution to the design of the survey and their comments on the manuscript.

FUNDING INFORMATION

This project has been funded by the French National Research Agency (ANR) and by the Occitanie region.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Wang, Z., Rafaï, I., & Willinger, M. (2023). Does age affect the relation between risk and time preferences? Evidence from a representative sample. *Southern Economic Journal*, 1–28. https://doi.org/10.1002/soej.12662