Risk Aversion and Savings Behavior

Antoine Bommier François Le Grand Lionel Wilner*

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Abstract

This paper investigates the relationship between lifetime savings and risk aversion. First, we take a theoretical approach in a two-period framework with a very general non-parametric model. We show that risk aversion reduces savings in the presence of mortality risk. We then verify the negative impact of risk aversion on savings in a numerical exercise, with a multi-period setting where mortality risk is calibrated on actual demographic life tables. Finally, we check that this prediction holds based on an econometric analysis, resorting to the US Health and Retirement Study (HRS) longitudinal survey. The result is robust to different specifications for risk aversion and savings, and to the introduction of a number of controls – including income risk.

Keywords: risk aversion, savings, lifecycle models.

JEL codes: D15, G51, J14.

1 Introduction

Some statements seem so intuitive that they are often accepted without debate or challenge. One of them is that risk aversion increases savings. Since savings serve as a buffer against adverse outcomes, such as unemployment spells or unexpected health expenditures, it seems natural to think that more risk averse individuals should accumulate more wealth to prepare for such adverse events. However, this prediction has transcended the specifics of precautionary savings, evolving into a generalized intuition presumed to hold regardless of the economic environment. This premise is now so deeply entrenched in economic thinking that a positive correlation between elicited risk aversion and savings is sometimes used as a criterion

*Bommier: ETH Zurich; abommier@ethz.ch. LeGrand: ESSEC Business School and Thema; francois.le.grand@essec.edu. Wilner: CREST; lionel.wilner@ensae.fr. We thank Marie Brière, Jeanne Commault, Brigitte Dormont, and Mariacristina De Nardi for insightful comments, as well as audiences at CREST and Insee seminars, The Microeconomics of Ageing workshop (ETH Zurich 2023), and the Pensions and Ageing workshop (Caisse des Dépôts et des Consignations, Paris 2023).

for external validity in experimental economics (see, e.g., Galizzi et al., 2016 or Charness et al., 2020).

However, a rigorous examination of the empirical record challenges this "indisputable truth". The empirical literature reveals little evidence of a positive relationship between risk aversion and savings. While measurement difficulties historically limited empirical work on risk aversion, recent household surveys that directly elicit risk preferences have challenged this received wisdom. Several studies relying on such surveys (e.g., Bartzsch, 2008, Schunk, 2009, Limosani and Millemaci, 2014) report a statistically significant *negative* relationship between risk aversion and savings, while others (e.g., Noussair et al., 2014 and Charness et al., 2020) find no significant effect. These findings are often treated as anomalies or attributed to unobserved heterogeneity, with authors struggling to reconcile their estimates with the standard precautionary motive.[1] We advance an alternative hypothesis: the negative impact of risk aversion on savings is not an empirical anomaly, but the inherent outcome of mortality risk, the effects of which tend to dominate all other risks, including financial ones.

Our contribution combines theoretical, numerical, and empirical analyses to investigate this hypothesis. First, using a general non-parametric two-period model, we demonstrate that risk aversion reduces savings when agents face mortality risk. Intuitively, mortality creates a risk that accumulated savings may never be consumed; higher risk aversion exacerbates the welfare cost of this loss, effectively increasing impatience. We also show that the joint impact of mortality and risk aversion is negative until advanced ages: mortality risk tends to reinforce the heightened impatience implied by risk aversion. Second, our numerical analysis complements the theoretical framework by considering a more realistic multi-period lifecycle model. We assume that individuals hold risk-sensitive preferences and face an age-dependent mortality risk calibrated using demographic life tables.[2] Consistent with our theoretical results, our simulations confirm that risk aversion depresses savings. Moreover, this negative impact is found to be larger in absolute magnitude when mortality is higher. Finally, we test these predictions using data from the Health and Retirement Study (HRS) longitudinal survey that includes variables about risk aversion, mortality risk, and wealth accumulation. Consistent

[1] For example, Bartzsch (2008) writes "The coefficient of risk aversion is highly significant and negative. This result might seem to be somewhat counterintuitive and is in contrast to the positive effect usually found by simulations. But, as shown by Carroll (1997), this outcome is possible in a buffer-stock model and arises when the effect of a lower intertemporal elasticity of substitution is stronger than the precautionary savings motive. Notwithstanding, an omitted variable bias might be responsible for the negative coefficient of risk aversion. But it is at least not evident what variable could have been omitted."

[2] Risk-sensitive preferences were shown to be the only ones to disentangle risk aversion from intertemporal substitutability, while assuming preference monotonicity, stationarity and the structure of Kreps and Porteus (1978)'s dynamic choice theory. See Bommier et al. (2017).

with our theoretical and numerical analyses, we find that both risk aversion and mortality decrease savings.[3] Moreover, the interaction term between mortality and risk aversion is negative and statistically significant, consistent with risk aversion amplifying the negative association between mortality risk and wealth. These empirical relationships should be read as conditional correlations, not causal effects. While the theoretical effect is ambiguous—risk aversion should theoretically amplify both the precautionary motive (hence a positive effect on savings) and the mortality effect (hence a negative effect on savings)— the econometric analysis reveals that the mortality channel is empirically dominant. Although our analysis confirms the existence of a precautionary motive in response to income risk, the interaction term between risk aversion and income risk is statistically insignificant. The negative impact of risk aversion on wealth accumulation stands in contrast to the conventional wisdom, which relies on intuitive arguments related to precautionary motives but abstracts from mortality effects.

The rest of the article is organized as follows. Section 2 presents our theoretical framework and derives our predictions on the effect of mortality risk, risk aversion, as well as their joint effect on savings behavior in a two-period setting. Section 3 is devoted to numerical simulations in a multi-period setting. We present our data and econometric specification in Section 4. We discuss our results in Section 5, and some robustness checks in Section 6. Finally, we conclude in Section 7.

2 Formal results in a two-period framework

In this section, we formally characterize the comparative statics of savings within a two-period framework. Specifically, we demonstrate that savings decrease with higher mortality risk and increased risk aversion, and that these effects tend to reinforce each other. These findings are derived within a model-free setup, relying on minimal assumptions. We begin by presenting this setup.

2.1 Setting and preferences

We assume that agents live for either one or two periods, with p denoting the probability of surviving into the second period. Agents choose consumption pairs $(c_1, c_2) \in X$ where X is a subset of $\mathbb{R}^2_+$.[4] Here, c_1 represents first-period consump-

[3] Based on the same survey, though further restricted to a subsample of 387 individuals with consumption data, Salm (2010) documents a negative relationship between subjective mortality risk and nondurable consumption growth. This does not contradict our results: we find that higher subjective mortality risk diminishes the stock of savings.

[4] By allowing X to be smaller than $\mathbb{R}^2_+$ we incorporate the possibility of a minimum consumption level, which can be useful to exclude scenarios in which agents might prefer not to survive due to extreme poverty.

tion, while c_2 denotes either second-period consumption if the agent survives or the bequest if the agent dies at the end of the first period.

Agents have preferences over consumption levels and survival probabilities, represented as triplets (c_1, c_2, p) belonging to $X \times [0,1]$. We denote such a preference relationship by $\succeq$ and we assume it can be represented by a continuously differentiable utility function $\phi : X \times [0,1] \to \mathbb{R}$.

To articulate the assumptions necessary for our results, it is useful to define the *lifetime* utility functions U_1 and U_2, corresponding to the utilities from living one period for sure and living two periods for sure, respectively. Formally, these lifetime utilities map X into $\mathbb{R}$ as follows:

$$\begin{cases} U_1(c_1, c_2) = \phi(c_1, c_2, 0), \\ U_2(c_1, c_2) = \phi(c_1, c_2, 1). \end{cases}$$

Our first assumption is that agents strictly prefer longer lives to shorter ones.

Assumption 1. *For all* $(c_1, c_2) \in X$*:*

$$U_1(c_1, c_2) < U_2(c_1, c_2).$$

This assumption posits that, for a given consumption bundle, agents strictly prefer experiencing this bundle over two periods rather than one.

Our second assumption is that preferences are monotonic with respect to first-order stochastic dominance. Formally:

Assumption 2. *For all* $(c_1, c_2), (c_1', c_2') \in X$*:*

$$\begin{cases} U_1(c_1', c_2') \geq U_1(c_1, c_2) \\ \textit{and} \\ U_2(c_1', c_2') \geq U_2(c_1, c_2) \end{cases} \Rightarrow \phi(c_1', c_2', p) \geq \phi(c_1, c_2, p) \textit{ for all } p \in (0,1),$$

with, moreover, $\phi(c_1', c_2', p) > \phi(c_1, c_2, p)$ *when* $U_1(c_1', c_2') > U_1(c_1, c_2)$ *or* $U_2(c_1', c_2') > U_2(c_1, c_2)$*.*

Monotonicity says that a consumption path (c_1, c_2) should not be chosen if another available path (c_1', c_2') provides better utilities regardless of survival. In other words, if a consumption path dominates another one—in the sense that the former is always ex post preferred to the latter—then the former should be ex ante preferred. Therefore, Monotonicity rules out the choice of dominated strategies. This property holds, for instance, in the standard expected-utility model. Arrow (1951, p. 426) described this assumption as being "extremely reasonable".

A noteworthy implication of Monotonicity is that the utility function $\phi(c_1, c_2, p)$ can be derived from the "aggregation" of the lifetime utilities associated with living

one or two periods for sure. The ex ante utility function can thus be viewed as a function of lifetime utilities and survival probability. We have the following lemma.

Lemma 1. *If the preference relation associated with ϕ is monotone, there exists a (unique) real-valued function ψ, such that for all $(c_1, c_2, p) \in X \times [0,1]$:*

$$\phi(c_1, c_2, p) = \psi(\phi(c_1, c_2, 0), \phi(c_1, c_2, 1), p). \tag{1}$$

The function ψ is defined on the domain $D \times [0,1]$, where:

$$D = \{(u_1, u_2) \in \mathbb{R}^2 : u_1 = \phi(c_1, c_2, 0) \text{ and } u_2 = \phi(c_1, c_2, 1) \text{ for some } (c_1, c_2) \in X\},$$

For any $p \in [0,1]$, the function $(u_1, u_2) \in D \mapsto \psi(u_1, u_2, p)$ is increasing.

The formulation of equation (1) clarifies that choices under uncertainty (i.e., when $p \in (0,1)$) involve trade-offs between the two possible lifetime utilities (i.e., death at the end of the first period, or survival for two periods), and this trade-off depends on the actual survival probability. For analytical simplicity, we assume in the rest of the section that the function ψ is continuously differentiable with strictly positive derivatives. This assumption can be relaxed, as detailed in Assumption 6 in Appendix A.2. The characterization of comparative risk aversion in Lemma 2 is proven under this weaker assumption.

Our third assumption is consequentialism.[5]

Assumption 3. *For all $(U_1, U_2) \in D$, we assume:*

$$p' \geq p \;\Rightarrow\; \frac{\frac{\partial \psi}{\partial U_2}(U_1, U_2, p')}{\frac{\partial \psi}{\partial U_1}(U_1, U_2, p')} \geq \frac{\frac{\partial \psi}{\partial U_2}(U_1, U_2, p)}{\frac{\partial \psi}{\partial U_1}(U_1, U_2, p)}. \tag{2}$$

This property of consequentialism states that as the likelihood of living two periods increases, agents are more willing to trade utility obtained in a one-period life scenario (U_1) for utility obtained in a two-period life scenario (U_2). Said differently, agents become more concerned with what happens in a given state of the world when that state becomes more likely. Such an assumption, which appears very natural, is obviously fulfilled in the case of expected utility (where $\psi(U_1, U_2, p) = (1-p)U_1 + pU_2$)), but also for all kinds of bi-separable preferences (Ghirardato and Marinacci, 2001), which encompass a broad class of non-expected utility models.

2.2 Comparative risk aversion

We now examine the concept of comparative risk aversion. To do so, we consider two agents A and B, who have monotone preferences and make identical choices

[5] We provide a general definition of consequentialism in Definition 2 of Appendix A.

in the absence of uncertainty. As discussed in the seminal works of Kihlstrom and Mirman (1974) and Epstein and Zin (1989), comparing agents in terms of risk aversion requires that they rank deterministic outcomes similarly when there is no risk. We denote their utility functions in the presence of mortality risk with a superscript: ϕ^A represents the preferences of agent A, while ϕ^B represents those of agent B. Since both agents' choices coincide in the absence of risk, their ex ante utility can be expressed as the aggregation of the same lifetime utility functions U_1 and U_2. Formally, there exist two functions ψ^A and ψ^B and two lifetime utility functions U_1 and U_2, such that the preferences of A and B can be expressed as follows:

$$\phi^A(c_1, c_2, p) = \psi^A(U_1(c_1, c_2), U_2(c_1, c_2), p), \tag{3}$$

$$\phi^B(c_1, c_2, p) = \psi^B(U_1(c_1, c_2), U_2(c_1, c_2), p). \tag{4}$$

The proof of this result can be found in Lemma 5 of Appendix A.2.

Comparing the risk aversion of both agents is based on the following definition.

Definition 1. We say that agent A is more risk averse than agent B if and only if for all $(U_1, U_2), (U_1', U_2') \in D$ such that $U_1' \leq U_1 \leq U_2 \leq U_2'$ and $p \in [0, 1]$ we have:

$$\left(\psi^A(U_1', U_2', p) \geq \psi^A(U_1, U_2, p)\right) \Rightarrow \left(\psi^B(U_1', U_2', p) \geq \psi^B(U_1, U_2, p)\right). \tag{5}$$

In the statement above, we consider utility pairs satisfying $U_1' \leq U_1 \leq U_2 \leq U_2'$: The utility pair (U_1', U_2') brackets the utility pair (U_1, U_2). Compared to (U_1, U_2), (U_1', U_2') implies a lower utility in the bad state, when the agent lives only one period ($U_1' \leq U_1$) and a higher utility in the good state, where the agent lives two periods ($U_2' \geq U_2$). The utility pair (U_1', U_2') thus represents a risk increase compared to (U_1, U_2). Definition 1 states that an agent is more risk averse than another one if any risk increase preferred by the more risk averse agent is also preferred by the less risk averse agent. This definition of comparative risk aversion is similar to that of Yaari (1969), with one difference. Our notion of risk increase is a notion of utility spread, as in Bommier et al. (2012), whereas Yaari considered a lottery riskier than another only when the latter was riskless.

The following result explains the implications of comparative risk aversion for utility functions.

Lemma 2. *Agent A is more risk averse than agent B, if and only if for all $(U_1, U_2) \in D$ and all $p \in (0, 1)$:*

$$\frac{\frac{\partial \psi^A}{\partial U_1}(U_1, U_2, p)}{\frac{\partial \psi^A}{\partial U_2}(U_1, U_2, p)} \geq \frac{\frac{\partial \psi^B}{\partial U_1}(U_1, U_2, p)}{\frac{\partial \psi^B}{\partial U_2}(U_1, U_2, p)}. \tag{6}$$

Lemma 2 states that, compared to the less risk averse agent, the more risk averse agent is more willing to sacrifice utility obtained in the good state (i.e., two-period life) for an increase in utility in the bad state (i.e., one-period life). The characterization implied by inequalities (2) and (6) is quite general, as it does not rely on any specific decision model (such as expected utility). However, as discussed in the next section, it is sufficient to derive clear-cut results on how mortality risk and risk aversion impact savings behaviors.

2.3 Savings behavior

To analyze agents' savings behavior, we assume that the two agents, A and B, are endowed with the same initial wealth W and can save without borrowing restriction through a riskless asset that yields a gross interest rate $R > 0$. The consumer problem involves finding the first- and second-period consumption pair (c_1, c_2) that maximizes utility subject to a given mortality risk and a budget constraint.

Formally, for a survival probability $p \in [0, 1]$, the consumer problem of agent $i = A, B$ can be written as follows:

$$\max_{(c_1,c_2)\in\mathbb{R}^2_+} \phi^i(c_1, c_2, p) \text{ s.t. } c_1 + \frac{c_2}{R} \leq W, \tag{7}$$

which is supposed to admit a unique solution.[6]

This consumption-saving problem can be reformulated using the notation from the previous section, particularly equations (3)–(4), as follows:

$$\max_{s\in[0,W]} \psi^i(U_1(W - s, Rs), U_2(W - s, Rs), p). \tag{8}$$

Under Assumption 4, the objective is strictly concave in s and the solution is unique. For conciseness, we denote the optimal savings solving the consumer problem (8) by $s^i_*(p)$, or simply s^i_* to avoid overloading the notation by dependencies (e.g., interest rate or wealth) that we do not focus on.

We make the following assumption.

Assumption 4. *Lifetime utility functions U_1 and U_2 verify the following two points.*

1. The functions $s \mapsto U_1(W-s, Rs)$ and $s \mapsto U_2(W-s, Rs)$ are strictly concave.
2. $\underline{s} = \arg\max_{s\in[0,W]} U_1(W - s, Rs) \leq \overline{s} = \arg\max_{s\in[0,W]} U_2(W - s, Rs)$.

The first point of Assumption 4 ensures that the consumption-saving problem in the absence of mortality risk admits a unique solution. The second point implies

[6] This can be guaranteed by assuming that $(c_1, c_2) \mapsto \phi^i(c_1, c_2, p)$ is strictly quasi-concave.

that agents save more when living for two periods than when living for only one period. While the first point is mostly technical, the second suggests that the consumption motive when alive in the second period is stronger than the bequest motive when deceased: Agents are more willing to transfer resources to a state where they are alive rather than dead.

2.3.1 Impact of mortality risk

Assumption 4 states that agents save more when their survival probability is one—meaning that they live for two periods—than when their survival probability is zero—meaning that they live for one period. The following proposition extends this relationship between survival probability and savings to a marginal variation in survival probability.

Proposition 1. *For all $p \in (0,1)$ and for $i = A, B$:*

$$\frac{\partial s_*^i}{\partial p}(p) \geq 0.$$

The proof can be found in Appendix A.3.3. The more likely survival in the second period is, the more agents save in the first period. Conversely, a higher mortality risk reduces savings, a well-known result in the case of additively separable preferences, and shown here to extend to a much wider class of models.

2.3.2 Impact of risk aversion

We now characterize the impact of risk aversion on savings behavior with the following result.

Proposition 2. *For all $p \in (0,1)$, if A is more risk averse than B, then:*

$$\underline{s} \leq s_*^A \leq s_*^B \leq \overline{s}.$$

The proof can be found in Appendix A.3.1. Proposition 2 indicates that the savings of both agents, s_*^A, s_*^B lie in the interval $[\underline{s}, \overline{s}]$: agents never save more than if they were certain to live two periods, and less if they were certain to live one period. These bounds on savings are in fact a direct consequence of preference monotonicity. The second finding is that $s_*^A \leq s_*^B$, which provides an unambiguous characterization of the role of risk aversion: *The more risk averse agent saves less than the less risk averse one.* The intuition can be understood as follows. The more risk averse an agent, the more they care for the bad state of the world (where they live only one period), and the closer their savings choice to what would be optimal in this bad state (i.e., their savings get closer to $\underline{s}$).

It is worth emphasizing that this result is very general and does not rely on a specific model of choice under risk. Another remark is that the negative relationship between risk aversion and savings holds in the presence of mortality risk only. Should we consider income risk only, precautionary saving would be increasing with income risk and risk aversion when preferences are monotone (see Bommier and LeGrand, 2019). When mortality risk and income risk are simultaneously present, the net effect of risk aversion on savings thus combines two opposing effects. It is an empirical issue to determine which of the two effects dominate.

2.3.3 Cross effect mortality × risk aversion

We finally focus on the cross effect of mortality risk and risk aversion on savings. Specifically, we investigate how the impact of mortality on savings depends on risk aversion. We know that for both agents savings increase with survival probabilities (the functions $p \mapsto s_*^i(p)$ are increasing). However, we also know that agents choose the same amount of savings in the absence of risk (that is, when $p = 0$ or $p = 1$). Indeed, agents have the same preferences in the absence of risk, and thus make the same choices. Thus, we cannot hope to derive any general result about the cross effect of mortality risk and risk aversion. In fact, whenever p is different from 0 or 1, we have $s_*^A(p) \neq s_*^B(p)$ implying that consumption levels also differ. In the absence of further assumptions on the utility functions, it is impossible to derive statements on how $\frac{\partial s_*^A}{\partial p}$ and $\frac{\partial s_*^B}{\partial p}$ compare, since "income effects" and "substitution effects" are simultaneously at play. We can nonetheless derive results in the neighborhoods of $p = 0$ and $p = 1$, by taking advantage of the fact that $s_*^A(0) = s_*^B(0)$ and $s_*^A(1) = s_*^B(1)$. This is summarized in the following result.

Proposition 3. *If the functions $p \to s_*^i(p)$ are (left-)differentiable in $p = 1$, then:*

$$\frac{\partial s_*^A}{\partial p}(p)\bigg|_{p=1} \geq \frac{\partial s_*^B}{\partial p}(p)\bigg|_{p=1} \geq 0. \tag{9}$$

If the functions $p \to s_*^i(p)$ are (right-)differentiable in $p = 0$, then:

$$0 \leq \frac{\partial s_*^A}{\partial p}(p)\bigg|_{p=0} \leq \frac{\partial s_*^B}{\partial p}(p)\bigg|_{p=0}. \tag{10}$$

The proof can be found in Appendix A.3.4. Proposition 3 shows that the cross effect of survival probability and risk aversion is expected to be positive around $p = 1$ and negative around $p = 0$. If, as in our empirical analysis, one prefers to look at the effect of mortality (rather than survival probability), the signs are simply reversed, with a negative cross effect around $p = 1$ (i.e., for low mortality levels) and a positive cross effect around $p = 0$ (i.e., when death is almost certain).

In words, a larger mortality risk—close to certain survival ($p = 1$)—reduces the savings of all agents and even more so for the more risk averse agent. The more risk averse the agents, the more their savings respond to a higher mortality risk (for p close to 1).

The cross-effects have opposite signs depending on the initial survival probability. The most empirically relevant case yet corresponds to near-certain survival. Until very advanced ages, death is indeed a very unlikely outcome. In the Human Mortality Database for 2020, the survival probability in the US general population does not fall below 80% before age 93. One would therefore expect a negative cross effect of mortality and risk aversion on savings. The numerical simulations provided in the following section seem to confirm that, when one uses mortality rates taken from actual life tables, savings decrease with mortality risk and risk aversion, and that these two effects tend to magnify each other (the cross effect being negative).

3 Numerical simulations

In this section, we verify that the results derived in the previous two-period model can be extended to a multi-period model, in which the decision-maker faces a mortality risk that is realistically calibrated. More precisely, we examine our three main theoretical statements: (i) higher mortality risk decreases savings; (ii) greater risk aversion diminishes savings; and (iii) the decrease in savings due to higher mortality risk is more pronounced for more risk-averse decision makers.

Setup. We consider decision-makers who live for a finite but unknown number of periods in an economy with a single good. They are endowed with risk-sensitive preferences and have no bequest motives.[7] In the absence of risks other than mortality, the utility function U_t representing their preferences can be defined through the following recursion:

$$U_t = u(c_t) - \frac{\beta}{k} \ln \left(p_t e^{-kU_{t+1}} + 1 - p_t \right), \tag{11}$$

where c_t is date-t consumption, u the instantaneous utility, $\beta \in (0, 1)$ the discount factor, $k > 0$ the risk aversion parameter and p_t the probability of being alive at date $t + 1$. Recursion (11) assumes that the agent's utility when dead (with probability $1 - p_t$ at $t + 1$) is set to zero. Since risk-sensitive preferences are translation-invariant, this choice is a harmless normalization—as long as no other

[7] To make the link with the previous section, the absence of bequest motive corresponds to the particular case where $U_1(c_1, c_2)$ only depends on c_1.

constraint is imposed on u. We further assume that u features constant IES $\frac{1}{\sigma} > 0$:

$$u(c) = \begin{cases} u_0 + \frac{c^{1-\sigma}-1}{1-\sigma}, & \text{if } \sigma \neq 1, \\ u_0 + \ln(c), & \text{otherwise,} \end{cases}$$

where u_0 is the utility gap between being alive and consuming one unit of good and being dead.

The agent can trade a one-period riskless asset paying the gross interest rate $R > 0$. Denoting the agent's savings choices by a_t and her income by y_t, her budget constraint is:

$$c_t + a_t \leq y_t + Ra_{t-1}. \tag{12}$$

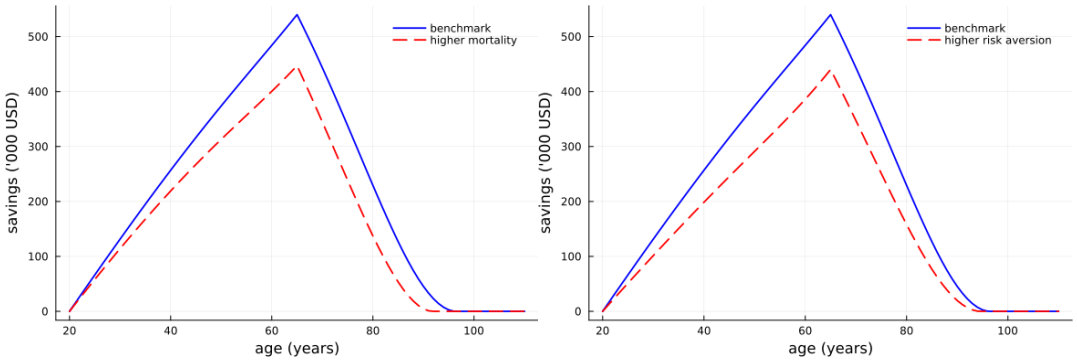
The agent's consumption-saving program thus consists of finding the allocation $(c_t, a_t)_{t\geq 0}$ that maximizes utility (11) subject to the budget constraints (12) and the borrowing constraints $a_t \geq 0$ for all t.

Calibration. We use the mortality data of the US general population in 2018 as reported in the Human Mortality Database (HMD). Beyond date T (corresponding to age 110), the agent's survival probability is null: $p_t = 0$ for $t \geq T$. The risk-free rate is set to $R = 1.02$, following Campbell and Viceira (2002). For the income process, we assume that before retirement at date T_R (set to age 65), the income is fixed and equal to $\$\,50,000$, which is roughly the average net compensation in 2018 as reported by the US Social Security.[8] After retirement, the income is assumed to be 40% of the working-age wage. The replacement rate of 40% is approximately the average value offered by the Social Security in the US (Biggs and Springstead, 2008).

Regarding preference parameters, we set $\sigma = 2$, $k = 1$, $\beta = 0.9983$, and $u_0 = 6.2407$. The value for σ is standard and the value of k is adapted from Bommier et al. (2020). The values of u_0 and β are calibrated so as to match a value of mortality risk reduction of 10 million USD (see Viscusi, 2018) and a wealth at age 65 of $\$\,540,000$, which corresponds to the average net worth of singles above 55 years with no child in 2019, as reported in the Survey of Consumer Finances.[9]

Results. In Figure 1, we report the savings paths for the benchmark calibration, showing that both higher mortality and higher risk aversion reduce savings. This corresponds to the solid blue line in the two panels. We also report in Panel 1a the savings path following a 50% increase in the mortality risk at all ages (dashed red line). Specifically, we use the same calibration as in the benchmark but consider

[8] See https://www.ssa.gov/oact/cola/central.html.
[9] See https://www.federalreserve.gov/econres/scf/dataviz/scf/table/.



(a) Impact of a 50% increase in the mortality risk at all ages.

(b) Impact of an increase in the risk aversion parameter.

Figure 1: Lifetime savings paths

updated survival rates $(p_t)_t$ as follows:

$$1 - \tilde{p}_{t,g} = \begin{cases} \min((1+g)(1-p_t), 1), & \text{for } t < T, \\ 1 & \text{for } t \geq T, \end{cases} \tag{13}$$

where g is set to 50%. The 50% increase is chosen to approximately replicate the gap in life expectancy at birth between males and females in the US in 2018, which amounts to 5.01 years. For our general population data, life expectancy at birth decreases from 78.88 years to 73.85 years after the 50% increase in mortality. Panel 1a clearly shows that higher mortality risk yields lower savings, consistent with Proposition 1.

We also report in Panel 1b the savings path following an increase in the risk aversion parameter, while the rest of the calibration, including mortality, is identical to the benchmark. The risk aversion parameter k is set to 3.689 instead of 1. This value is chosen such that the drop in savings at 65 due to the 50% higher mortality risk and the one due to the higher risk aversion are of similar magnitudes. It can be seen in Panel 1b that higher risk aversion implies lower savings. This is consistent with the result of Proposition 2. By construction, the effects on the two panels of Figure 1 are of similar magnitude at age 65 and differ at other ages, which will be helpful for identification purposes in our empirical analysis.

Finally, we analyze the joint effect of higher mortality risk and higher risk aversion. We increase both mortality *and* risk aversion, and study the impact of this joint increase net of the sum of individual increases. Computing lifetime paths as in Panels 1a and 1b presents some difficulties due to savings paths diverging with age. Indeed, the savings at a given age a reflect a direct effect of larger risk aversion and higher mortality, but also an indirect effect through the dependence on savings at age $a-1$. The effect of risk aversion and mortality is confounded

by a wealth effect. To disentangle these effects, we control for the wealth level. Specifically, at each age a, we compute the savings implied by higher mortality and higher risk aversion, starting from the savings at age $a-1$ in the benchmark calibration—i.e., as given by the blue plain line of Figure 1. This approach provides a net effect of a joint increase in risk aversion and mortality without an additional wealth effect.

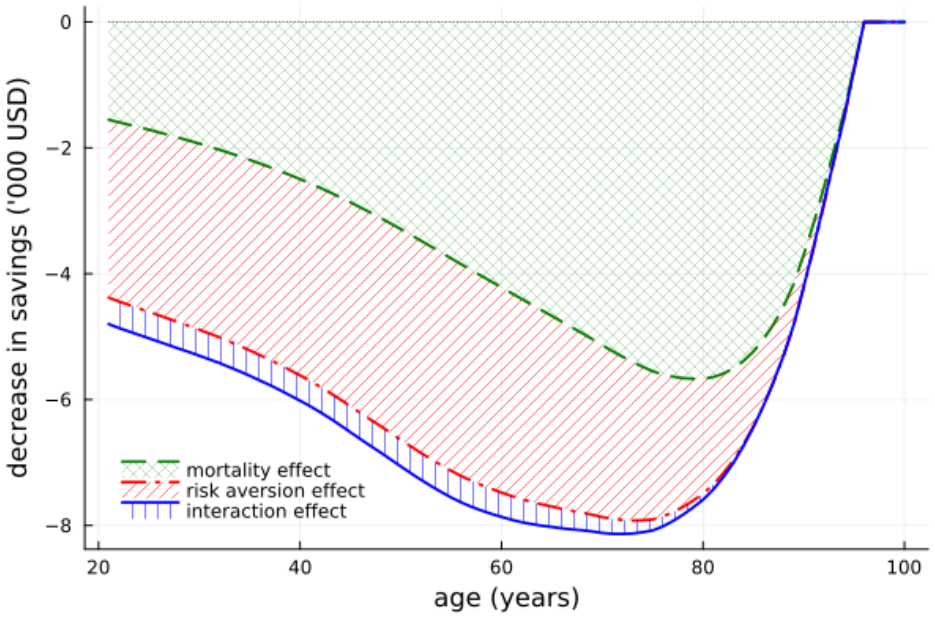


Figure 2: Savings variations implied by a joint increase in mortality and risk aversion, while controlling for initial wealth. See Section 3 for further details.

Results are plotted in Figure 2. The green area (with crossed hatches) corresponds to the decrease in savings related to higher risk aversion only, with a risk aversion parameter set to 3.689 instead of 1. The red area (with diagonal hatches) corresponds to the decrease in savings due to a 50% higher mortality risk only. The blue area (with vertical hatches) corresponds to the decrease in savings implied by the cross effect of mortality and risk aversion. In other words, the sum of the three colored areas (green, red, and blue) corresponds to the *total* decrease in savings due to higher risk aversion and higher mortality.

Consistent with the results of Propositions 1 and 2, each of higher mortality and higher risk aversion implies smaller savings, and hence a negative variation in savings. The gap between the total effect and the sum of the two individual effects measures the cross effect of mortality and risk aversion and is represented by the blue area. That effect is negative up to old ages, approximately age 80. At that age, survival probability is still quite high, above 95%. At very old ages, when survival probabilities become smaller, the cross-effect diminishes and vanishes. This is consistent with Proposition 3, even though we do not actually observe

sizably negative cross effects. This is due to the fact that, at oldest ages, agents are credit-constrained in our simulation and survival probabilities remain fairly large (they only fall below 90% at 88 and below 70% at 99). Furthermore, Figure 2 also shows that the cross-effect is much smaller than each individual effect. On average, the cross-effect is more than ten times smaller than each of the two individual effects.

These simulations deliver sign predictions for the effects of mortality risk and risk aversion, and clarify the expected interaction. They also motivate the empirical measurement choices that follow: subjective survival beliefs, elicited risk aversion, and wealth ranks as a stock outcome. The next section describes the HRS data and the econometric specification used to assess whether these predicted signs appear in the data.

4 Data and econometric specification

We now test our theoretical predictions of Propositions 1–2 using empirical data. As explained in Section 2, the role of risk aversion on savings presents a challenge. On one hand, it increases savings due to the precautionary motive; on the other hand, it decreases savings through the mortality channel described in Proposition 2. The theoretical net effect is ambiguous, making an empirical investigation necessary to characterize the actual relationship between risk aversion and savings.

In the remainder of this section, we present the data we rely on in Section 4.1 and outline our econometric specification in Section 4.2.

4.1 Data

Our empirical analysis is based on US data, namely the Health and Retirement Study (HRS), a biennial panel survey of individuals aged 50 and older conducted from 1992 to 2018. We primarily use the panel version accessible to researchers, known as the RAND HRS Longitudinal File (Version 2, released in July 2022). Below, we describe how these data are employed to measure our dependent variable, wealth, and our main regressors: risk aversion, mortality risk, and income risk.

4.1.1 Wealth

Our analysis measures household wealth in real terms, focusing on its distribution while excluding observations from the bottom 30%. This restriction mitigates potentially binding liquidity constraints, which can make savings unresponsive to marginal changes.

Definition of wealth. In detail, we rely on a concept of net wealth, defined as the difference between gross wealth and debt. Gross wealth refers to a comprehensive measure of a household's asset holdings, which includes both illiquid assets, such as real estate or businesses, and liquid assets, such as cash, bonds, or stocks.[10] Debt encompasses all mortgages and land contracts related to both primary and secondary residences, other home loans, as well as any other forms of debt. The approach to aggregating these assets and liabilities aligns with existing literature (see, e.g., Lusardi et al., 2017, Poterba et al., 2018, Angrisani et al., 2019, Been et al., 2020). To address potential measurement errors, the HRS data—particularly the section known as "section U"—have undergone corrections for inconsistencies in individuals' responses regarding assets (see Hurd et al., 2016).

Additionally, wealth is measured in real terms, with all asset balances adjusted to 2018 US dollars using the Consumer Price Index (CPI) series provided by the Bureau of Labor Statistics (BLS). Unless otherwise noted, wealth will refer to real net wealth throughout the remainder of this analysis.

One challenge in defining wealth is to determine how to allocate it among different household members. To address this concern, we define wealth at the household level rather than the individual level. This approach assumes that each household member has access to the entire wealth held by the household. This method is standard in the literature; see, for example, Poterba et al. (2018).[11] In line with this definition of wealth, our empirical analysis will incorporate covariates from both household members, when available. This approach aligns with recent empirical literature focused on intra-household decisions, such as studies by Ke (2021) and Frémeaux and Leturcq (2022), among others.

Wealth and credit constraints. Liquidity constraints can significantly impact our empirical analysis. Households facing unexpected personal shocks, such as unemployment or health problems, may be unable to borrow to mitigate these shocks. Consequently, all liquidity-constrained households may exhibit similar behavior, leaving no room for variations due to risk aversion or mortality risk. Liquidity constraints can thus be seen as a confounding factor in our analysis. Unfortunately, typical measures of liquidity constraints, such as consumption above current in-

[10] Specifically, it includes real estate (at the exclusion of residences), primary residence, secondary residence, mobile home, businesses and farms, IRA and Keogh accounts, stocks (including mutual funds and investment trusts), bonds (and bond funds), checking and savings (or money market accounts), CDs (including government savings bonds and T-bills), vehicles, trusts, and other assets.

[11] "Our unit of observation is the individual [e.g. for risk aversion], but for those who are married, we associate household wealth with each member of the couple. It can be difficult to assign ownership of assets, such as housing or jointly held financial assets, to specific household members." in Poterba et al. (2018, p.\,80).



Figure 3: Median savings rate.

come or having liquid assets within $2,000 of some income threshold, cannot be computed from the available information in the HRS.

To address this, we calculate the net savings rate for each household, defined as the ratio of the change in net wealth between past and current waves to past net wealth. We then determine the median savings rate for each percentile of the current wealth distribution. These values are reported in Figure 3. The pattern of savings rates increases along the wealth distribution; it is concave at the bottom, then linear, and finally convex at the very top. This empirical evidence aligns with findings by Fagereng et al. (2019) or Bach et al. (2020). The relationship between wealth and savings rate appears to change around the 30th percentile of the wealth distribution. Higher percentiles exhibit positive savings rates, which increase linearly and mildly with the location in the wealth distribution from 0 to 25%—except above the 95th percentile, where the increase is more pronounced. Conversely, lower percentiles in the wealth distribution exhibit negative savings rates, reflecting asset decumulation and potentially binding liquidity constraints.

To ensure that our empirical analysis is unaffected by liquidity constraints, we exclude household-year observations below the 30th percentile of each annual wealth distribution. We confirm that the age distributions remain quite similar above and below this threshold, ensuring that this selection does not exclude very old individuals who might be decumulating savings. A sensitivity analysis with respect to this threshold is provided in Section 6.

4.1.2 Mortality risk

We measure subjective mortality risk using survival probabilities at specific target ages, as self-assessed by survey respondents. We calculate a proxy for subjective mortality risk that we define as a "surmortality risk" and set equal to the difference between subjective and objective mortality risks, with the latter derived from life tables and the former from reported survival probabilities at different target ages.

The HRS has included subjective survival probabilities (SSP) since 1992 (but not in 1998), with specific target ages based on the survey year and respondents' ages. Initially, in 1992, respondents were asked about their SSP at age 85. From 1994 to 2004, the target ages varied, including 80, 85, 90, 95, or 100, depending on both the year of survey and the age of respondents. In 1998, this question was not asked to survey respondents.[12] Since 2006, individuals under 65 have been asked about their SSP at age 85. Since only individuals aged 50 to 84 are kept in our sample (see Section 4.1.3), our target ages vary between 80 and 95. As a result, we consider six distinct subjective mortality risks: the mortality risk at 80 for the 65-69 before 2006, the mortality risk at 85 for the 70-74 before 2006, the mortality risk at 90 for the 75-79 before 2006, the mortality risk at 95 for the 80-84 before 2006, the mortality risk at 80 for the 50-64 before 2006, and the mortality risk at 85 for the 50-64 in 2006. For each individual, we define subjective mortality risk as one minus the SSP, and we multiply this number by 100. This approach is grounded in a substantial body of empirical literature focused on mortality risk and related measurement issues, including works analyzing the post-2000 period (Hurd and McGarry, 1995, Gan et al., 1998, Hurd and McGarry, 2002, Hurd et al., 2004, Gan et al., 2005, Bloom et al., 2006, Hurd, 2009, Manski and Molinari, 2010, Salm, 2010, Delavande and Rohwedder, 2011a,b, Angrisani et al., 2012, Gan et al., 2015, Delprat et al., 2016, Bissonnette et al., 2017, Boyer et al., 2019, among many others).

We then use these six SSPs to build a measure of mortality risk that accounts for age within the age interval. More precisely, we denote by SSP_{it}^{T} the SSP at target age T for an individual i surveyed in year t of age age_{it}. To adjust for the fact that this probability increases within each 5-year interval, we purge it from 1-year age effects:

$$\text{SSP}_{it}^{T} = \sum_{k=0}^{4} \delta_k \mathbb{1}\{\text{age}_{it} \equiv k[5]\} + u_{it}, \tag{14}$$

where $\mathbb{1}\{\text{age}_{it} \equiv k[5]\}$ is an indicator function equal to 1 if the individual age

[12] More precisely, respondents under 70 were asked about their SSP at age 80. Those aged 70 to 74 were asked about their SSP at age 85. Respondents aged 75 to 79 were asked about their SSP at age 90. Those aged 80 to 84 were asked about their SSP at age 95. Respondents aged 85 to 90 were asked about their SSP at age 100.

is equal to k modulo 5 and zero otherwise. Our adjusted measures of subjective mortality risks correspond to $100(1-\hat{u}_{it})$, where $\hat{u}_{it} = \text{SSP}_{it}^{T} - \hat{\delta}_{\text{age}_{it}-5\lfloor \text{age}_{it}/5 \rfloor}$ is the residual of the regression (14).

Finally, we define the "surmortality risk" as the difference between this subjective mortality risk and the objective mortality risk given by the HMD for each age, gender, and year. This surmortality risk quantifies how pessimistic individuals are about their survival probability.

We assess in Section 6 the robustness of our results to the measure of mortality risk. Instead of a unique mortality risk, we will also consider the previous six subjective mortality risks $100(1-\hat{u}_{it})$ that are specific to each 5-year age interval and to the corresponding target age. Our results remain mostly unchanged under this modification.

4.1.3 Risk aversion

Individual preferences regarding risk aversion are self-reported by survey respondents and are available as a 6-valued ordinal variable. To ensure the stability of measurement over time, we primarily focus on the period from 2000 to 2006. Due to the survey design regarding this question, our analysis needs to be restricted to individuals aged between 50 and 84.

Availability of the risk aversion information across survey waves. To measure risk aversion, we rely on questions related to risk behavior in financial matters when they are available in the HRS. From 1998 to 2006, some surveyed individuals were asked a question about income gambling, and had to indicate which lottery they would favor. They had to choose among 6 available lotteries.[13] This survey setup allows us to consider six possible ordinal values for risk aversion, consistent with the literature (Barsky et al., 1997, Kimball et al., 2008, Sahm, 2012, Harrati, 2014 among many others). A similar question about risk aversion was also included in the 1992 survey, but respondents had to choose from only four possible values. From 2014 to 2018 respondents were asked to indicate their willingness to take risks along several dimensions on a scale from 0 to 10. Respondents had to provide an evaluation of their risk appetite as a discrete value: unlike in previous

[13]The exact question was: *Suppose that you are the only income earner in the family. Your doctor recommends that you move because of allergies, and you have to choose between two possible jobs. The first would guarantee your current total family income for life. The second is possibly better paying, but the income is also less certain. There is a 50-50 chance the second job would double your total lifetime income and a 50-50 chance that it would cut it by [X]. Which job would you take – the first job or the second job?* The survey allowed respondents to choose the answer within a finite set of 6 values for X: $X \in \{3/4, 1/2, 1/3, 1/5, 1/10\}$.

surveys, they did not respond by choosing a lottery value from a given set.[14] The risk aversion question was absent from the survey in 1994, 1996, and from 2008 to 2012.[15]

The focus of these questions (for waves from 2014 to 2018) was not limited to risk-taking in financial matters. For the purpose of maintaining consistency with previous survey waves, our focus remains on risk aversion in financial matters. Importantly, empirical studies (Dohmen et al., 2011, Vieider et al., 2015, Falk et al., 2023) have documented that the measurement of risk aversion does not significantly depend on the specific context of the risk. Dohmen et al. (2011), for instance, demonstrated that various measures of risk aversion in the German Socio-Economic Panel (GSOEP)—such as risk aversion related to financial matters, health, driving behavior, or leisure activities like sports—were highly correlated with each other and aligned with experimental evidence. We conducted a similar analysis using the HRS survey data and calculated the correlation matrix between different measures of risk aversion. As shown in Table C5 in Appendix C, the different measures of risk aversion in our sample are also highly correlated. It may not be surprising to find these correlations when considering that risk aversion is a broad concept referring to a structural trait of preferences that directly influences the agents' choices, whether through the perception of income or health.

Implications for sample selection. Exploiting information on risk aversion in the HRS led us to make a number of choices. First, due to the data availability as regards subjective survival probabilities, our empirical analysis is mostly based on the 2000-2006 subperiod for the sake of conceptual homogeneity. In addition, we provide robustness checks with respect to that empirical choice.[16]

Second, due to survey design, the composition of the subsample of respondents to that question has changed over time. From 1998 onwards, this question has been asked to individuals based on a combination of cohort, age, and random selection. For instance, the question might be skipped for individuals older than 65, or for some cohorts, depending on the wave considered. We report in Figure B1 in

[14] The exact wording was: *People behave differently in different situations. We'd like to know how willing you are to take risks in the following areas. Using a 0 to 10 scale where 0 means "unwilling to take any risks" and 10 means "fully prepared to take risks" please mark one box (X) in each row. How willing are you to take risks (i) While driving (ii) In financial matters (iii) During leisure and sport (iv) In your occupation (v) With your health.* Note that unlike in the 4- and 6-value cases, a low ordinal value of the response corresponds to high risk aversion.

[15] Actually, a question about risk behavior was asked to some respondents in 1994 but with a different wording. The information is moreover missing from the RAND HRS longitudinal file that we use.

[16] It is for instance possible to consider: i) 4 values from 1992 to 2006 (but 1994–1996); ii) 6 values from 1998 to 2006, or iii) 11 values from 2014 to 2018. Another option is to group the 11 possible answers from 2014 to 2018 surveys into 4 ordinal values and to compare the distributions obtained with the ones that prevailed from 1992 to 2006. See Section 6.1.

Appendix C the distribution of age of the respondents to the risk aversion question. Since our dependent variable is conditional on age, our estimates should still be immune to selection concerns. We furthermore follow Ke (2021) and restrict our attention to individuals aged from 50 to 85. We also remove people aged 85 due to subjective mortality risks being provided for each 5-year age interval, as explained in the previous paragraph.

Third, only a few hundred individuals have consistently reported their risk aversion over all waves from 1998 to 2006. Restricting our attention to this subsample would drastically lower our sample size. We therefore keep all respondents, independently of how often they reported their risk aversion. Having a balanced panel for risk aversion is unnecessary, as it is unclear whether risk aversion at the individual level is time-varying (see, e.g., Harrati, 2014, Table 5.6).

Figure B2 in Appendix depicts cross-sectional distributions of risk aversion depending on the number of values considered (4, 6, or 11). About 60% (resp. 40%, 20%) of individuals reveal being most averse to risk when the question takes 4 (resp. 6, 11) possible values. On the whole, risk aversion is rather dispersed in the population. We can thus be confident that the theoretical mechanism we describe in Section 2 can be identified in the data. The HRS provides within-cohort variation in elicited risk aversion and SSPs, which yields sufficient independent variation to identify the interaction with mortality risk.

4.1.4 Other control variables

We discuss here the control variables we consider in our empirical exercise.

Income risk. As we explained in Section 2, income risk drives savings through the precautionary motive. Unlike mortality risk, a larger income risk increases savings and also makes risk aversion positively contribute to savings. It is thus crucial to control for this risk. We compute the income risk IR at the household level $h(i)$, where we denote a given individual by i, as the logarithm of the standard deviation of the difference between current income $Y_{h(i)t}$ and permanent income $Y^p_{h(i)t}$.[17]

In the HRS, income is measured every wave at the household level in nominal terms. We convert it into 2018 US dollars as we did for wealth items using the CPI provided by the BLS. This real value corresponds to the household's current income. Permanent income is then calculated as in Fuchs-Schündeln and Schündeln (2005), which involves two steps. First, the detrended income is computed as the ratio of the current household income over the average annual income calculated

[17]Formally, $IR_{h(i)} = \frac{1}{2} \ln \mathbb{V}\left(Y_{h(i)t} - Y^p_{h(i)t}\right)$, where $\mathbb{V}$ is the empirical variance.

from all households in the corresponding survey year. Second, the permanent income is equal to the average detrended income, computed for every household over all survey years, multiplied by the average annual income.[18]

It should be noted that income appears quite volatile in the HRS: from raw data, 1/4 of households experience a deviation of their current income with respect to the mean of 21% (resp. 33%) or more, while for another quarter of households the relative deviation exceeds 15% (resp. 22%) over the 2000-2006 (resp. 1992-2014) period.[19] Various factors likely account for that: occupational changes (including retirement), changes in family status (including a divorce, children departure, and the death of a spouse), but also imputations and other measurement issues. As a result, our main estimates below as regards the correlation between wealth, on the one hand, and risk aversion and mortality risk, on the other hand, should be viewed as conservative since they are obtained when controlling for a presumably overestimated income risk.[20]

Sociodemographic controls. In all estimating equations, we control for a number of sociodemographic variables (denoted by X_{it}). Following Ke (2021) among others, our set of covariates includes the rank in the distribution of income, income risk, the marital status, the number of children, gender, region-year FE, as well as a whole set of interactions between the respondent and her spouse's characteristics (5-year age dummies, education, ethnicity, and religion). Controlling for income rank partly addresses concerns about endogenous exposure to risk through occupation choice as in Fuchs-Schündeln and Schündeln (2005), according to which more risk-averse individuals might choose occupations with lower mortality and income risks but also lower earnings, hence accumulating less wealth.

4.1.5 Working sample

The consistency requirements discussed above for risk aversion and mortality risk measures in the survey determine our baseline estimation sample. We focus on surveys conducted between 2000 and 2006 and on individuals aged 50 to 84. We further restrict the sample to households with (non-missing) wealth above the 30th percentile of the distribution. To make the analysis feasible, we also require

[18] Formally, this measure of the permanent income is equal to $Y^p_{h(i)t} = \frac{\overline{Y_{h(i)t}}}{\overline{Y_{.t}}} Y_{.t}$, where both the dot and the upper bar refer to the annual average over all households.

[19] To be consistent with our definition of the working sample below, we compute the income risk based on the 2000-2006 period only.

[20] Compared with the observed volatility of household income in the data, the type of indicator used to proxy that income risk is a second-order issue. We nevertheless assess the sensitivity of our results with respect to the indicator used in Section 6.3. Administrative data could be a solution to improve the quality of the data.

non-missing values for self-declared risk aversion, and survival probability at the corresponding target age. We finally end up with a baseline estimation sample composed of 10,358 individual-year observations.

Table 1 summarizes the main features of our working sample. The median individual is a woman aged 58, lives in a household with an annual income of 90,000 dollars and holds wealth of slightly less than 400,000 dollars. Her average subjective mortality risk at age 85 is 56% in 2006.

Table 1: Summary statistics

	mean	std	median	min	max
Age	58.6	4.9	58	50	84
Income	133,066	394,841	90,765	0	32m
Wealth	815,507	2,105,482	393,315	76,255	130m
Risk aversion	4.6	1.5	5	1	6
Mortality risk at 80	47.1	29.8	50	0	100
Mortality risk at 85	56.8	29.5	50	0	100
Surmortality risk	4.5	30.2	3.1	-97.7	79.1
Income risk	10.6	1	10.6	4.7	16.9
Observations			10,358		

Note. Risk aversion: 6-valued.
Mortality risk at 80: for individuals aged 55-59 (before 2006).
Mortality risk at 85: for individuals aged 55-59 (in 2006).

Section 6 contains a sensitivity analysis to both restrictions defining that working sample and the threshold of the wealth distribution considered for truncation.

4.2 Econometric specification

We now present our econometric specification. Our main goal is to estimate how wealth ranks vary with risk aversion, income risk, mortality risk, and their interactions. Our dependent variable is wealth, proxied by its percentile rank in the age-specific distribution, and the key regressors are risk aversion, mortality risk, and income risk.

Net wealth is distributed over a large support: it can be negative, zero or very high. To alleviate concerns related to dispersion, we consider the percentile rank R^w in the cross-sectional distribution of net wealth, conditional on age, as the dependent variable. We follow here an empirical literature devoted to intergenerational mobility (Chetty et al., 2014, Epper et al., 2020, Fagereng et al., 2020, 2021). By definition, and up to a normalization, this rank belongs to $[0, 1]$ and follows the standard uniform distribution. Such an approach does not rely on any functional form like, e.g., the logarithm or the inverse hyperbolic sine (IHS) transform, often used to deal with wealth as an outcome. We rely on cross-sectional surveys to compute those percentile ranks of the wealth distribution, conditional on each 1-year age dummy.[21]

[21] Doing so requires selecting 2,957 out of 42,233 individuals for whom no information on wealth

Our baseline econometric specification regresses wealth on risk aversion, and income and mortality risks:

$$R^{w}_{h(i)t} = \beta \,\text{risk aversion}_{it} + \alpha_1 \,\text{income risk}_{h(i)} + \alpha_2 \,\text{mortality risk}_{it} + X'_{it}\gamma + \delta_t + \epsilon_{it}. \quad (15)$$

In Specification (15), t is the year of survey. The vector X_{it} contains the set of sociodemographic controls (with the exception of income risk, which we single out explicitly), while δ_t corresponds to time fixed effects. Standard errors are clustered at the household level.

As previously mentioned, risk aversion takes six possible values which range from 1 to 6. Due to the survey design, these values only have an ordinal meaning: higher values correspond to more risk averse behavior. However, in (15), we assign a cardinal meaning to the ordinal values of risk aversion, which simplifies the interpretation of the coefficient and the analysis of the role of risk aversion. We check the robustness of our results to our specification for risk aversion by sticking to the ordinal meaning of survey answers. We consider a variation of (15) where we include six dummy variables corresponding to the six possible values of risk aversion. This is formalized in specification (17) in Section 6.

To investigate how the coefficient β—driving the relationship between risk aversion and wealth—varies with both income and mortality risks, we may allow this marginal effect of risk aversion to depend on such risks in (15):

$$\beta = \beta_0 + \beta_1 \times \text{income risk}_{h(i)} + \beta_2 \times \text{mortality risk}_{it}. \quad (16)$$

5 Results

We now present the results of our estimation of equation (15) based on the data described in Section 4.1. Overall, we find compelling evidence that the theoretical mechanisms of Section 2 are supported in the data. While higher risk aversion and higher mortality contribute to reducing savings, a higher income risk raises them. All these relationships are economically sizable and statistically significant.

We start with the role of risk aversion in Section 5.1. We discuss the impact of income and mortality risks in Section 5.2 and the cross-effects in Section 5.3. Finally, the role of other savings determinants (e.g., age, gender)— that are very much in line with the literature— can be found in Section 5.4.

is ever available. This selection has already been taken into account in the previous definition of our working sample.

5.1 Impact of risk aversion

Regarding the role of risk aversion for wealth, we find that the effect highlighted in Proposition 2 dominates: more risk averse agents save less. In other words, the mortality channel dominates the precautionary motive.

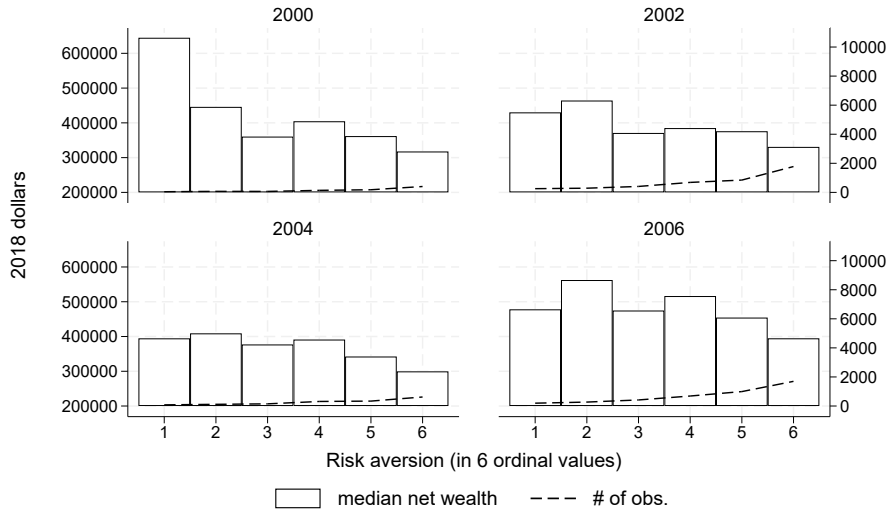


Figure 4: Median net wealth and risk aversion (2000-2006).

Descriptive evidence supports our claims about the relationship between risk aversion and wealth. For each of the six ordinal levels of risk aversion, we compute the median net wealth of households. Figure 4, which also includes the number of households for each level of risk aversion, shows that *the higher the risk aversion level, the lower the median net wealth.* This pattern is not specific to the 2000-2006 period; the decreasing relationship holds regardless of the number of risk aversion categories (see Figure B3 in Appendix B). We next confirm this eyeball evidence by a *ceteris paribus* econometric analysis.

Empirical analysis shows that more risk averse people save less, consistent with Proposition 2. The coefficient driving the relationship between wealth and (cardinal) risk aversion is negative ($\hat{\beta} < 0$) and highly significant. Table 2 reports the results of our main estimating equation (15) with a cardinal risk aversion. The relationship between risk aversion and savings remains negative and significant at the 1% level, independently of which controls are included. Omitting controls for usual determinants of wealth overestimates the absolute value of $\hat{\beta}$, but further controlling for region-year fixed effects has barely any impact. The value of $\hat{\beta}$ in Column 4 of Table 2 has the following interpretation: on average, a +1 shift in self-assessed risk aversion on the 1-6 numerical scale diminishes the rank in the wealth distribution by 0.43.

This result is robust to a number of variations in the data selection or in

Table 2: Effect of risk aversion

Dependent variable	rank in wealth distribution			
	(1)	(2)	(3)	(4)
Time period	2000-2006			
Risk aversion	-1.238***	-1.194***	-0.437***	-0.428***
	(-8.60)	(-8.42)	(-3.50)	(-3.49)
Controls	No	No	Yes	Yes
Region-year FE	No	Yes	No	Yes
Observations	10688	10678	10367	10358
R^2	0.008	0.035	0.303	0.319

Lecture. A higher risk aversion (on a 1-6 scale) is associated with a -0.428 percentile rank in the wealth distribution (conditional on age).
Controls: income (rank), income risk, gender, marital status, number of children, spouse's age (5-year dummies), (education, ethnicity, religion) interacted with spouse's.
Note. Estimation period: 2000-2006.
Clustered standard errors at the household level.
t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the regression specifications. Considering a regression with ordinal dummies for risk aversion, changing the time period for the dataset (and hence a risk aversion reported on a different scale than 1 to 6), or controlling for mortality and income risks preserves the result both qualitatively and quantitatively. These robustness checks, as well as additional ones, are reported in Section 6.1.

5.2 Impact of income and mortality risks

Our estimations next confirm that higher income risk leads to higher savings, while higher mortality risk leads to lower savings, consistent with theoretical predictions. This diagnosis holds regardless of the measurement of these risks.

The results of our baseline specification are reported in Table 3. In Column (1), in the absence of interaction terms, the income risk is strongly and positively correlated with wealth ($\widehat{\alpha_1} > 0$). The effect is large and significant at the one-percent level. The 5.8-point estimate tells us that an income risk that increases by 1, i.e., a standard deviation of the difference between lifetime and permanent income that is multiplied by e^1, increases the rank in the wealth distribution by approximately 5.8. Hence a +1% increase in the standard deviation of a household's income increases its rank in the wealth distribution by approximately 0.058. This corroborates the theoretical finding that the precautionary motive increases with income risk, remembering nevertheless that we probably estimate an upper

bound of that impact due to the volatility of household income in the data.

Conversely, elicited mortality risk has a depressing impact on wealth accumulation ($\widehat{\alpha_2} < 0$). The effect is significant at the 1% level. This shows that the theoretical prediction of Proposition 1 holds in the data: A higher mortality risk tends to diminish savings. The quantitative result can be interpreted as follows. A +1pp increase in the surmortality risk reduces the rank in the wealth distribution by approximately 0.024. To make this concrete, consider the median individual in our sample in 2006. She is a woman aged 58, whose average objective mortality risk at 85 amounts to nearly 50% in 2006, meaning that she approximately has the same objective probability of being alive at 85 as of dying before 85. Her objective life expectancy is 25.6 years, corresponding to an expected death at age 83 years and 7 months. A one-year decrease in her life expectancy—meaning an expected death at age 82 years and 7 months—corresponds to a +4.2pp increase in her surmortality risk, under the assumption that this extra mortality risk is generated by a homogeneous increase in mortality rates at all ages (including those past age 85), similarly to what we did in equation (13) of the computational exercise of Section 3.

The effect of income and mortality risks is robust to the measure of mortality and income risks, as discussed in Sections 6.2 and 6.3.

5.3 Cross effect mortality × risk aversion

The cross effect between risk aversion and mortality risk is found to be negative and significant at the 5 or 10% level: A higher mortality risk reduces savings more for highly risk averse individuals. These results are consistent with Proposition 3 in the case of a high survival probability. Although our sample includes older individuals, annual mortality rates never exceed 0.11 and remain relatively low, which makes our empirical setting closer to the high-survival case of Proposition 3. By contrast, the cross effect of income risk and risk aversion turns out not to be significant: we cannot reject $H_0 : \widehat{\beta_1} = 0$ at 5%, regardless of which cross-effects for mortality risk are included.

We thus find concurring evidence that the channel through which risk aversion operates most is the mortality risk. Note that the objective (life table) mortality risk does not significantly affect savings decisions. On top of being consistent with Proposition 3, it also fits the rationale that agents take their consumption-saving decisions with respect to their own beliefs as regards death, rather than according to some cohort-specific prior.

Table 3: Cross effect of subjective surmortality risk and risk aversion

Dependent variable	rank in the wealth distribution					
	(1)	(2)	(3)	(4)	(5)	(6)
Time period	2000-2006					
Risk aversion	-0.420***	-0.439	-0.400***	0.507	0.310	-0.212
	(-3.43)	(-0.34)	(-3.23)	(0.36)	(0.59)	(-0.16)
Income risk	5.754***	5.746***	5.760***	5.845***	5.761***	5.840***
	(18.58)	(8.80)	(18.61)	(8.90)	(18.63)	(8.87)
Life-table mortality risk	-0.00632	-0.00632	-0.00674	0.0667	0.0667	-0.00683
	(-0.19)	(-0.19)	(-0.20)	(1.05)	(1.05)	(-0.20)
Surmortality risk	-0.0237***	-0.0237***	0.00703	0.0122	0.0119	0.00730
	(-3.48)	(-3.48)	(0.38)	(0.63)	(0.62)	(0.39)
Risk aversion × income risk		0.00179		-0.0184		-0.0177
		(0.01)		(-0.15)		(-0.15)
Risk aversion × life-table mortality risk				-0.0154	-0.0154	
				(-1.37)	(-1.37)	
Risk aversion × surmortality risk			-0.00659*	-0.00765*	-0.00759**	-0.00664*
			(-1.75)	(-1.96)	(-1.96)	(-1.75)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10358	10358	10358	10358	10358	10358
R^2	0.320	0.320	0.320	0.320	0.320	0.320

Lecture. Column 1: A higher subjective surmortality risk of +10pp is associated with a -0.237 percentile rank in the wealth distribution (conditional on age).

Note. Surmortality risk: difference between self-assessed (subjective) and life-table (objective) mortality risk.

Controls: same as in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.4 Other wealth determinants

All covariates have their usual signs: Having a high income, being female, having a small number of children, and a high level of education all come with high savings. We report the estimates in Table C1 of Appendix C. For instance, the rank-rank correlation between income and wealth empirically amounts to 0.13-0.19, depending on the sample considered (either all respondents or the sole respondents to risk aversion questions). In other words, a +1 increase in the income rank implies a +0.13/+0.19 higher rank in the wealth distribution.

Another take-away from Table C1 is that the determinants of wealth do not change much with the sample. Restricting our attention to the subsample of individuals answering the risk aversion questions is rather innocuous.

6 Extensions and sensitivity analysis

We conduct a number of supplementary analyses to ensure that our results—in particular, the relationship between risk aversion and savings—are robust to alternative sample definitions and to measurement issues regarding risk aversion (Section 6.1), mortality and income risks (Sections 6.2 and 6.3), and wealth (Section 6.4). Overall, our results remain to a very large extent unchanged: the impact of risk aversion and mortality risk on wealth mostly follows the theoretical conclusions of Propositions 1 and 2—thereby showing that the precautionary motive is dominated by the mortality risk motive.

6.1 Risk aversion

Regarding risk aversion, we check that our results are not related to the sample selection nor to our specification of risk aversion in our econometric regression.

Sample selection. We consider two variations for our sample: (i) including data for which we have information about risk aversion, but not about mortality; (ii) considering waves with 4- or 11- valued risk aversion. All the results point to a negative and significant relationship between risk aversion and wealth that is both qualitatively and quantitatively robust to the time period considered.

First, we extend our sample by no longer restricting it to the sole observations with a subjective mortality risk. This means that we consider all data points from the period 1998-2006 for which we have information about wealth, risk aversion and the previous controls. Our sample size grows from 10358 observations (column 4 in Table 2) to 14061 observations (column 3 of Table C4). For homogeneity reasons, we stick to the period during which risk aversion is reported with 6 possible values.

The relationship between risk aversion and wealth does not sizably change, neither in terms of magnitude nor in terms of significance.

We further extend the sample by also including survey waves corresponding to 4- or 11- valued risk aversion. We report the results for each of the three sub-samples (4-, 6- and 11-valued risk aversion, respectively), as explained in footnote 16. By construction, columns 2 to 4 of Table C4 do not involve any grouping assumption. We also pool survey waves from 1992 to 2018 altogether, for which we express all risk aversion values on a 4-degree scale.[22] The results are reported in column 1 of Table C4. If anything, the grouping procedure tends to increase the intensity of this relationship.

Risk aversion as an ordinal measure. We check that our results still hold when risk aversion is treated as an ordinal variable. Indeed, our main econometric specification relies on risk aversion being treated as a cardinal value. However, the survey answers only attribute an ordinal meaning to risk aversion. We modify our econometric specification and we replace the risk aversion term in equation (15) by a sum of dummy variables, where each dummy corresponds to a specific risk aversion value. Formally, if risk aversion can take K values, our econometric specification becomes:

$$R^w_{h(i)t} = \sum_{k=1}^{K} \beta_k \mathbb{1}(\text{risk aversion}_{it} = k) + \alpha_1 \text{ income risk}_{h(i)} + \alpha_2 \text{ mortality risk}_{it} + X'_{it}\gamma + \delta_t + \epsilon_{it}. \quad (17)$$

Equation (17) thus estimates one coefficient for each value taken by risk aversion in the survey. This unrestricted specification allows for a flexible dependence of wealth on risk aversion.

We report the results in Figure B4c of Appendix B. The results of the specification (17) are consistent with our baseline estimates. The estimated coefficient $\hat{\beta}_k$ is decreasing with the level k of risk aversion. Agents reporting a higher risk aversion value tend to have a lower percentile rank in the distribution. Moving from the lowest to the highest level of risk aversion, which corresponds to a +5 in cardinal terms, is associated with a 2.8-point decrease in the wealth distribution—a magnitude that is very similar to what we obtained under the cardinal interpretation of risk aversion.

[22] The grouping procedure consists in aggregating raw answers 0 to 4 into value 4, raw answer 5 into value 3, raw answers 6 and 7 into value 2, and raw answers 8 to 10 into value 1.

6.2 Mortality risk

A disaggregated measure of mortality risk. Instead of the previous aggregate surmortality risk, we here consider disaggregated measures of subjective mortality risks (similarly to the disaggregation check for risk aversion) and verify that our results still hold: Higher income risk leads to higher savings, and higher risk aversion and mortality risk are associated with lower savings.[23]

We accordingly modify our econometric specification by including the six measures of subjective mortality risk, corresponding to the different pairs of current 5-year age interval and survival target age (see Section 4.1.2) as covariates.[24]

As reported in Table C11 (column 1) of Appendix C, the results with this disaggregated measure of subjective mortality risk are mostly unchanged: we still find the same effect for the two types of risk, as well as for risk aversion. Note that although the coefficients on mortality risk are not comparable in the two mortality risk specifications, those for income risk and risk aversion remain quantitatively very similar to those obtained with the surmortality risk measure of Table 2. All of them remain highly significant.

Focal points. We verify that our results still hold when removing focal points, namely subjective probabilities of 0, 0.5, or 1. Removing them tends in fact to make the surmortality measure more accurate. In particular, Delavande and Rohwedder (2011a) and Hurd (2009) recommend excluding 0.5 answers, which they refer to as evidence of *epistemic uncertainty*.[25]

We run our regression on a subsample of our baseline dataset, in which we have excluded focal values (0.5, but also 0 and 1). As reported in Table C7 of Appendix C, not only do our results remain, but they even tend to be more significant. This suggests that focal points are probably not very informative about the actual mortality risk perceived by agents and hence tend to bias results. They indeed could reflect that agents have no clear idea about their survival—or do not want to disclose it.

An alternative measure of mortality risk. We further control for the self-reported general health status as an alternative measure of the mortality risk in our wealth equation. Indeed, health could possibly explain the self-reported mortality risk, and could arguably be viewed as a proxy for that risk. Since it may also

[23] We check that our results also hold when considering another aggregate measure for the mortality risk, see Appendix D.

[24] By construction, those measures are undefined outside an individual's 5-year age interval, hence the necessity to further control for 5-year age dummies in those equations—this requirement holds regardless of the fact that our dependent variable is conditional on age.

[25] See Manski and Molinari (2010) for a convincing treatment of the rounding issue.

be related to risk aversion, it could also bias our results. However, as reported in Table C10 (column 2) of Appendix C, subjective health has the same effect as mortality risk: perceiving oneself as less healthy decreases savings. It also leaves the risk aversion channel unaffected, both in values and in significance. The same holds for the income risk channel. The health channel does not hide any of the channels we have uncovered.

6.3 Income risk

As explained above, the volatility of household income is high in the HRS. Previous results can thus be viewed as conservative since the negative correlation between wealth and risk aversion remains after controlling for an income risk that is presumably overestimated. We adopt a less conservative approach when controlling for that income risk, and check that our results about risk aversion and mortality risk remain unchanged.

We focus on households who do not experience any change in their marital status over the period, thereby excluding divorces or spouse's deaths.[26] Such a restriction reduces noise from shocks related to marital status and thus helps limit the observed volatility of income in the data. On such a subsample of stable individuals with respect to the marital status, it makes sense to compare the impacts of both income and mortality risks on wealth accumulation.

To that aim, we compute percentile ranks in the distributions of income and mortality risks, and replace previous proxies for those risks with these ranks in our estimating equation (15). Doing so enables us to interpret the obtained coefficients as rank-rank correlations. We consider either the distribution of the income risk as previously measured, or the distribution of the relative income risk.[27] As regards mortality, we consider the distribution of our previous surmortality risk.

The results displayed in Table C12 suggest that for single individuals, their income risk becomes insignificant while their mortality risk remains significant at 5%. Both risks are of similar magnitude, while for couples, the income risk effect would be 50% higher than the mortality risk for couples. For the median single, a percentile rank increase of 10 in the distribution of the relative income risk (namely, a shift from a 9.76% to a 10.02% relative income risk) yields a non-significant +0.007 increase of the rank in the wealth distribution. At the same time, a percentile rank increase of 10 in the distribution of the surmortality risk

[26] We may also restrict our attention to households in which nobody retires between 2000 and 2006, but this would shrink the sample dramatically since respondents to the risk aversion question tend to be close to the retirement age.

[27] The latter corresponds to the standard deviation of the difference between current and permanent income (at the household level, and over time), this difference being taken in absolute value and normalized by the permanent income.

(namely, a shift from 3.1 to 14.4pp gap between subjective and objective mortality risks) results in a significant -0.05 decrease of the rank in the wealth distribution.

Importantly, the negative correlation between wealth and risk aversion is obtained regardless of how the income risk is controlled for: either directly as above, through the rank in the corresponding distribution, or through the rank in the distribution of relative income risk. The same holds for the mortality risk: controlling for that risk, in level, or for the rank in its distribution does not matter in this regard.[28]

6.4 Wealth

Our sample selection involves discarding the bottom 30th percentile of the wealth distribution—in order to mitigate the role of credit constraints—and assuming that each household member has access to the household wealth. We here verify that our results still hold when these assumptions are challenged. We also check that it is robust to the inclusion of other explanatory variables regarding portfolio composition or bequest motive.

Sample construction. We perform a sensitivity analysis with respect to the choice of the threshold (bottom 30th percentile) of the wealth distribution below which observations are selected out of our sample. The results are reported in Tables C8 and C9 in Appendix C, where we consider both a truncation at the 25th and at the 35th percentiles. Overall, our results are robust to that truncation parameter.

Within-household wealth attribution. Our sample construction also assumes that both spouses have access to the household wealth. In the absence of intra-household information, this is a reasonable assumption. We here verify that this assumption does not sizably affect our results, by focusing either on single-headed households (no attribution problem) or on households where risk aversion for both spouses is known.

[28] We also check that our results hold when changing our measure of income risk while (almost) keeping the same sample. As already mentioned, this is a second-order consideration with respect to the volatility of income in the raw data. We nevertheless compute income risk following the method proposed by Arellano et al. (2022). This measure is based on the within-household dispersion of income over time. We use their coefficient of variation (CV) measure of income uncertainty at the household level, which relies on a prediction of income from past realizations. Our specified predictors include previous income realizations, including the last one (and up to three lags). We report the results in Table C10 (columns 5 and 6) of Appendix C. The negative impact of risk aversion remains and the magnitude hardly varies, while the impact of this alternative measure of income risk is still positive and significant at usual levels. Note that the two measures have different scales, meaning that their impact cannot be directly compared.

First, we circumvent the problem related to the attribution of wealth within the household by focusing on single-headed households. This reduces the sample to 2613 observations. The estimation then yields an even more negative correlation between wealth and risk aversion, as reported in Table C2 in Appendix C. A +1 increase in the reported risk aversion decreases the rank in the wealth distribution by 0.49, while it was 0.43 for the baseline. The coefficient is still significant at the 1% level.

Second, we mitigate the problem of wealth attribution within the household by restricting the sample to partnered or married individuals for whom information on both spouses' risk aversion is available. As reported in Table C3 of Appendix C, both spouses' risk aversion is found to be negatively correlated with wealth. Furthermore, and interestingly, it is not possible to reject the null hypothesis that the correlations are equal across spouses at 5%—providing weak support for assortative matching on risk attitudes.[29]

Role of bequest motives. We test the theoretical implication that bequest motives weaken the relationship between risk aversion and wealth: the stronger the bequest motive, the weaker the effect of risk aversion.

In the presence of bequest motives, the theoretical predictions of Section 2 remain valid provided that people still prefer survival to death, and consumption to leaving bequests. Since bequest motives induce individuals to save more in order to transmit wealth to their heirs, the ability to derive utility from bequests makes death a less adverse event. Thus, bequest motives are expected to mitigate the impact of mortality risk and risk aversion, so the magnitude of the observed effects in our baseline regression should decline with the intensity of bequest motives.

We test this hypothesis by exploiting the heterogeneity between parents and non-parents, under the assumption that parents possess stronger bequest motives than childless individuals. As reported in Table C6, risk aversion significantly diminishes wealth accumulation for both parents and non-parents. However, in line with the theoretical mechanism described above, the effect of risk aversion is less pronounced for parents than for non-parents.

Portfolio composition. We verify that our results are robust to the inclusion of the portfolio composition as a possible confounding factor. We control for the share of risky assets in our estimating equation and report the results in Table C10, both for stocks (column 3) and for IRA (column 4). This does not change our results regarding the role of risk aversion or income risk. These two factors can be viewed as proxies for portfolio composition and thus for the average return of assets. It

[29] A similar pattern has already been documented on German data (e.g., Bacon et al., 2014).

is therefore not surprising that these factors are positive and highly significant. Of course, it should be kept in mind that these controls may be suspected of endogeneity due to the dynamic nature of wealth accumulation.

6.5 Summary

Our sensitivity analysis confirms that our results are robust to sample definition and measurement error regarding risk aversion, mortality risk, income risk, and wealth. Moreover, our investigation of the role of bequest motives, where we compare the saving behavior of parents and non-parents, provides additional support for our theoretical arguments. Death is an adverse event, especially for those who have fewer reasons to care about bequests, and the impact of mortality risk and risk aversion on wealth accumulation is greater for this population.

7 Conclusion

The savings behavior of risk averse agents facing adverse events remains a non-trivial issue. It is in fact uncertain whether the risk of financial losses, which favors wealth accumulation, or the risk of death, which reduces the willingness to save and encourages immediate consumption, empirically dominates. As we show, both effects are amplified by risk aversion, leading to the finding that risk aversion increases savings when the primary risk is financial, but reduces savings when the primary risk is mortality.

The economic literature has predominantly focused on models that account for financial risk while abstracting from mortality risk (assuming either an infinite horizon or a finite deterministic one). This is particularly evident in studies investigating the role of risk aversion. A broad literature examines the impact of risk aversion in environments without mortality risk (with Kihlstrom and Mirman, 1974 and Epstein and Zin, 1989 as key contributions), whereas only a much smaller, more recent strand, initiated by Bommier (2006), focuses on mortality risk. Consequently, the "now-standard" result highlighted in the established literature – namely that risk aversion increases savings – is widely recognized, while the opposing effects documented in the recent literature remain less appreciated. There exist nevertheless two lines of literature that reach opposing conclusions regarding the impact of risk aversion on savings. This apparent disagreement does not indicate that one approach is valid and the other is not. Rather, it reflects distinct assumptions: one strand focuses on financial risk, the other on mortality risk. While both are internally consistent, they are both incomplete, as they fail to capture the fact that, in real life, financial and mortality risks are simultaneously

present.

Unlike theoretical models, empirical analyses must confront the reality that survey respondents always face both types of risk. Empirical findings may therefore reflect both lines of literature. Based on US data over the 2000-2006 period, our analysis suggests that the effects predicted in the mortality risk literature prevail, in that they empirically dominate those predicted in the financial risk literature. We find that mortality risk significantly reduces savings—an effect amplified by risk aversion, while the impact of income risk, though significant, is statistically independent of risk aversion. This suggests that risk averse individuals are more sensitive to the possibility of death than to financial risk. In other words, the Latin proverb "*vera philosophia mortis est meditatio*" ("true philosophy is meditation on death") may apply as much to economics as it does to philosophy, and even more so if human beings are risk averse.

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Appendix

A Proofs for the 2-period framework

This section contains the proofs and additional results of the two-period model of Section 2.

A.1 A representation result

We assume that preferences are monotone with respect to first-order stochastic dominance in the sense of Assumption 2. We start with a representation result, stating that the utility function $\phi(c_1, c_2, p)$ can equivalently be expressed in terms of lifetime utilities.

Lemma 3. *Consider a preference relation $\succeq$ over $X \times [0,1]$ represented by a continuous utility function $\phi(c_1, c_2, p)$. If this preference relation is monotone, there exists a (unique) function $\psi : D \times [0,1] \to \mathbb{R}$ defined as:*

$$D = \{(u_1, u_2) \in \mathbb{R}^2 : u_1 = \phi(c_1, c_2, 0) \text{ and } u_2 = \phi(c_1, c_2, 1) \text{ for some } (c_1, c_2) \in X\},$$

such that for all $(c_1, c_2, p) \in X \times [0,1]$:

$$\phi(c_1, c_2, p) = \psi(\phi(c_1, c_2, 0), \phi(c_1, c_2, 1), p).$$

For any $p \in [0,1]$, the function $(u_1, u_2) \in D \mapsto \psi(u_1, u_2, p)$ is increasing.

Proof. Let $(c_1, c_2) \in \mathbb{R}^2_+$. We set $u_1 = \phi(c_1, c_2, 0)$ and $u_2 = \phi(c_1, c_2, 1)$ and define for all $p \in [0,1]$:

$$\psi(u_1, u_2, p) = \phi(c_1, c_2, p).$$

Consider $(c_1', c_2') \in \mathbb{R}^2_+$ (that potentially differ from (c_1, c_2)) such that $(c_1, c_2, 0) \sim (c_1', c_2', 0)$ and $(c_1, c_2, 1) \sim (c_1', c_2', 1)$. Monotonicity implies that $(c_1, c_2, p) \sim (c_1', c_2', p)$ for all p and ψ is well defined. We indeed have $\psi(u_1, u_2, p) = \phi(c_1, c_2, p) = \phi(c_1', c_2', p)$ for all p. In other words, ψ does not depend on the choice of the consumption bundle representing the lifetime utility pair (u_1, u_2). The function ψ is unique up to an increasing transformation. By construction, the set of definition of ψ is D.

Let us show that $(u_1, u_2) \in D \mapsto \psi(u_1, u_2, \cdot)$ is increasing. Let $(u_1, u_2) \geq (u_1', u_2')$ be two elements of D and $p \in [0,1]$. By definition, there exists (c_1, c_2) and

(c_1', c_2') in X, such that

$$u_1 = \phi(c_1, c_2, 0) \text{ and } u_2 = \phi(c_1, c_2, 1),$$
$$u_1' = \phi(c_1', c_2', 0) \text{ and } u_2' = \phi(c_1', c_2', 1),$$

and which verify $(c_1, c_2, 0) \succeq (c_1', c_2', 0)$ and $(c_1, c_2, 1) \succeq (c_1', c_2', 1)$ because $u_1 \geq u_1'$ and $u_2 \geq u_2'$. Because of Monotonicity (Assumption 2), we have $(c_1, c_2, p) \succeq (c_1', c_2', p)$ for all $p \in [0, 1]$, or equivalently, $\phi(c_1, c_2, p) \geq \phi(c_1', c_2', p)$. This implies that $\psi(u_1, u_2, p) \geq \psi(u_1', u_2', p)$, which proves that $(u_1, u_2) \in D \mapsto \psi(u_1, u_2, \cdot)$ is increasing. □

Lemma 3 therefore states that a preference relationship that is monotone in the sense of Definition 2 can be represented by a utility function ψ defined over lifetime utilities (when alive for one and two periods respectively). The definition set of ψ is denoted D thereafter.

A.2 Comparative risk aversion

To investigate comparative risk aversion, we consider two agents, denoted by A and B, who are endowed with monotone preferences over X. We assume that their preferences can be represented by continuous utility functions, ϕ^A and ϕ^B, defined over X.

We are interested only in how A and B differ along their preferences in the presence of risk. As is standard (Kihlstrom and Mirman, 1974, Epstein and Zin, 1989), we assume that agents make identical choices when comparing consumption bundles when the mortality risk is resolved. Formally, we can state the following assumptions.

Assumption 5. *Agents A and B are said to have the same ordinal preferences if and only if for all $(c_1, c_2), (c_1', c_2') \in X$ and $(p, p') \in \{0, 1\}^2$:*

$$\left(\phi^A(c_1', c_2', p') \geq \phi^A(c_1, c_2, p)\right) \Leftrightarrow \left(\phi^B(c_1', c_2', p') \geq \phi^B(c_1, c_2, p)\right). \tag{18}$$

In other words, if the lifetime utility associated with (c_1', c_2', p') is preferred by A to the lifetime utility associated with (c_1, c_2, p), then this is also the case for B. Observe that p and p' can only be 0 or 1, reflecting that there is no uncertainty with respect to survival and that the comparison involves lifetime utilities.

Assumption 5 implies that we normalize the lifetime utility functions of both agents such that they are identical.

Lemma 4. *Agents A and B are said to have the same ordinal preferences if and only if we can renormalize ϕ^A and ϕ^B such that for all $(c_1, c_2) \in X$ and $p \in \{0, 1\}$:*

$$\phi^A(c_1, c_2, p) = \phi^B(c_1, c_2, p). \tag{19}$$

Proof. We denote by $LT^i = \{\phi^i(c_1, c_2, p) : (c_1, c_2, p) \in X \times [0, 1]\}$ ($i = A, B$ and $p \in \{0, 1\}$) the set of lifetime utility levels of agent i.

When LT^A is reduced to a singleton, inequality (18) used twice implies that LT^B is also a singleton. In other words, ϕ^A and ϕ^B are constant, and without loss of generality, we can assume that these constants are identical, which proves the result. We henceforth assume that LT^A contains at least two distinct elements.

We define the function $f : LT^A \to \mathbb{R}$ as: for any $u \in LT^A$, $f(u) = \phi^B(c_1, c_2, p)$, where $(c_1, c_2, p) \in X \times \{0, 1\}$ verify $\phi^A(c_1, c_2, p) = u$. By definition of LT^A, such a triplet (c_1, c_2, p) exists for any $u \in LT^A$ – it may be non-unique, though. Let us check that f is well-defined. Let $u \in LT^A$ and (c_1, c_2, p) and (c_1', c_2', p') in $X \times \{0, 1\}$, such that $u = \phi^A(c_1, c_2, p) = \phi^A(c_1', c_2', p')$. Using inequality (18) twice, we deduce that $\phi^B(c_1, c_2, p) = \phi^B(c_1', c_2', p')$ and that $f(u)$ is independent of the choice of the element in the pre-image set $(\phi^B)^{-1}(\{u\})$. Hence f is well-defined.

Let us prove that f is increasing on LT^A. Let $u' > u$ in LT^A that contains at least two distinct elements. By definition of LT^A, we have $u' = \phi^A(c_1', c_2', p') > \phi^A(c_1, c_2, p) = u$ for (c_1, c_2, p) and (c_1', c_2', p') in $X \times \{0, 1\}$. Inequality (18) implies $\phi^B(c_1', c_2', p') > \phi^B(c_1, c_2, p)$ – indeed, if we had $\phi^B(c_1', c_2', p') \leq \phi^B(c_1, c_2, p)$, (18) would imply $\phi^A(c_1', c_2', p') \leq \phi^A(c_1, c_2, p)$, which contradicts $u' > u$. By definition of f, we obtain $f(u') > f(u)$. We thus deduce that f is increasing.

Therefore, $f \circ \phi^A$ represents the same preferences as ϕ^A. We can thus assume that equality (19) holds. □

We denote by ψ^A and ψ^B the utility functions representing the preferences of agents A and B, constructed using Lemma 3. A direct corollary of Lemma 4 is the following one.

Lemma 5. *If Agents A and B have the same ordinal preferences, then the functions ψ^A and ψ^B defined in the sense of Lemma 3 can be assumed to be defined on the same set $D \times [0, 1]$.*

Proof. Lemma 3 implies that ψ^A and ψ^B can be defined on two sets denoted by D_A and D_B. Each of the set, D_i, can be seen as the Cartesian product $\phi^i(X, 0) \times \phi^i(X, 1)$ (where $\phi^i(X, p)$ for $p \in \{0, 1\}$ is the set of lifetime utilities either in case of certain survival, with $p = 1$ or in case of certain death with $p = 0$). Since both agents are assumed to have the same ordinal preferences, Lemma 4 implies that ϕ^A and ϕ^B can be assumed to be identical (up to some harmless renormalization). Hence the sets $\phi^i(X, 0) \times \phi^i(X, 1) = D_i$ are identical. □

We assume henceforth that ψ^A and ψ^B are defined on the same set D. We make the following assumption.

Assumption 6. *We assume that:*

- the functions ψ^A and ψ^B are continuously differentiable,
- the partial derivatives of ψ^A and ψ^B verify for all $(u_1, u_2) \in D$:

$$\frac{\partial \psi^i}{\partial u_1}(u_1, u_2, p) \geq 0 \text{ and } \frac{\partial \psi^i}{\partial u_2}(u_1, u_2, p) \geq 0.$$

Assumption 6 is weaker than the one made in the main text, where we impose strict positivity of partial derivatives of ψ. We can similarly derive a result that extends Lemma 2.

Lemma 6 (Generalizing Lemma 2)**.** *Agent A is more risk averse than agent B, if and only if for all $(u_1, u_2) \in D$:*

$$\frac{\partial \psi^A(u_1, u_2, p)}{\partial u_2} \frac{\partial \psi^B(u_1, u_2, p)}{\partial u_1} \leq \frac{\partial \psi^A(u_1, u_2, p)}{\partial u_1} \frac{\partial \psi^B(u_1, u_2, p)}{\partial u_2}. \tag{20}$$

Proof. We start by proving that if A is more risk averse than B, then inequality (20) holds. Let $p \in [0, 1]$, and $(u_1, u_2), (u_1', u_2') \in D$ such that $u_1 \leq u_2$, $u_1' = u_1 - \varepsilon_1$ and $u_2' = u_2 + \varepsilon_2$ (with $\varepsilon_1, \varepsilon_2 > 0$). Assume that $\frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p) = 0$. In that case, since ψ^A and ψ^B are nondecreasing in u_1 and u_2, we deduce that:

$$(u_2 - u_1)\frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p)\frac{\partial \psi^B}{\partial u_1}(u_1, u_2, p) = 0 \leq (u_2 - u_1)\frac{\partial \psi^A}{\partial u_1}(u_1, u_2, p)\frac{\partial \psi^B}{\partial u_2}(u_1, u_2, p),$$

and inequality (20) holds. We now assume that $\frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p) > 0$. We have:

$$\psi^i(u_1', u_2', p) = \psi^i(u_1, u_2, p) - \varepsilon_1 \frac{\partial \psi^i}{\partial u_1}(u_1, u_2, p) + \varepsilon_2 \frac{\partial \psi^i}{\partial u_2}(u_1, u_2, p) + o(\varepsilon_1, \varepsilon_2),$$

where $o(\varepsilon_1, \varepsilon_2)$ is a generic function such that $\varepsilon_i^{-1} o(\varepsilon_1, \varepsilon_2) \to_{(\varepsilon_1, \varepsilon_2) \to (0,0)} 0$. Since A is more risk averse than B and $u_1' \leq u_1 \leq u_2 \leq u_2'$, equation (5) is equivalent to:

$$\varepsilon_2 \frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p) \geq \varepsilon_1 \frac{\partial \psi^A}{\partial u_1}(u_1, u_2, p) \Rightarrow \varepsilon_2 \frac{\partial \psi^B}{\partial u_2}(u_1, u_2, p) \geq \varepsilon_1 \frac{\partial \psi^B}{\partial u_1}(u_1, u_2, p).$$

We choose ε_2 such that $\varepsilon_2 = \varepsilon_1 \frac{\partial \psi^A}{\partial u_1}(u_1, u_2, p)(\frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p))^{-1} > 0$. The above inequality implies:

$$\frac{\partial \psi^A}{\partial u_1}(u_1, u_2, p)\frac{\partial \psi^B}{\partial u_2}(u_1, u_2, p) \geq \frac{\partial \psi^A}{\partial u_2}(u_1, u_2, p)\frac{\partial \psi^B}{\partial u_1}(u_1, u_2, p),$$

which proves (20) with $u_1' \leq u_2'$. The case $u_1' \geq u_2'$ is symmetric.

Let us prove the other implication and assume that (20) holds. We define $u_k(t) = (1-t)u_k + tu'_k$ with $k = 1, 2$, such that $u_1(0) = u_1$, $u_2(0) = u_2$, $u_1(1) = u'_1$, $u_2(1) = u'_2$. We consider the function $h_A : t \in [0,1] \mapsto \inf_{\tau \in [t,1]} \psi^A(u_1(\tau), u_2(\tau), p)$. Because ψ^A is continuous on $[0,1]$, ψ^A reaches its infimum on $[t,1]$ on a point of $[t,1]$. We thus define as τ_t the smallest element of $[t,1]$, where ψ^A reaches its minimum.[30] Then we define:

$$\forall \tau \in [t, \overline{s}_t],\ \tilde{u}_k(\tau) = u_k(\tau_t),$$
$$\hat{h}_A(\tau) = h_A(\tau_t).$$

Note that since ψ^A is continuous and non-constant, it admits at most a countable number of local minima (see Behrends et al., 2007/2008). Hence there is a (at most) countable set of points $0 \leq t_1 < t_2 < \ldots \leq 1$ and a countable set of segments $[\underline{\tau}_{t_n}, \overline{\tau}_{t_n}]$ of strictly positive size such that for any n:

$$\forall \tau \in [\underline{\tau}_{t_n}, \overline{\tau}_{t_n}], \tilde{u}_k(\tau) = u_k(\tau_t),$$
$$\hat{h}_A(\tau) = h_A(\tau_t).$$

For any $t \in [0,1] \setminus \bigcup_{n \geq 1} [\underline{\tau}_{t_n}, \overline{\tau}_{t_n}]$, we have $\tilde{u}_k(t) = u_k(t)$ and $\hat{h}_A(t) = h_A(t)$. It is then immediate to check that: (i) $\tilde{u}_1(0) = u_1$, $\tilde{u}_2(0) = u_2$, $\tilde{u}_1(1) = u'_1$, $\tilde{u}_2(1) = u'_2$, (ii) $\tilde{u}_k(\cdot)$ is increasing and piecewise continuous (with at most a countable number of jumps), and admits left and right derivatives everywhere (both may differ along a countable set), (iii) the function $\hat{h}_A$ is continuous, left and right differentiable everywhere (both derivatives may differ along a countable set). Define $0 \leq d_1 < d_2 < \ldots < 1$ as the countable set of points such that $\tilde{u}_k$ and $\hat{h}_A$ are differentiable on every (d_j, d_{j+1}). Then for any j and any $t \in (d_j, d_{j+1})$, we have:

$$\frac{\partial u_1(t)}{\partial t} \frac{\partial \psi^A}{\partial u_1}(u_1(t), u_2(t), p) + \frac{\partial u_2(t)}{\partial t} \frac{\partial \psi^A}{\partial u_2}(u_1(t), u_2(t), p) \geq 0$$

If $\frac{\frac{\partial \psi^A}{\partial u_1}(u_1(t),u_2(t),p)}{\frac{\partial \psi^A}{\partial u_2}(u_1(t),u_2(t),p)} \geq \frac{\frac{\partial \psi^B}{\partial u_1}(u_1(t),u_2(t),p)}{\frac{\partial \psi^B}{\partial u_2}(u_1(t),u_2(t),p)}$ we obtain (since $u'_1(t) \leq 0$ and $u'_2(t) \geq 0$)

$$\frac{\partial u_1(t)}{\partial t} \frac{\partial \psi^B}{\partial u_1}(u_1(t), u_2(t), p) + \frac{\partial u_2(t)}{\partial t} \frac{\partial \psi^B}{\partial u_2}(u_1(t), u_2(t), p) \geq 0$$

and by integration over (d_j, d_{j+1}) and summing over j, $\psi^B(u'_1, u'_2, p) \geq \psi^B(u_1, u_2, p)$. □

Lemma 6 directly implies equality (6) – and hence Lemma 2 – when the partial derivatives of ψ^i are further assumed to be non-zero.

[30] Its existence follows from $\arg\min_{s \in [t,1]} \psi^A(s)$ being the pre-image of a singleton and being closed; it is also a subset of $[t,1]$, which is compact, hence it is compact.

A.3 Savings behavior: Proofs

In the remainder, to avoid treating too many corner cases, we assume that the partial derivatives of ψ^A and ψ^B are strictly positive.

A.3.1 Proof of Proposition 2

Proof. Let $p \in (0,1)$. For the sake of simplicity, we denote for $k = 1, 2$ and for all $s \in [0, W]$:

$$\tilde{U}_k(s) = U_k(W - s, Rs), \ k = 1, 2, \tag{21}$$

$$\tilde{\psi}^i(s) = \psi^i(U_1(W - s, Rs), U_2(W - s, Rs), p), \ i = A, B, \tag{22}$$

$$\frac{\partial \tilde{\psi}^i}{\partial u_k}(s) = \frac{\partial \psi^i}{\partial u_k}(U_1(W - s, Rs), U_2(W - s, Rs), p), \tag{23}$$

where $\tilde{\psi}^i(s)$ accounts for the lifetime utility as a function of savings choices. By the chain rule, for any $s \in (0, W)$, we have:

$$\frac{d\tilde{\psi}^i}{ds}(s) = \tilde{U}_1'(s)\frac{\partial \tilde{\psi}^i}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial \tilde{\psi}^i}{\partial u_2}(s).$$

Assumption 4 guarantees that the function $\tilde{U}_i$ is strictly concave.

The first point of Proposition 2 is a direct implication of monotonicity and the strict concavity of lifetime utility functions. Indeed, assume for instance that $s_A^* < \underline{s} \leq \overline{s}$. In that case, because of the strict concavity of lifetime utilities, we have:

$$\tilde{U}_1(\underline{s}) > \tilde{U}_1(s_A^*) \text{ and } \tilde{U}_2(\underline{s}) > \tilde{U}_2(s_A^*).$$

Monotonicity implies then that agent A strictly prefers saving $\underline{s}$ rather than s_A^*. The same reasoning applies for B. One could similarly show that $s_A^*, s_B^* < \overline{s}$.

A corollary of this first point is that if $s_A^* = \underline{s}$, the second point of Proposition 2 holds since $s_A^* = \underline{s} \leq s_B^*$. We can thus assume that $s_A^* > \underline{s}$.

As a preliminary to the second point, observe that we must have $\tilde{U}_1'(\underline{s}) \leq 0$. Indeed, since $\underline{s} \in [0, W]$ and $\underline{s} < \overline{s}$, we deduce that either $\underline{s} = 0$ (and $\tilde{U}_1'(\underline{s}) > 0$ yielding a contradiction) or $\underline{s}$ is interior (and $\tilde{U}_1'(\underline{s}) = 0$). The strict concavity of $\tilde{U}_1$ then implies $\tilde{U}_1'(s) < 0$ for all $s > \underline{s}$. We symmetrically prove that $\tilde{U}_2'(s) > 0$ for all $s < \overline{s}$.

Assumption 6 implies that $\frac{\partial \psi^i}{\partial u_1} > 0$ and $\frac{\partial \psi^i}{\partial u_2} > 0$. Start by assuming that the solution to the saving program (8) for agent A is a corner solution: $s_A^* = \overline{s}$. In that case, with notation (22) the FOC of the saving program is:

$$\tilde{U}_1'(\overline{s})\frac{\partial \tilde{\psi}^A}{\partial u_1}(\overline{s}) + \tilde{U}_2'(\overline{s})\frac{\partial \tilde{\psi}^A}{\partial u_2}(\overline{s}) \geq 0.$$

or equivalently, using previous remarks ($\frac{\partial\tilde{\psi}^A}{\partial u_2}(\overline{s}) > 0$ and $\tilde{U}_1'(\overline{s}) < 0$):

$$\frac{\frac{\partial\tilde{\psi}^A}{\partial u_1}(\overline{s})}{\frac{\partial\tilde{\psi}^A}{\partial u_2}(\overline{s})} \leq -\frac{\tilde{U}_2'(\overline{s})}{\tilde{U}_1'(\overline{s})}. \tag{24}$$

Since A is more risk averse than B and since $\tilde{U}_2(\overline{s}) > \tilde{U}_1(\overline{s})$, inequality (6) holds and implies with (24): $\tilde{U}_1'(\overline{s})\frac{\partial\tilde{\psi}^B}{\partial u_1}(\overline{s}) + \tilde{U}_2'(\overline{s})\frac{\partial\tilde{\psi}^B}{\partial u_2}(\overline{s}) \geq 0$, which means that $s_B^* = \overline{s}$ and the second point of Proposition 2 holds. We can next assume that s_A^* is interior, and similarly that s_B^* is interior (either $s_B^* = \overline{s}$ and this is direct, or $s_B^* = \underline{s}$ and we then prove that $s_A^* = \underline{s}$). The two saving levels are thus characterized by the following FOCs:

$$\frac{\frac{\partial\tilde{\psi}^A}{\partial u_1}(s_A^*)}{\frac{\partial\tilde{\psi}^A}{\partial u_2}(s_A^*)} = -\frac{\tilde{U}_2'(s_A^*)}{\tilde{U}_1'(s_A^*)} \text{ and } \frac{\frac{\partial\tilde{\psi}^B}{\partial u_1}(s_B^*)}{\frac{\partial\tilde{\psi}^B}{\partial u_2}(s_B^*)} = -\frac{\tilde{U}_2'(s_B^*)}{\tilde{U}_1'(s_B^*)}. \tag{25}$$

Furthermore, since s_A^* is unique by assumption, we must have:

$$\tilde{U}_1'(s)\frac{\partial\tilde{\psi}^A}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial\tilde{\psi}^A}{\partial u_2}(s) > 0 \text{ for } s < s_A^*, \tag{26}$$

Indeed, consider $s \mapsto \tilde{U}_1'(s)\frac{\partial\tilde{\psi}^A}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial\tilde{\psi}^A}{\partial u_2}(s)$ on $s < s_A^*$. It cannot change sign or cancel unless contradicting the uniqueness of s_A^*. If strictly negative, it means that utility can be strictly increased by considering $s < s_A^*$ and close to s_A^* – which contradicts the optimality of s_A^*.

Suppose for contradiction that $s_A^* > s_B^*$.

We deduce from (25) and (26):

$$\tilde{U}_1'(s_B^*)\frac{\partial\tilde{\psi}^A}{\partial u_2}(s_B^*)\left(\frac{\frac{\partial\tilde{\psi}^A}{\partial u_1}(s_B^*)}{\frac{\partial\tilde{\psi}^A}{\partial u_2}(s_B^*)} - \frac{\frac{\partial\tilde{\psi}^B}{\partial u_1}(s_B^*)}{\frac{\partial\tilde{\psi}^B}{\partial u_2}(s_B^*)}\right) > 0,$$

which, with $\tilde{U}_1'(s_B^*) < 0$ and $\frac{\partial\tilde{\psi}^A}{\partial u_2}(s_B^*) > 0$, implies:

$$\frac{\frac{\partial\tilde{\psi}^A}{\partial u_1}(s_B^*)}{\frac{\partial\tilde{\psi}^A}{\partial u_2}(s_B^*)} < \frac{\frac{\partial\tilde{\psi}^B}{\partial u_1}(s_B^*)}{\frac{\partial\tilde{\psi}^B}{\partial u_2}(s_B^*)},$$

which contradicts inequality (6) and A more risk averse than B. □

A.3.2 A formal definition of consequentialism

We provide here a formal definition of consequentialism that underlies inequality (2) for marginal rate of substitution.

Definition 2. We will say that agent i is consequentialist if and only if for all

$(u_1, u_2), (u_1', u_2') \in D$ such that $u_1 \leq u_1' \leq u_2' \leq u_2$ and $p, p' \in [0,1]$ we have:

$$p' \geq p \Rightarrow \left(\psi^i(u_1, u_2, p) \geq \psi^i(u_1', u_2', p)\right) \Rightarrow \left(\psi^i(u_1, u_2, p') \geq \psi^i(u_1', u_2', p')\right). \quad (27)$$

Definition 2 states that if a spread of utilities (u_1, u_2) is preferred to (u_1', u_2') for a survival probability p, then it is also preferred for any higher survival probability.

Definition 2 implies inequality (2), as can be seen in the following lemma – which is a slight generalization of (2) that does not require strictly positive derivatives for ψ^i.

Lemma 7. *Agent i is consequentialist if and only if for all $(u_1, u_2) \in D$ and all $p, p' \in [0,1]$:*

$$(p' - p)\frac{\partial \psi^i(u_1, u_2, p')}{\partial u_2}\frac{\partial \psi^i(u_1, u_2, p)}{\partial u_1} \leq (p' - p)\frac{\partial \psi^i(u_1, u_2, p')}{\partial u_1}\frac{\partial \psi^i(u_1, u_2, p')}{\partial u_2}. \quad (28)$$

Proof. Let $(u_1', u_2') \in D$, such that $u_2' > u_1'$, $0 \leq p \leq p' \leq 1$, and $\varepsilon_x > 0$. We set $\varepsilon_y = \frac{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_1}}{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_2}}\varepsilon_x > 0$. We have:

$$\begin{aligned}\psi^i(u_1' - \varepsilon_x, u_2' + \varepsilon_y, p) &= \psi^i(u_1', u_2', p) - \varepsilon_x \frac{\partial \psi^i(u_1', u_2', p)}{\partial u_1} + \varepsilon_y \frac{\partial \psi^i(u_1', u_2', p)}{\partial u_2} + o(\varepsilon_x, \varepsilon_y) \\ &= \psi^i(u_1', u_2', p) + o(\varepsilon_x).\end{aligned}$$

The term in $o(\varepsilon_x)$ could be made arbitrarily small and we hence deduce from (27) and from a similar first-order development that:

$$-\varepsilon_x \frac{\partial \psi^i(u_1', u_2', p')}{\partial u_1} + \frac{\partial \psi^i(u_1', u_2', p')}{\partial u_2}\frac{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_1}}{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_2}}\varepsilon_x + o(\varepsilon_x) \geq 0.$$

Dividing by ε_x and taking the limit $\varepsilon_x \to 0$, we obtain:

$$\frac{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_1}}{\frac{\partial \psi^i(u_1', u_2', p)}{\partial u_2}} \geq \frac{\frac{\partial \psi^i(u_1', u_2', p')}{\partial u_1}}{\frac{\partial \psi^i(u_1', u_2', p')}{\partial u_2}}.$$

□

A.3.3 Proof of Proposition 1

Proof. Let $p, p' \in (0,1)$ with $p' \geq p$. We can assume that $s_*(p) > \underline{s}$. For any $p \in (0,1)$, define $\tilde{\psi}_p(s) = \psi(U_1(W - s, Rs), U_2(W - s, Rs), p)$. By the chain rule, for any $s \in (0, W)$, we have:

$$\frac{d\tilde{\psi}_p}{ds}(s) = \tilde{U}_1'(s)\frac{\partial \tilde{\psi}_p}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial \tilde{\psi}_p}{\partial u_2}(s).$$

Assume first that $s_*(p) = \overline{s}$. In that case, with notation (22) the FOC of the saving program is:

$$\tilde{U}_1'(\overline{s})\frac{\partial\tilde{\psi}_p}{\partial u_1}(\overline{s}) + \tilde{U}_2'(\overline{s})\frac{\partial\tilde{\psi}_p}{\partial u_2}(\overline{s}) \geq 0,$$

where we make the dependence in p explicit. Equivalently, using the remarks of the proof of Proposition 2 ($\frac{\partial\tilde{\psi}_p}{\partial u_2}(\overline{s}) > 0$ and $\tilde{U}_1'(\overline{s}) < 0$):

$$\frac{\frac{\partial\tilde{\psi}_p}{\partial u_1}(\overline{s})}{\frac{\partial\tilde{\psi}_p}{\partial u_2}(\overline{s})} \leq -\frac{\tilde{U}_2'(\overline{s})}{\tilde{U}_1'(\overline{s})}. \tag{29}$$

Since $p' \geq p$ and since $\tilde{U}_2(\overline{s}) > \tilde{U}_1(\overline{s})$, inequality (2) holds and implies with (29): $\tilde{U}_1'(\overline{s})\frac{\partial\tilde{\psi}_{p'}}{\partial u_1}(\overline{s}) + \tilde{U}_2'(\overline{s})\frac{\partial\tilde{\psi}_{p'}}{\partial u_2}(\overline{s}) \geq 0$, which means that $s_*(p') = \overline{s}$ and the second point of Proposition 2 holds. We now consider that $s_*(p)$ is interior, and similarly that $s_*(p')$ also is. The two saving levels are thus characterized by the following FOCs:

$$\frac{\frac{\partial\tilde{\psi}_p}{\partial u_1}(s_*(p))}{\frac{\partial\tilde{\psi}_p}{\partial u_2}(s_*(p))} = -\frac{\tilde{U}_2'(s_*(p))}{\tilde{U}_1'(s_*(p))} \text{ and } \frac{\frac{\partial\tilde{\psi}_{p'}}{\partial u_1}(s_*(p'))}{\frac{\partial\tilde{\psi}_{p'}}{\partial u_2}(s_*(p'))} = -\frac{\tilde{U}_2'(s_*(p'))}{\tilde{U}_1'(s_*(p'))}. \tag{30}$$

Furthermore, since $s_*(p)$ is unique by assumption, we must have:

$$\tilde{U}_1'(s)\frac{\partial\tilde{\psi}_p}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial\tilde{\psi}_p}{\partial u_2}(s) > 0 \text{ for } s < s_*(p), \tag{31}$$

Indeed, consider $s \mapsto \tilde{U}_1'(s)\frac{\partial\tilde{\psi}_p}{\partial u_1}(s) + \tilde{U}_2'(s)\frac{\partial\tilde{\psi}_p}{\partial u_2}(s)$ on $s < s_*(p)$. It cannot change sign or cancel unless contradicting the uniqueness of $s_*(p)$. If strictly negative, it means that utility can be strictly increased by considering $s < s_*(p)$ and close to $s_*(p)$ – which contradicts the optimality of $s_*(p)$.

Assume that $s_*(p) > s_*(p')$. We deduce from (30) and (31):

$$\tilde{U}_1'(s_*(p'))\frac{\partial\tilde{\psi}_p}{\partial u_2}(s_*(p'))\left(\frac{\frac{\partial\tilde{\psi}_p}{\partial u_1}(s_*(p'))}{\frac{\partial\tilde{\psi}_p}{\partial u_2}(s_*(p'))} - \frac{\frac{\partial\tilde{\psi}_{p'}}{\partial u_1}(s_*(p'))}{\frac{\partial\tilde{\psi}_{p'}}{\partial u_2}(s_*(p'))}\right) > 0,$$

which, with $\tilde{U}_1'(s_*(p')) < 0$ and $\frac{\partial\tilde{\psi}_p}{\partial u_2}(s_*(p')) > 0$, implies:

$$\frac{\frac{\partial\tilde{\psi}_p}{\partial u_1}(s_*(p'))}{\frac{\partial\tilde{\psi}_p}{\partial u_2}(s_*(p'))} < \frac{\frac{\partial\tilde{\psi}_{p'}}{\partial u_1}(s_*(p'))}{\frac{\partial\tilde{\psi}_{p'}}{\partial u_2}(s_*(p'))},$$

which contradicts inequality (2) and that i is p-monotone. □

A.3.4 Proof of Proposition 3

We start with inequality (9). Since agents A and B have identical ordinal preferences, their behavior in the absence of risk is identical and their savings, when survival is certain, is the same: $s_A(1) = s_B(1)$. We thus obtain from Proposition 2 that for any $\varepsilon > 0$:

$$s_A(1-\varepsilon) - s_A(1) \leq s_B(1-\varepsilon) - s_B(1) \leq 0, \tag{32}$$

which shows that the increase ε in mortality probability implies a higher reduction in savings for the more risk averse agent. We deduce the formal result (9) from inequality (32) by dividing by $-\varepsilon < 0$ and taking the limit $\varepsilon \to 0^+$.

Let us turn to inequality (10). Since we also have $s_A(0) = s_B(0)$, we deduce $s_A(\varepsilon) - s_A(0) \leq s_B(\varepsilon) - s_B(0)$ for any $\varepsilon > 0$ and the result is then direct.

B Supplementary figures

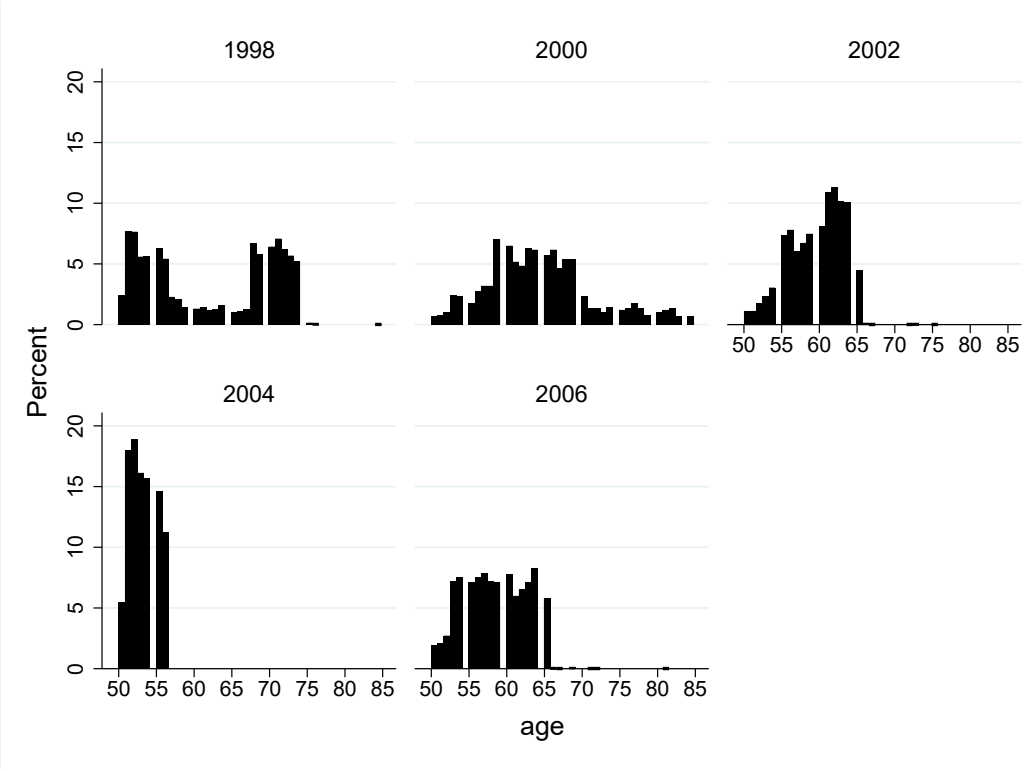
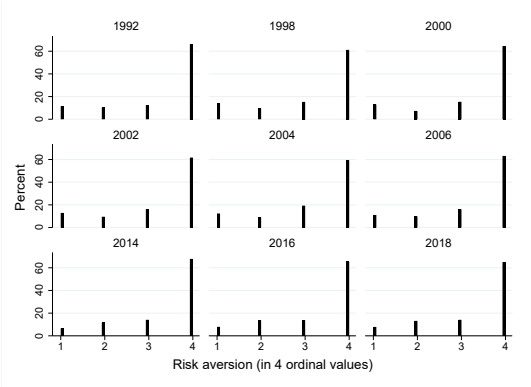
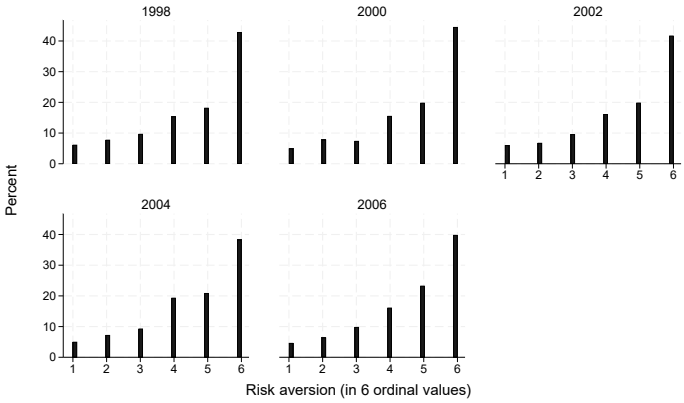


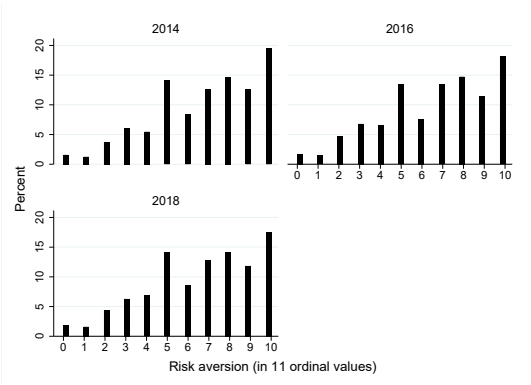
Figure B1: Age of respondents to risk aversion question.



(a) 4-valued (1992-2018; grouping from 2014 to 2018)

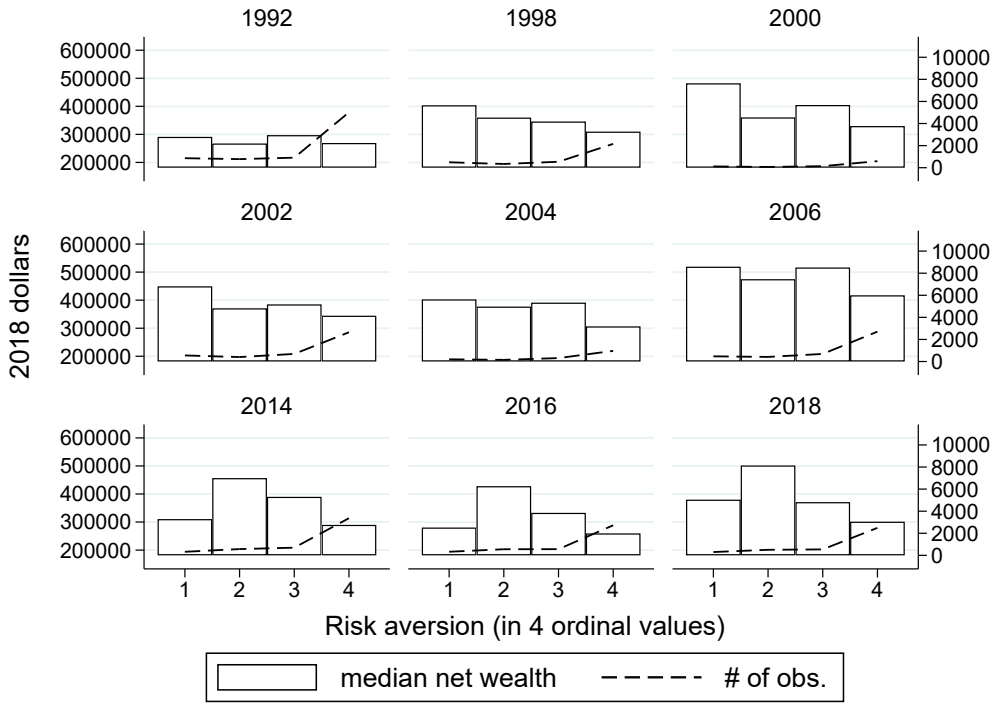


(b) 6-valued (2000-2006)

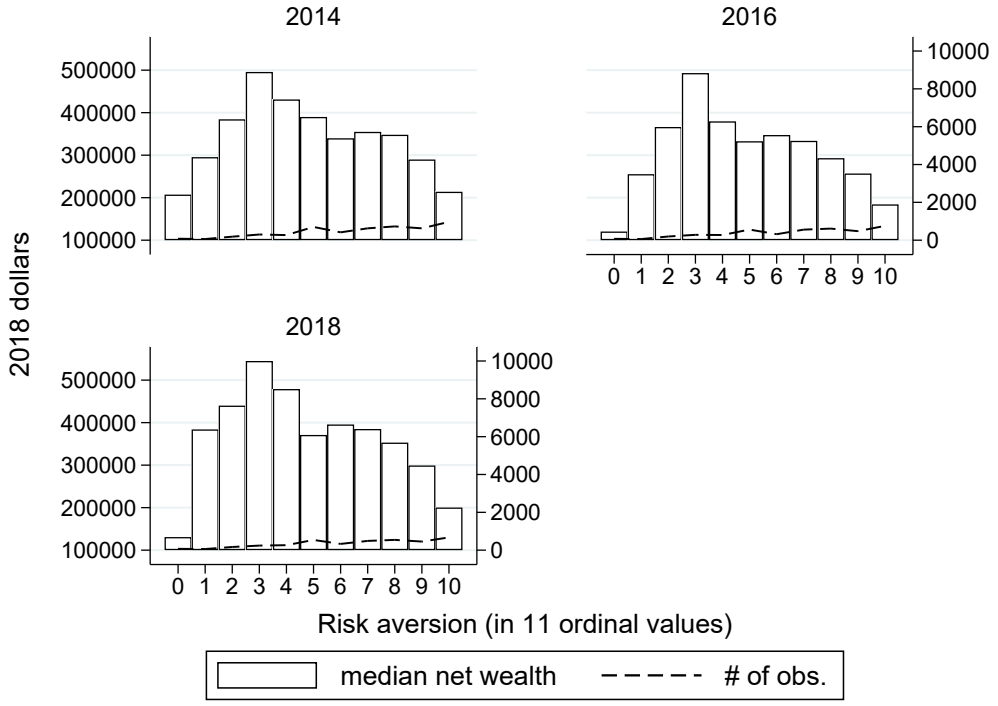


(c) 11-valued (2014-2018)

Figure B2: Distribution of risk aversion

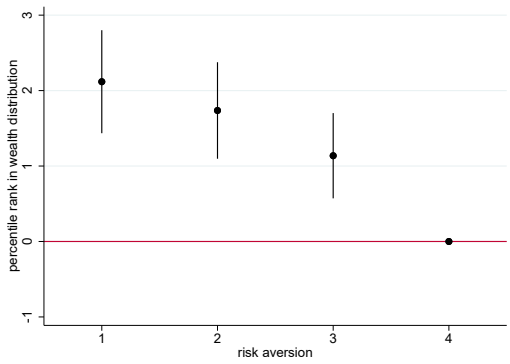


(a) 4-valued (1992-2018)

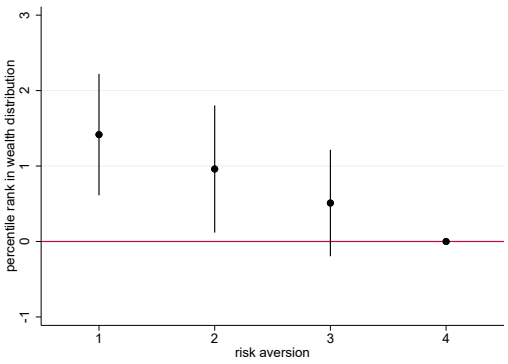


(b) 11-valued (2014-2018)

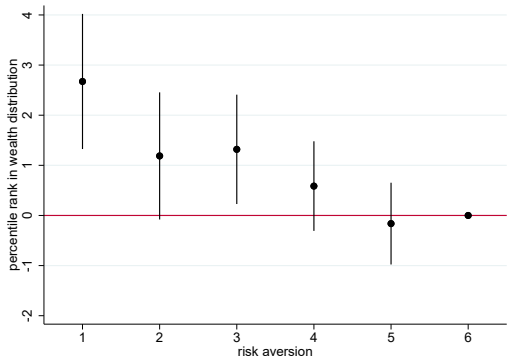
Figure B3: Median net wealth and risk aversion (4- and 11-valued)



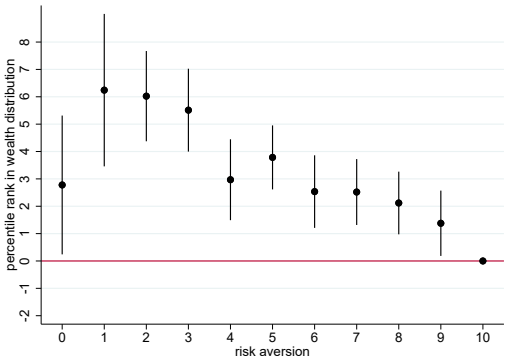
(a) 4-valued (1992-2018; grouping from 2014 to 2018)



(b) 4-valued (1998-2006)

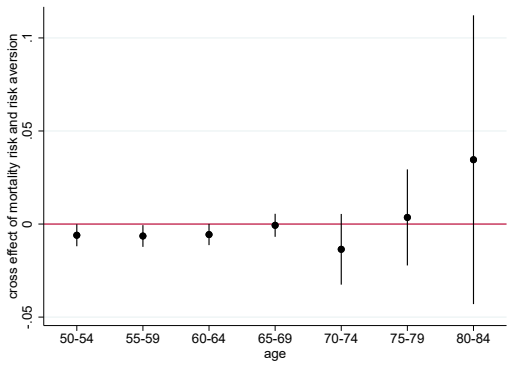


(c) 6-valued (1998-2006)

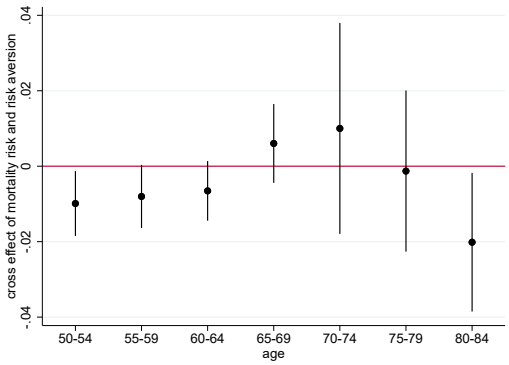


(d) 11-valued (2014-2018)

Figure B4: Unrestricted estimates of risk aversion coefficients β_k.



(a) Subjective mortality risk (proportional shift method)



(b) Surmortality risk (subjective-objective mortality risk)

Figure B5: Cross effect of mortality risk and risk aversion (by 5-year age interval)

C Supplementary tables

Table C1: Determinants of percentile rank of wealth

	All respondents	Risk aversion respondents
Time period	1992-2018	1998-2006
Constant	16.30***	-1.879
	(11.81)	(0.69)
Income (rank)	0.194***	0.130***
	(40.02)	(12.03)
Income risk	4.041***	5.809***
	(32.36)	(21.85)
Marital status (ref: married)		
Spouse absent	-1.490	4.634
	(-1.26)	(1.17)
Partnered	-1.819***	-2.008
	(-2.90)	(-1.64)
Separated	-1.504*	-2.439
	(-1.68)	(-1.13)
Divorced	-3.815***	-3.647***
	(-9.73)	(-5.14)
Separated/divorced	-12.41	-
	(-1.64)	
Widowed	-0.560*	-0.535
	(-1.83)	(-0.72)
Never married	-0.613	-2.296*
	(-0.90)	(-1.85)
Female	0.678***	1.157***
	(6.29)	(4.61)
Nb. of children	-0.654***	-0.545***
	(-9.06)	(-4.06)
Education (ref: dropout)		
Vocational	-1.574***	-2.541**
	(-2.79)	(-2.45)
High-school graduate	3.545***	2.468***
	(10.23)	(3.54)
Some college	5.300***	4.785***
	(14.03)	(6.45)
College graduate	9.425***	8.816***
	(22.73)	(11.13)
Religion (ref: protestant)		
Catholic	1.293***	2.089***
	(4.06)	(3.87)
Jewish	4.855***	4.754***
	(5.58)	(3.43)
None/no pref	1.099**	1.174
	(2.52)	(1.52)
Other	1.326	-2.115
	(1.63)	(-1.14)
Ethnicity (ref: white/caucasian)		
African american	-8.859***	-8.141***
	(-24.13)	(-11.23)
Other	-0.992*	-1.921*
	(-1.93)	(-1.93)
Hispanic dummy	-4.464***	-4.807***
	(-9.00)	(-5.25)
Region-year FE	Yes	Yes
Observations	103406	14188
R^2	0.323	0.302

t statistics in parentheses

Clustered standard errors at the household level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C2: Single-headed households

Dependent variable	rank in wealth distribution			
Time period	1992-2018	1992-2006	1998-2006	2014-2018
risk aversion (4-valued)	-1.261***	-0.727**		
	(-5.55)	(-2.52)		
risk aversion (6-valued)			-0.488**	
			(-2.13)	
risk aversion (11-valued)				-0.777***
				(-6.09)
Controls	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	6802	3490	2613	3312
R^2	0.286	0.279	0.268	0.317

Lecture. A higher risk aversion (on a 1-6 scale) is associated with a -0.488 percentile rank in the wealth distribution (conditional on age).
Clustered standard errors at the household level.
t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C3: Partnered or married households

Dependent variable	rank in wealth distribution	
Time period	1992-2006	1998-2006
risk aversion (4-valued)	-0.443***	
	(-3.13)	
spouse's risk aversion (4-valued)	-0.449***	
	(-3.19)	
risk aversion (6-valued)		-0.398***
		(-3.11)
spouse's risk aversion (6-valued)		-0.368***
		(-2.83)
Controls	Yes	Yes
Region-year FE	Yes	Yes
Observations	13810	8272
R^2	0.311	0.317

Lecture. A higher risk aversion (on a 1-6 scale) is associated with a -0.398 percentile rank in the wealth distribution (conditional on age).
Clustered standard errors at the household level.
t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C4: Sensitivity analysis wrt measurement of risk aversion

Dependent variable	rank in wealth distribution			
	(1)	(2)	(3)	(4)
Time period	1992-2018	1992-2006	1998-2006	2014-2018
4-valued risk aversion	-0.769***	-0.475***		
	(-7.51)	(-3.85)		
6-valued risk aversion			-0.443***	
			(-4.19)	
11-valued risk aversion				-0.585***
				(-8.64)
Controls	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	33217	20990	14061	12227
R^2	0.332	0.321	0.326	0.382

Lecture. A higher risk aversion (on a 1-6 scale) is associated with a -0.443 percentile rank in the wealth distribution (conditional on age).
Controls: income (rank), income risk, gender, marital status, number of children, spouse's age (5-year dummies), (education, ethnicity, religion) interacted with spouse's.
Note. Column (1) combines 1992-2006 with 2014-2018: see footnote 16 for details.
Clustered standard errors at the household level.
t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C5: Correlation matrix of different measures of risk aversion

Risk aversion wrt	Financial matters	Driving	Health	Leisure activities	Occupation
Financial matters	1	0.5534	0.4864	0.5056	0.5543
Driving	0.5534	1	0.539	0.4652	0.5057
Health	0.4864	0.539	1	0.3896	0.5364
Leisure activities	0.5056	0.4652	0.3896	1	0.5608
Occupation	0.5543	0.5057	0.5364	0.5608	1

Table C6: Parents vs. non-parents

Dependent variable	rank in wealth distribution	
Time period	2000-2006	
Non-parents	-1.254***	
	(-2.71)	
Parents		-0.353***
		(-2.78)
Controls	Yes	Yes
Region-year FE	Yes	Yes
Observations	713	9645
R^2	0.464	0.317

Lecture. Separate estimations for parents and non-parents.

Parents: Households with at least 1 child.

Non-parents: Households with no child.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C7: Cross effect of subjective surmortality risk and risk aversion - Excluding focal answers

Dependent variable	rank in the wealth distribution					
	(1)	(2)	(3)	(4)	(5)	(6)
Time period	2000-2006					
Risk aversion	-0.445***	0.0221	-0.409***	1.822	0.997	0.359
	(-2.99)	(0.01)	(-2.72)	(1.02)	(1.52)	(0.22)
Income risk	5.650***	5.848***	5.657***	6.011***	5.663***	5.983***
	(16.53)	(7.51)	(16.56)	(7.62)	(16.58)	(7.59)
Life-table mortality risk	0.00923	0.00898	0.0101	0.152*	0.152*	0.00973
	(0.19)	(0.19)	(0.21)	(1.85)	(1.85)	(0.20)
Surmortality risk	-0.0228***	-0.0228***	0.0255	0.0372	0.0361	0.0265
	(-2.65)	(-2.65)	(1.03)	(1.46)	(1.43)	(1.06)
Risk aversion × income risk		-0.0437		-0.0765		-0.0718
		(-0.29)		(-0.50)		(-0.47)
Risk aversion × life-table mortality risk				-0.0306**	-0.0305**	
				(-2.19)	(-2.18)	
Risk aversion × surmortality risk			-0.0106**	-0.0130**	-0.0128**	-0.0108**
			(-2.11)	(-2.52)	(-2.51)	(-2.13)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6649	6649	6649	6649	6649	6649
R^2	0.320	0.320	0.320	0.321	0.321	0.320

Lecture. Column 1: A higher subjective surmortality risk of +10pp is associated with a -0.228 percentile rank in the wealth distribution (conditional on age).

Note. Surmortality risk: difference between self-assessed (subjective) and life-table (objective) mortality risk.

Controls: same as in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C8: Cross effect of subjective surmortality risk and risk aversion - Keeping individual-year observations above P35 (instead of P30) of wealth distribution

Dependent variable	rank in the wealth distribution					
	(1)	(2)	(3)	(4)	(5)	(6)
Time period	2000-2006					
Risk aversion	-0.369***	-0.0792	-0.354***	0.738	0.269	0.106
	(-3.09)	(-0.06)	(-2.94)	(0.53)	(0.52)	(0.08)
Income risk	5.528***	5.651***	5.533***	5.732***	5.533***	5.728***
	(18.26)	(8.84)	(18.29)	(8.92)	(18.31)	(8.89)
Life-table mortality risk	0.00481	0.00470	0.00437	0.0682	0.0682	0.00418
	(0.15)	(0.14)	(0.13)	(1.10)	(1.10)	(0.13)
Surmortality risk	-0.0268***	-0.0268***	-0.00303	0.00193	0.00123	-0.00235
	(-4.02)	(-4.02)	(-0.17)	(0.10)	(0.07)	(-0.13)
Risk aversion × income risk		-0.0272		-0.0438		-0.0431
		(-0.23)		(-0.37)		(-0.36)
Risk aversion × life-table mortality risk				-0.0135	-0.0135	
				(-1.23)	(-1.23)	
Risk aversion × surmortality risk			-0.00511	-0.00615	-0.00600	-0.00526
			(-1.40)	(-1.62)	(-1.59)	(-1.42)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9612	9612	9612	9612	9612	9612
R^2	0.298	0.298	0.298	0.298	0.298	0.298

Lecture. Column 1: A higher subjective surmortality risk of +10pp is associated with a -0.268 percentile rank in the wealth distribution (conditional on age).

Note. Surmortality risk: difference between self-assessed (subjective) and life-table (objective) mortality risk.

Controls: same as in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C9: Cross effect of subjective surmortality risk and risk aversion - Keeping individual-year observations above P25 (instead of P30) of wealth distribution

Dependent variable	rank in the wealth distribution					
	(1)	(2)	(3)	(4)	(5)	(6)
Time period	2000-2006					
Risk aversion	-0.412***	-1.232	-0.387***	-0.0581	0.519	-0.976
	(-3.28)	(-0.95)	(-3.05)	(-0.04)	(0.96)	(-0.74)
Income risk	6.137***	5.785***	6.142***	5.897***	6.144***	5.889***
	(19.39)	(8.74)	(19.43)	(8.85)	(19.46)	(8.81)
Life-table mortality risk	-0.00974	-0.00947	-0.0102	0.0831	0.0831	-0.0100
	(-0.28)	(-0.27)	(-0.30)	(1.27)	(1.27)	(-0.29)
Surmortality risk	-0.0288***	-0.0288***	0.00429	0.00964	0.0106	0.00335
	(-4.21)	(-4.20)	(0.23)	(0.49)	(0.54)	(0.17)
Risk aversion × income risk		0.0775		0.0543		0.0555
		(0.64)		(0.44)		(0.45)
Risk aversion × life-table mortality risk				-0.0196*	-0.0196*	
				(-1.70)	(-1.71)	
Risk aversion × surmortality risk			-0.00707*	-0.00817**	-0.00837**	-0.00687*
			(-1.87)	(-2.07)	(-2.15)	(-1.79)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11030	11030	11030	11030	11030	11030
R^2	0.344	0.344	0.344	0.344	0.344	0.344

Lecture. Column 1: A higher subjective surmortality risk of +10pp is associated with a -0.288 percentile rank in the wealth distribution (conditional on age).

Note. Surmortality risk: difference between self-assessed (subjective) and life-table (objective) mortality risk.

Controls: same as in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C10: Robustness checks: Control variables

Dependent variable	rank in the wealth distribution					
	(1)	(2)	(3)	(4)	(5)	(6)
Time period	2000-2006					
Risk aversion	-0.428***	-0.417***	-0.390***	-0.378***	-0.451***	-0.411***
	(-3.49)	(-3.40)	(-3.34)	(-3.17)	(-3.34)	(-3.19)
Income risk (baseline)	5.776***	5.659***	5.370***	5.502***		
	(18.68)	(18.52)	(17.98)	(17.97)		
Income risk (CV)					9.404***	8.235***
					(2.96)	(3.28)
Health (ref: Excellent)						
Very good health		-1.048**				-1.271**
		(-2.00)				(-2.23)
Good health		-3.367***				-3.591***
		(-5.72)				(-5.63)
Fair health		-4.315***				-4.414***
		(-5.93)				(-5.57)
Share of risky assets			0.264***			0.276***
			(25.23)			(24.20)
Share of stocks				0.284***		
				(18.71)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10358	10355	10358	10358	8686	8683
R^2	0.319	0.324	0.389	0.356	0.276	0.359

Controls: same as in Table 2.

Income risk (CV): measure issued from Arellano et al. (2022).

Risky assets: Stocks + IRA.

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C11: Cross effect of mortality risks and risk aversion

Dependent variable	rank in wealth distribution			
	(1)	(2)	(3)	(4)
Time period	2000-2006			
Risk aversion (6-valued)	-0.424***	-0.460	-0.0161	0.336
	(-3.46)	(-0.36)	(-0.07)	(0.25)
Income risk	5.787***	5.801***	5.789***	5.937***
	(18.61)	(8.89)	(18.63)	(8.97)
Mortality risk at 80 (50-64)	-0.0316***		0.00487	0.00537
	(-3.86)		(0.23)	(0.25)
Mortality risk at 85 (50-64)	-0.0256***		0.00814	0.00851
	(-2.63)		(0.35)	(0.37)
Mortality risk at 80 (65-69)	0.0429*		0.103**	0.104**
	(1.94)		(2.45)	(2.46)
Mortality risk at 85 (70-74)	-0.00337		0.221	0.223
	(-0.04)		(1.47)	(1.48)
Mortality risk at 90 (75-79)	0.0242		0.0903	0.0923
	(0.39)		(0.91)	(0.92)
Mortality risk at 95 (80-84)	0.00382		0.254**	0.256**
	(0.06)		(2.11)	(2.11)
Risk aversion × income risk		0.00262		-0.0326
		(0.02)		(-0.27)
Risk aversion × mortality risk at 80 (50-64)			-0.00787*	-0.00797*
			(-1.85)	(-1.86)
Risk aversion × mortality risk at 85 (50-64)			-0.00715	-0.00723
			(-1.59)	(-1.60)
Risk aversion × mortality risk at 80 (65-69)			-0.0125*	-0.0127*
			(-1.71)	(-1.72)
Risk aversion × mortality risk at 85 (70-74)			-0.0481*	-0.0486*
			(-1.76)	(-1.78)
Risk aversion × mortality risk at 90 (75-79)			-0.0130	-0.0135
			(-0.72)	(-0.74)
Risk aversion × mortality risk at 95 (80-84)			-0.0520**	-0.0524**
			(-2.11)	(-2.11)
Controls	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	10358	10358	10358	10358
R^2	0.322	0.322	0.322	0.322

Lecture. Column 1: For individuals aged 50-64, reporting a survival probability at 80 of +10pp is associated with a +0.316 percentile rank in the wealth distribution (conditional on age).

Controls: 5-year age dummies (as well as an interaction between the last bracket and year 2006) on top of those mentioned in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C12: Robustness wrt income risk

Dependent variable	rank in wealth distribution	
Marital status	Always singles	Always couples
Risk aversion	-0.886***	-0.529***
	(-3.13)	(-3.05)
Surmortality risk (percentile rank)	-0.053***	-0.028***
	(-1.99)	(-2.69)
Relative income risk (percentile rank)	0.007	0.043***
	(0.27)	(3.13)
Controls	Yes	Yes
Region-year FE	Yes	Yes
Observations	784	5705
R^2	0.256	0.268

Lecture. A +1pp in the distribution of surmortality risk is associated with a -0.028 percentile rank in the wealth distribution (conditional on age).
Clustered standard errors at the household level.
t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

D An alternative aggregate measure of mortality risk

Instead of using the surmortality measure of Section 4.1.2, we propose another option to aggregate subjective mortality risks into a single one by resorting to the so-called *proportional shift* method (as in, e.g., Delavande and Rohwedder, 2011a). To that end, let us consider some baseline target age: say, 85. We then compute a predicted mortality risk at 85 by shifting every 5-year age-dependent mortality risk: we multiply those risks by the ratio of the life table probability of dying at 85 over the life table probability of dying at target ages 80, 90, or 95, depending on the respondent's 5-year age. Choosing the youngest target age available in the survey, namely 80, as the baseline would of course ensure that shifted mortality risks do not exceed 100%; however, individuals aged 80-84 in the sample would then have a null subjective mortality risk since those individuals have survived until 80. By definition, the life table counterpart of the subjective probability of survival at target age $T = 80, 85, 90, 95$ is $P_T = \prod_{x=a}^{T-1}(1 - q_x)$, where q_a designates the life table probability of dying between age a and $a + 1$, for any female or male cohort and for any age a within the $[0, 110]$ range. Table D1 in Appendix then enables us to further corroborate our previous diagnoses: in a wealth equation, risk aversion and subjective mortality risk coefficients have negative signs; the cross effect of income risk and risk aversion is not significant; the cross effect of that subjective mortality risk and risk aversion is negative (though significant at 10% only).

Table D1: Cross effect of subjective mortality risk and risk aversion

Dependent variable	rank in the wealth distribution			
	(1)	(2)	(3)	(4)
Time period	2000-2006			
Risk aversion	-0.423***	-0.461	-0.0974	0.0672
	(-3.45)	(-0.36)	(-0.44)	(0.05)
Income risk	5.756***	5.740***	5.763***	5.832***
	(18.67)	(8.80)	(18.70)	(8.86)
Subjective mortality risk	-0.0170***	-0.0170***	0.00714	0.00730
	(-3.43)	(-3.43)	(0.51)	(0.51)
Risk aversion × income risk		0.00357		-0.0153
		(0.03)		(-0.13)
Risk aversion × subjective mortality risk			-0.00516*	-0.00520*
			(-1.84)	(-1.83)
Controls	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	10358	10358	10358	10358
R^2	0.320	0.320	0.320	0.320

Lecture. Column 1: A higher subjective mortality risk of +10pp is associated with a -0.17 percentile rank in the wealth distribution (conditional on age).

Note. Subjective mortality risk computed from proportional shifts to previous mortality risks, based on HMD life-tables.

Controls: same as in Table 2.

Clustered standard errors at the household level.

t statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.