Health insurance and treatment decisions: a theoretical and experimental investigation

David Crainich[1], Léontine Goldzahl[2], Florence Jusot[3,4], and Doriane Mignon[*,3]

[1]CNRS (LEM UMR 9221) and IESEG School of Management
[2]Edhec Business School
[3]Université Paris-Dauphine, PSL, LEDa, LEGOS, Paris, France
[4]IRDES

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Abstract

We examine health insurance decision using a bivariate model with financial and health outcomes. We derive theoretical predictions on the effect of preferences (preference for health relative to wealth, financial risk aversion and preferences towards the correlation between wealth and health) on treatment and health insurance decisions. Depending on these preferences, we also derive theoretical predictions on the relationship between insurance indemnity and treatment intensity. We test these predictions using data collected in a laboratory experiment. In line with our theoretical model, our empirical results suggest that preference for health relative to wealth explains health insurance through treatment choice and correlation averse individuals purchase higher levels of health insurance coverage.

JEL: I13, C91, D90
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[*]Corresponding author: doriane.mignon@dauphine.fr
Université Paris-Dauphine, Place du Maréchal de Lattre de Tassigny, 75016 Paris

1 Introduction

Health insurance is a specific type of insurance for two reasons. These have important implications in how health insurance decision are modelled. First, empirical evidence suggests that the demand for health insurance is not only driven by the willingness to cover financial risks (Arrow, 1963; Pauly, 1968), but also to improve one's health. Health improvement results from better access to healthcare providers or reduced waiting time (Finkelstein et al., 2012; Aron-Dine et al., 2013; Michalopoulos et al., 2011). Hence, modelling health insurance decisions requires to use a bi-dimensional utility function with a health and a financial component. Second, an individual is able to decide the extent of his health damages ex-post *i.e.* when he knows he is sick. In other words, he can decide to buy a treatment, among a set of more or less expensive and effective treatments, that will improve his health if he is sick. Health insurance is typically used to cover such expenses. Therefore, the extent of health insurance coverage influences treatment choices, and vice versa. Modelling health insurance decisions should consider the joint decision of health insurance coverage and treatment.
Our paper examines joint health insurance and treatment decisions using a bi-variate model with financial and health outcomes in an expected utility framework. Incorporating these two features to model health insurance decision results in considering the impact of health preference relative to money and preference towards correlation as well as the interaction between treatment and health insurance decisions. We derive theoretical predictions and test them using data collected in a lab experiment. We find that preferences for risk and for correlation have a direct impact on health insurance decision, while preference for health relative to money has a direct impact on treatment choice and an indirect impact on health insurance decision through its effect on treatment choice. These theoretical results are partially supported by our data.

Our contribution to the existing literature is twofold. First, we contribute to the theoretical literature by considering health insurance consequences on individuals' health state through its relationship with treatment decisions. This differs from Rey (2003)'s theoretical model which does not include a treatment decision as treatment cost is exogenous. In our paper, the individual chooses among several treatment that differs according to their costs and effectiveness. Incorporating a joint treatment and health insurance decision yield a new determinant to health insurance demand which is health preference relative to money whose effect on health insurance has not been looked at.
Second, the empirical test of the theoretical predictions rely on data generated in a lab

experiment. Previous papers measuring determinants of health insurance coverage differ from ours in several ways. Three papers focus on the relationship between risk preference in the financial domain and health insurance coverage decisions. Schram and Sonnemans (2011) and Kairies-Schwarz et al. (2017) use the experimental lab to measure risk preference in relation to health insurance decisions. They respectively base their studies on the expected utility theory and prospect theory. van Wilgenburg (2018)'s work adds to this stream of the literature by examining how subjective belief about health expenses in addition to risk preference and probability weighting affect health insurance coverage decisions. Other papers account for the bi-dimensional nature of the utility function to address health-related issues, and hence measure preference towards correlation. Finkelstein et al. (2016) used survey data to propose a measure of preference toward correlation in relation to health insurance. Attema et al. (2019) and Gyrd-Hansen (2016) also measured preference for correlation using experimental data, although their aim was not to study health insurance demand. Besides, Attema et al. (2019) use years of life which relates more to preference for longevity rather than health. Our experimental design is closer to Gyrd-Hansen (2016), especially because she measures both preference for correlation and the preference for health relative to money. Overall, the objective of the three papers was to describe the population distribution of preferences, while we focus on the relationship between preferences and health insurance decisions.

The paper proceeds as follow. In section 2, we develop our theoretical model and derive the predictions. Section 3 describes the experimental setting. Our results are displayed in section 5 and discussed in the last one.

2 Theoretical Setting

2.1 The model

Let us consider individuals maximizing their expected utility over one time period and deriving utility from wealth (w) and health (h), so that their utility function is denoted $u(w, h)$. The utility function is increasing but we make no assumptions about the signs of its second-order derivatives in order to consider different preferences towards risk.[1]. A given disease occurs with probability p and lowers individual's health status from h to $h - m$, where m

[1]First and second derivatives of the utility function with respect to the first argument (wealth) are respectively denoted by $u_1(w, h)$ and $u_{11}(w, h)$. First and second derivatives of the utility function with respect to the second argument (health) are respectively denoted by $u_2(w, h)$ and $u_{22}(w, h)$. The cross derivative of the utility function is denoted by $u_{12}(w, h)$. An individual is correlation averse if $u_{12}(w, h) < 0$.

denotes the severity of the disease. We refer to this state as the loss state. In case of disease, the individual has the opportunity to undertake a treatment (the intensity of which is denoted n) reducing the detrimental effect of the disease: $m(n)$ is thus the severity of disease where $m'(n) < 0$ (treatment reduces the severity of disease) and $m''(n) > 0$ (the marginal return of treatment is decreasing) are assumed. The unit cost of the treatment is constant (it is denoted by c). The total cost of the treatment is then $cn = T$. Before the potential occurrence of disease, individuals are offered insurance at fair odds: when purchasing insurance contracts, individuals choose a lump-sum indemnity $I \in [0, \overline{I}]$[2] received in case of disease in exchange for a premium pI. The individual maximization program is thus given by:

$$Max_{I,n} EU = (1-p)U(w - pI, h) + pU(w - pI - T + I, h - m(n))$$

We adopt the following notation: $A = (w - pI, h)$ and $B = (w - pI - T + I, h - m(n))$. The first order conditions related to this maximization program are given by:

$$\frac{\delta EU}{\delta I} = -(1-p)pu_1(A) + (1-p)pu_1(B) = 0 \tag{1}$$

$$\frac{\delta EU}{\delta n} = -cu_1(B) - m'(n)u_2(B) = 0 \tag{2}$$

We suppose that second order conditions are met so that Eqs. (1) and (2) jointly define an interior solution which is a maximum. Note that aversion to financial risk ($u_{11}(w,h) < 0$)) is a necessary condition for these second order conditions to be satisfied.

2.2 The effect of preferences on treatment and insurance decisions

Regardless of the treatment intensity n, it can be deduced from Eq.(1) that the optimal level of insurance indemnity is such that $u_1(A) = u_1(B)$ when an interior solution prevails. As indicated by Rey (2003), this implies that the insurance demand depends on individuals' attitudes towards correlation. More precisely:

$$I \lessgtr T \Leftrightarrow u_{12}(w,h) \gtrless 0 \tag{3}$$

The demand for insurance in bivariate environments is dictated by preferences towards both risk and correlation. When individuals are risk averse in the financial domain ($u_{11}(w,h) < 0$)

[2] $\overline{I}$ being the highest insurance indemnity sold by companies.

and correlation neutral ($u_{12}(w,h) = 0$), they transfer wealth from the loss state to the no-loss state only to reduce financial risks. Besides, as shown by Mossin (1968), when insurance premia are actuarially fair, risk averse individuals eliminate risks by purchasing full insurance coverage ($I = T$). This first incentive to transfer wealth across states of the world is combined with another one resulting from preferences towards correlation (*i.e.* if individuals are correlation averse or correlation seekers). When individuals are correlation averse ($u_{12}(w,h) < 0$), their marginal utility of wealth is higher in the loss state than in the no-loss state (Richard, 1975). As a result, correlation aversion offers an additional incentive to transfer wealth from the latter state to the former, so that financial risk aversion combined with correlation aversion lead to more than full insurance ($I > T$) when insurance contracts are purchased at fair odds. In contrast, when they are correlation lovers ($u_{12}(w,h) > 0$), individuals' marginal utility of wealth is higher in the no-loss state than in the loss state. Consequently, individuals do not buy full insurance coverage ($I < T$) as their attitude towards correlation gives them incentives to transfer wealth to the no-loss state.

Suppose now that individuals are risk neutral ($u_{11}(w,h) = 0$), *i.e.* they have no particular preference for the spread of the distribution. In that case, their insurance demand is only driven by their preference towards correlation. Specifically, they purchase more than full insurance when their marginal utility of wealth is higher in the disease state than in the healthy state (correlation aversion) and purchase less than full insurance in the opposite case (correlation seeking). Eq. (1) even indicates that corner solutions prevails when individuals are risk neutrals and: 1) correlation averse ($I = \overline{I}$); 2) correlation seekers ($I = 0$). To see this, consider that $u_{12}(w,h) < 0$ and evaluate Eq. (1) at $I = \overline{I}$:

$$\frac{\delta EU}{\delta I} = -u_1(w - p\overline{I}, h) + u_1(w - p\overline{I} - T + \overline{I}, h - m(n)) > 0 \tag{4}$$

Correlation averse individuals' expected utility increases whenever wealth is transferred from the healthy state to the disease state. As a result, they buy as much insurance as possible and are constrained to buy the maximum indemnity $\overline{I}$.

The same rationale prevails when individuals are correlation seekers ($u_{12}(w,h) > 0$). Consider that preference and Eq. (1) evaluated at $I = 0$:

$$\frac{\delta EU}{\delta I} = -u_1(w,h) + u_1(w - T, h - m(n)) < 0 \tag{5}$$

Correlation seekers transfer as much wealth as possible from the disease state to the healthy state as their marginal utility of wealth is higher in the later state than in the former. There-

fore, they buy no insurance ($I = 0$). Note that individuals who are both correlation neutral and risk neutral are indifferent to insurance.

Risk seeker individuals ($u_{11}(w, h) > 0$) have a preference for maximizing the spread of the wealth distribution they are exposed to. In that case, Eq. (1) does not define a maximum and corner solutions prevail. Individuals make extreme insurance choices (no insurance or maximum insurance) which are dictated by their preferences towards correlation: they buy the maximum level of insurance offered when they are correlation averse (as their marginal utility of wealth is higher in the disease state; inequality (4) also holds in this case) and buy no insurance when they are correlation seekers (as their marginal utility of wealth is higher in the no-disease state; inequality (5) holds). In these two cases, risk seeking thus reinforces the choice dictated by preferences toward correlation (*i.e.* maximum insurance or no insurance). When they are risk seekers and correlation neutral, individuals choose the option that maximizes the difference between the wealth levels in the disease and in the no disease state. This is equivalent to maximizing the absolute value of $I - T$. In our experiment, the extent of the upwards deviations from T were lower than that of downwards deviations. As a result, risk seeking and correlation neutral or seeker subjects are expected to choose no insurance ($I = 0$).

Table 1: Predictions of health and treatment choices according to risk preference and preference towards correlation

T>0	Risk aversion	Risk neutrality	Risk seeking
Correlation aversion	$I > T$	$I > T$	$I > T$
Correlation neutrality	$I = T$	indifference	max $\mid I - T \mid$
Correlation seeking	$I < T$	$I < T$	$I < T$
T=0	Risk aversion	Risk neutrality	Risk seeking
Correlation aversion	$I > T$	$I > T$	$I > T$
Correlation neutrality	$I = T$	indifference	max $\mid I - T \mid$
Correlation seeking	$I = T$	$I = T$	$I = T$

These results are summarized in Table 1. The top panel is when a treatment is chosen (T>0), while the bottom one is when individuals take no treatment (T=0). The absence of treatment (second panel) introduces two differences between the two tables: 1) correlation seekers cannot choose $I < T$ as the insurance indemnity they choose must be non-negative. Therefore, they buy no insurance ($I = T = 0$); 2) correlation neutral and risk seekers

individuals choose $I = 0$ when $T > 0$ (this is in our experiment the option that maximizes the difference between T and I) and $I = \overline{I}$ when $T = 0$.

2.3 Treatment intensity and indemnity level relationship

The treatment intensity choice is made in certainty situation (*i.e.* when the individual is sick). Therefore, as indicated by Eq.(2), it is not directly driven by preferences towards risk or towards correlation. The only preference that directly influences the treatment intensity is the relative preference individuals have towards wealth and health.
However, preferences toward risk and correlation have an indirect impact on treatment intensity through their effect on the insurance indemnity. Likewise, relative preferences towards wealth and health have an indirect impact on the demand for insurance. Therefore, in order to measure these indirect effects, we must determine how the demand for treatment and insurance influence each other. When Eqs. (1) and (2) define an interior solution, the direction of this interaction depends on the sign of Eq. (6):

$$\frac{\delta EU}{\delta I \delta n} = (1-p)p[-cu_{11}(B) - m'(n)u_{12}(B)] \tag{6}$$

Using Eq.(2), it can be shown that the slope of the reaction functions depends on the relative intensity of preferences towards risk and correlation:

$$\frac{\delta EU}{\delta I \delta n} \lessgtr 0 \Leftrightarrow \frac{-u_{11}(B)}{u_1(B)} \lessgtr \frac{-u_{12}(B)}{u_2(B)} \tag{7}$$

This result can be explained as follows. Any increase in treatment intensity in case of disease has - in the loss state - a negative effect on wealth and a positive effect on health. The first effect increases the insurance demand of risk averse individuals while the second increases (resp. decreases) the insurance demand if individuals are correlation seekers (resp. averse). Higher treatment intensity in case of disease indeed reduces the health state gap between the loss and the no-loss state, so that the incentives for correlation seekers (resp. correlation averse) individuals to transfer wealth from the loss state to the no loss state (resp. from the no-loss state to the loss state) is reduced. As a result, if individuals are risk averse and correlation seekers, $\frac{\delta EU}{\delta I \delta n} > 0$ the reaction functions are upward sloping. If individuals are risk averse and correlation averse, the sign of $\frac{\delta EU}{\delta I \delta n}$ depends on the relative intensities of absolute risk aversion ($\frac{-u_{11}(B)}{u_1(B)}$) and of correlation aversion ($\frac{-u_{12}(B)}{u_2(B)}$)[3].

[3]This ratio corresponds to one particular way of measuring the intensity of preferences towards correlation (Crainich et al., 2020)

For some combinations of preferences, the relationship between absolute risk aversion and correlation aversion is straightforward. For example for a risk averse and correlation seeker individual, $u_{11}(w,h) < 0$ is negative and $u_{12}(w,h) > 0$, so $\frac{-u_{11}(B)}{u_1(B)} > \frac{-u_{12}(B)}{u_2(B)}$. According to the relation defined in (7), the sign between insurance indemnity and treatment intensity is positive. Note that the sign of the insurance-treatment relationship may be uncovered without knowing the intensity of the preferences.

When corner solutions prevail, the relationship defined in (7) is not verified. When individuals are risk neutrals or risk seekers, they always either buy no insurance ($I = 0$) or the maximum available insurance ($I = \overline{I}$), regardless of the level of treatment.

3 Experimental design

3.1 Setting

The experiment was conducted in the experimental lab of Université Paris-Dauphine, Paris in France during two weeks in April 2019, and programmed with oTree (Chen et al., 2016). Subjects were second and third year business undergraduate students. Lab experiment participation is mandatory as part of their curriculum. The subjects did not receive any participation fee and no task was financially incentivised[4]. The objective was to avoid inducing a hypothetical bias solely on the health domain in decisions involving a trade-off between health and wealth. We suspected that incentivising only one domain would have made subjects overlooking the health consequences by drawing their attention only on the financial consequences. Answers were fully anonymous.

Upon arrival at the experiment, subjects were given oral instructions and were informed that there were no right or wrong answers, and that their responses are anonymous. The experiment has 3 parts. The first part is a training on probabilities and on getting subjects acquainted with health states description. Health states were described throughout the experiment using the Euroqol EQ-5D-5L descriptive system (EuroQol Group, 1990; Herdman et al., 2011). Every health state is described according to 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has 5 levels: no problems, slight problems, moderate problems, severe problems and extreme problems. Each

[4]Note that this is usually what is done when preferences towards health are measured (see for instance Gyrd-Hansen (2016) or Attema et al. (2019)). Using incentive compatible measure in the health domain is challenging and has not been successfully used so far.

level has a number from 1 to 5, where 1 corresponds to no problem. One can describe a health state by selecting a statement in each dimension. Each decision results in a 1-digit number that expresses the level selected for that dimension. The digits for the five dimensions can be combined into a 5-digit number that describes the respondent's health state.
The second part includes preference elicitation and the joint treatment and insurance tasks. The order of the tasks is random. The third part asks questions about individual socio-demographic and health characteristics.
Subjects took on average 16 minutes to complete the experiment. 289 subjects participated. Among them 19 were excluded due to inconsistencies in their answers to the risk preference measure (multiple switching and preference for strictly dominated option). Our final sample includes 270 individuals.

3.2 Elicitation of preferences

3.2.1 Risk preference

We measure risk aversion in the financial domain using a multiple price list elicitation procedure (Holt and Laury, 2002). The design is adapted from the work of Loomes and Pogrebna (2014) to favor consistency and avoid multiple switchers among our subjects, a concern when using multiple price lists (Lévy-Garboua et al., 2012) (see Appendix A.3.3 for the details of the question).
The subject is presented with a list of 10 decisions between paired gambles Left and Right, displayed in rows. For each decision, the subject chooses which gamble she prefers to play from each pair by picking the Left or the Right one. The payoffs of gamble remain constant across the 10 decisions, but the probabilities associated with each payoff changes. The first row presents the subject with, on the Left, 100% chance of loosing 480 euros, and on the Right hand side 100% chance of loosing 720 euros. All subjects are expected to choose the Left gamble, if they don't, they will be excluded from the sample as they picked a strictly dominated option. For the second decision row, there is only a 1/10 chance of getting a smaller loss for either option, and the expected payoff of the Left option is larger - lower expected loss - than the expected payoff of the Right option. Hence, only a very risk-seeking individual would choose the Right hand side option in the second decision row. Moving down the rows, the probability of the lower loss increases, such that the expected payoff of the Right option is larger - lower expected loss - than the expected payoff of the Left option. Risk preference categories (risk averse, risk neutral or risk seeker) are derived from the number of Left hand side option they choose before switching to the Right hand side one.

If the number of Left hand side gamble is less than 5, individuals are considered risk seeker. If the number of safe choices is exactly 5, individuals are considered risk neutral. Those remaining and who choose more than 5 safe choices are considered risk averse.

3.2.2 Health preference relative to wealth

The preference for health relative to wealth is captured by the individual willingness to pay to improve their health status: the higher her health preference relative to health, the more prone she is to pay for a better health status. The preference for health relative to wealth depends on both the initial health status and wealth. Our goal is to have a measure of health preference comparable across individuals. Therefore, we set for all subjects the same level of available income at 1000€ and a deteriorated initial health status (*55531* corresponding to "I am unable to walk about/I am unable to wash or dress myself/I am unable to do my usual activities/I have moderate pain or discomfort/I am not anxious or depressed"). Subjects first had to state whether they would be willing to pay in order to reach the best health status, that is to say to no longer have this health situation (the 5-digit health status would be 11111). If they were not willing to pay, we assumed their willingness to pay to be zero. Then, the subjects had to specify their willingness to pay by moving a slider from 0 to 1000€ (the detailed question is available in Appendix A.3.1). The start position of the slider was random.

3.2.3 Preference towards correlation

Preference towards correlation captures whether individuals prefer consuming while in good health or in poor health. As in Gyrd-Hansen (2016), subjects have to choose how much money they want to allocate between a good and a bad health state.
At the beginning of the task, the subjects are explained that they face the following situation. They had an accident that damaged their health. They are entitled with a two-months sick leave. Subjects experience a deteriorated health state during the first month as they wait for surgery. After the surgery, their health state improves during the second month. The health states differ along three dimensions: mobility, self-care and ability to perform usual activities[5]. Their employer gives them 200€ worth of vouchers. They have to allocate how much of these vouchers they want to spend in the first or in the second month of their sick leave. The vouchers can be redeemed in many stores or in exchange of services, and they have to be spent by the end of the month they are allocated to. The utilisation of vouchers

[5]The 5-digit EQ5D poor health status is *52531* and the good health status is *21231*

avoid money transfers between the two months and saving in future periods. The subject allocate how much money she wants in each month by moving a slider. The slider is initially position in the middle but no amount is shown, and subjects had to move the slider to see the allocated amounts.
If the subject chooses to allocate more than 100€ to the first month during which he has a poor health state, he is correlation averse. If the subject distributes the vouchers equally between the two months, he is correlation neutral. If the subject chooses to allocate more than 100€ to the second month during which he has a good health state, he is correlation seeker.

3.3 Treatment and health insurance decision

3.3.1 Joint treatment and health insurance task

In this task, subjects had to make an hypothetical joint decision of treatment and health insurance. Subjects are facing a 15% probability to have an accident which damages their health (the health status is *52531*). If the accident occurs, subjects have several treatment options. The cost of the treatment increases with its efficiency in improving health. Subject could choose between three treatment options resulting in various treatment intensity (see Table 2). Note that the difference between the health status are related to three dimensions: mobility, self-care and ability to perform usual activities. We did not introduce any changes along the pain or anxious/depressed dimensions as subjects have difficulty to apprehend them or may entirely focus on it as suggested by the pilot study. After choosing the treatment, health insurance contracts characterized by the amount of indemnity and the premium are displayed.
The contracts are calibrated such that there is always no insurance, incomplete insurance (50% of the treatment cost reimbursed), full insurance and more than full insurance (150% of the treatment cost reimbursed). Besides, premium were actuarially fair[6]. Subjects choosing no treatment only had three insurance indemnity options: no insurance, a fixed indemnity of 100€ or a fixed indemnity of 200€.

A table showing the financial and health consequences of the chosen combination of treatment and health insurance contract in each state of nature (accident or no accident) was made

[6]Due to a programming error, the premium offered for more than full coverage for treatment 1 was not fair. Instead of the intended 300€ indemnity level, 400€ was displayed for a premium of 45€. This may have biased decisions towards this coverage level. Robustness checks without the 23 individuals who chose treatment 1 and more than full coverage are conducted. Our results remain similar.

available to the subject. This aimed at helping him to understand the implications of treatment and health insurance decisions. To increase further the salience of the relationship between the treatment and health insurance choices, subjects had to explore at least 2 different combinations before moving on to the next task. This task is detailed in Appendix A.3.5.

The experimental task induces specific features to the health insurance contract. First, the health insurance decision is made on the indemnity amount, which is not the usual feature of insurance contracts. But it exists and is known under the name of critical illness insurance. A subscription to one of these contracts guarantees a lump-sum payment. Second, the contracts allows for more than full coverage (I>T). This feature also exists in long-term care insurance contracts.

Table 2: Cost and Health impact of treatments

Treatment	Cost	Health status after treatment
No treatment	0€	*52531*
Treatment 1	200€	*31331*
Treatment 2	400€	*11131*

3.3.2 Joint treatment and health insurance variable

Given our experiment, the treatment and insurance decisions are categorical variables. The treatment variable has three categories depending on the cost of the treatment: No Treatment, Treatment 1 and Treatment 2. The insurance variable has four categories reflecting coverage: no insurance, incomplete coverage, full coverage and more than full coverage. For individuals who chose no treatment, the insurance variable values can only be either no insurance or more than full coverage.

Our predictions involve a comparison between the cost of the chosen treatment and the indemnity linked to the health insurance contract chosen. We define an outcome variable as the difference between the health insurance indemnity (I in the model) and the treatment cost (T). We categorize our subjects in three groups: I<T, I=T and I>T. The first group (I<T) includes subjects who chose a treatment (Treatment 1 or Treatment 2) and chose no insurance or an incomplete coverage. The second group (I=T) includes subjects who chose no insurance and no treatment as well as subjects who chose a treatment and full insurance. Finally, the third group (I>T) includes all the subjects who chose more than full coverage,

regardless of the treatment option chosen.
We also define a variable indicating the chosen indemnity level, that is to say for no treatment either 0€, 100€ or 200€; for treatment 1 either 0€, 100€, 200€ or 400€[7]; for treatment 2 either 0€, 200€, 400€ or 600€.

3.4 Other measures

Since the task used to measure preference towards correlation involves also a trade-off of money in time, we cannot exclude that time preferences are involved in this decision. To be able to control for time preferences in our analysis, we measure it using the method developed by Falk et al. (2016) (detailed in Appendix A.3.4). As mentioned before, the third part of our experiment is a socioeconomic and health survey including questions on age, gender, income, self-assessed health status, complementary health insurance coverage and healthcare used in the past 12 months.

4 Testable predictions

The theoretical setting allows us to derive several testable predictions. The experimental design produces data which are used to test four groups of predictions. This section describes the predictions that are tested using the experimental data.

4.1 Prediction on the link between preference and treatment decision

From Eq. 2, we see that treatment intensity is related to the cost of the treatment (c), to treatment efficacy ($m'(n)$) and to health preference relative to wealth (the relative values of u_1 and u_2). As in our experiment treatments cost and efficacy are fixed, subject's treatment decision is only going to be driven by health preference relative to wealth. This provides us with our first testable prediction:

P1: Individuals with stronger preference for health relative to wealth choose a higher treatment intensity.

[7]We choose here to keep the indemnity level subjects saw. When this variable is involved, robustness checks are done with 300€ instead of 400€.

4.2 Predictions on the link between preferences and insurance decision

Eq. 3 gives us detailed predictions for nine combinations of preference towards correlation and risk preference. These predictions depend on whether subjects choose T=0 or T>0. The model predicts that correlation averse individuals always buy more than full insurance, regardless of whether they choose a treatment. From a theoretical perspective, risk seekers and correlation neutral subjects could choose to buy more than full insurance. Risk seekers and correlation neutral maximize the absolute value of $I-T$. In our experimental design, the difference between the treatment and insurance indemnity was larger when I=0 than when I>T. Therefore, risk seekers and correlation neutral subjects are expected to choose I=0 if they choose a treatment T>0. If they choose T=0, risk seekers/correlation neutrals would maximize the absolute value of $I-T$ by choosing the maximum insurance coverage ($I > T$). However, no subject were risk seeker and correlation neutral and chose no treatment in our experiment. As a result, the only subjects likely to buy more than full insurance are - regardless of the treatment selected - correlation averse. Thus our second testable prediction is:

P2 The propensity to buy more than full insurance is higher among correlation averse individuals than among correlation neutral and correlation seeker individuals.

From the detailed theoretical predictions in Table 1, it is also straightforward that when the treatment intensity is positive ($T > 0$), correlation seekers are more likely to buy partial insurance than correlation averse subjects.

P3 Among individuals choosing to treat ($T > 0$), the propensity to buy partial insurance ($I < T$) is higher among correlation seekers than among correlation averse individuals.

4.3 Prediction on the link between treatment and health insurance decision

It relates to Eq. 7. The sign of the relationship between the treatment and insurance decision depends on the sign of the relationship between preferences towards risk and preferences towards correlation. If preferences towards risk and preferences towards correlation

are of opposite sign, the sign of the relationship is straightforward. For example, for a risk averse and correlation seeker individual, this means $u_{11}(w,h) < 0$ and $u_{12}(w,h) > 0$, so $\frac{-u_{11}(B)}{u_1(B)} > \frac{-u_{12}(B)}{u_2(B)}$ and the relationship between insurance and treatment is positive. However if these preferences have the same sign, we need to be able to study their intensity.

Measuring the intensity of preferences towards correlation is not straightforward (Crainich et al., 2020). Our measure of preference towards correlation is only a measure of direction, not of intensity. Therefore, we are able to test predictions only when it does not involve to take into account preference intensities.
When corner solutions prevail, *i.e.* when individuals are risk neutrals or risk seekers, they either buy no insurance ($I = 0$) or the maximum available insurance ($I = \overline{I}$). In the first case, changes in T have no impact on the demand for insurance that remains null. In the second case, the insurance demand increases as the maximum available indemnity was proportional (150%) of the selected treatment. Taking into account interior and corner solutions, the Table 3 summarizes the testable predictions.

Table 3: Testable predictions on the relationship between insurance and treatment decision

	Risk aversion	Risk neutrality	Risk seeking
Correlation aversion	undefined	positive	positive
Correlation neutrality	positive	not related	constant
Correlation seeking	positive	constant	constant

To test these predictions, we would need to have for the same subject several insurance and treatment decisions. One would need to know how an individual changes its treatment intensity for various insurance indemnities, and conversely how an individual changes its health insurance coverage choices for various levels of treatment intensities. Changes of treatment (or health insurance indemnities) would need to be exogenous. This differs from our experimental design in which subjects face a joint health insurance and treatment decision. Therefore, our data does not allow us to properly test predictions resulting from the relationship between insurance and treatment decisions. We examine the sign of relationship between treatment and insurance choices given some combinations of preferences, although this relationship is endogeneous. Hence, our test will only provide limited evidence for this prediction.
P4 The relationship between treatment and insurance indemnity is :

P4a positive for risk averse/correlation neutral, risk averse/correlation seeker, risk neutral/correlation averse and risk seeker/correlation averse subjects

P4b constant for risk neutral/correlation seeker, risk seeker/correlation neutral and risk seeker/correlation seeker subjects

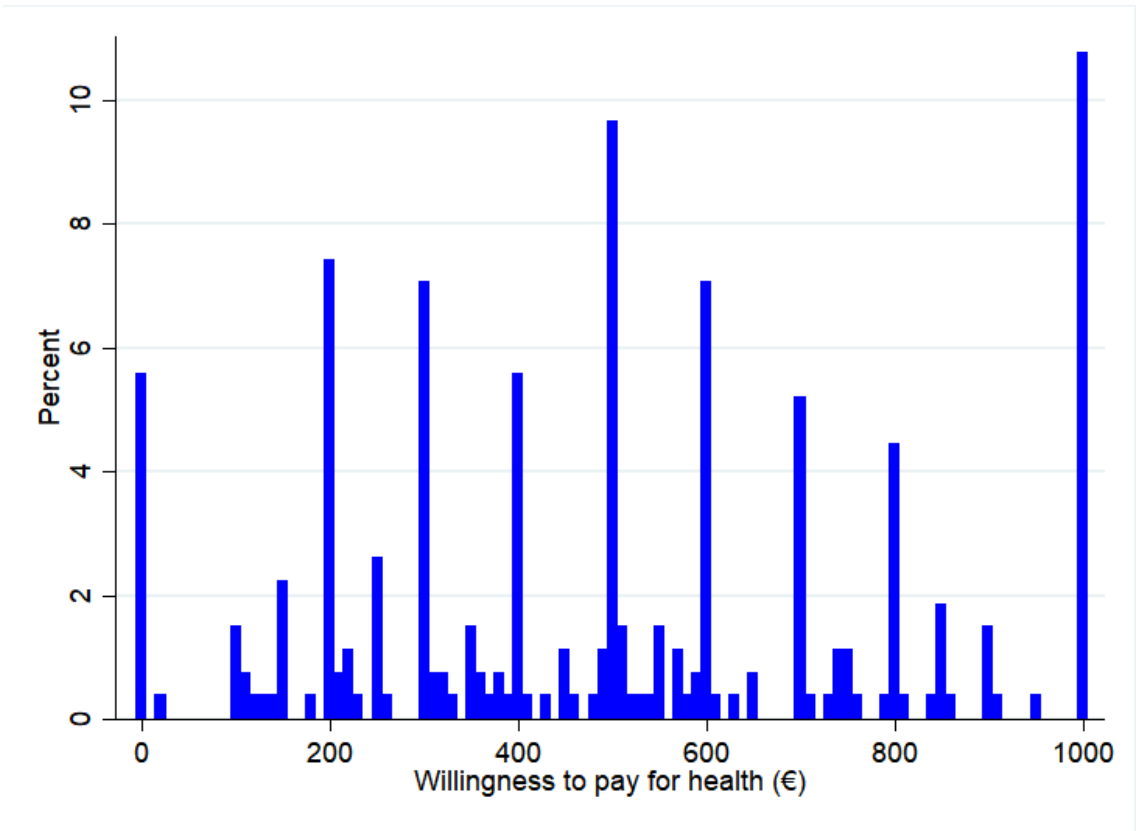
5 Results

5.1 Descriptive statistics

Preferences

We detail here individual's preferences. 5.2% of our participants were not ready to pay to improve their health. In the following, we consider that their willingness to pay for health is zero. The distribution is pictured in Figure 1. The distribution shows us that a considerable

Figure 1: Distribution of the preference for health relative to money



amount of subjects are willing to pay 500€ and 1000€. This may signal a bias toward the middle and toward the extreme. The mean is 501€ and the standard deviation is 286€.

The distribution of risk preference and of preference toward correlation are displayed in Table 4. Our data show that individuals are mainly risk averse (45.9%) and correlation lover (37%).

Preferences toward correlation are distributed quite equally across the three categories, even if individuals tend to be more correlation seekers. This is in line with the empirical work of Finkelstein et al. (2009) but contrary to the works using hypothetical choices of Gyrd-Hansen (2016) and Attema et al. (2019) who concluded that subjects were mostly correlation averse. If we cross-tabulate these two preferences, we find that our subjects exhibit mainly a combination of correlation aversion and risk aversion, as well as combinations of correlation seeking with risk neutrality or risk aversion.

Table 4: Distributions of risk preference and preference toward correlation

	Risk preference				
Preference towards correlation	Risk seeker	Risk neutral	Risk averse	Total	%
Correlation averse	15	29	46	90	33.3
Correlation neutral	15	29	36	80	29.6
Correlation seeker	18	40	42	100	37.0
Total	48	98	124	270	
%	17.8	36.3	45.9		100

Treatment and health insurance decisions

Table 5 shows the distribution of treatment and health insurance choices. Overall, subjects chose to buy a treatment (either Treatment 1 or Treatment 2) and almost 40% decide to buy a full insurance. Table 6 presents our outcome variable that is the difference between the health insurance indemnity (I in the model) and the treatment cost (T). Almost 42% of our sample chooses an indemnity level equal to the treatment cost.

Table 5: Treatment and health insurance decisions

	Treatment				
Insurance	No Treatment (0€)	Treatment 1 (200€)	Treatment 2 (400€)	Total	%
No insurance	6	9	16	31	11.5
Incomplete coverage	0	47	19	66	24.4
Full coverage	0	53	54	107	39.6
More than full coverage	19	23	24	66	24.4
Total	25	132	113	270	
%	9.3	48.9	41.9		

Table 6: Difference between health insurance indemnity and treatment costs

	N	%
I<T	91	33.7
I=T	113	41.9
I>T	66	24.4

5.2 Support for the validity of our experimental design

Our experimental measures of treatment and insurance decisions, preference towards correlation and preferences for health relative to wealth are not incentive compatible. The hypothetical context in which subjects make decisions set the same health and income levels for all subjects. Consequently, variation across individuals in terms of health and income levels should not explain variation in preferences or treatment and insurance choices.
To provide evidence that decisions are not dictated by subject's own health or socioeconomic status, we explore the correlation between choices made in the experiment and individual's characteristics.Results are available in the Appendix (Table A.11). Overall, individual characteristics have no or little impact on preferences. This suggests that despite the lack of incentive compatible tasks, subjects seem to have taken into account the health and income characteristics provided by the design instead of their own. This provides support to our experimental design.

5.3 Empirical test of predictions

5.3.1 Prediction 1: The relationship between preferences and treatment

Prediction 1 yields that health preference relative to money is positively correlated to treatment intensity. We regress the treatment choice on the logarithm of health preference relative to money[8] using an ordered logit model. We compute the marginal effect for each treatment level in Table 7. Panel A presents the results without controlling for preference toward correlation, risk preference and sociodemographic and health characteristics. Panel B shows the estimation results controlling for the covariates. Results are consistent between the two sets of estimations.
The willingness to pay for health measures the health preference relative to money. An increase of 1% in the willingness to pay for health increases by 4% the probability to choose the most expensive treatment (Treatment 2), decreases by 2.6% the probability to choose

[8]The interpretation can be done in terms of variation of a percentage of willingness to pay for health.

Table 7: Estimated effect of health preference relative to money on treatment intensity

Prediction 1	Panel A			Panel B		
	No Treat.	Treat. 1	Treat. 2	No Treat.	Treat. 1	Treat. 2
Health preference	-.015**	-.028**	.043**	-.014**	-.026**	.040**
relative to money	(.0070)	(.0125)	(.0187)	(.0070)	(.0124)	(.0188)
Covariates	No			Yes		
N	270			270		

Note: Marginal effects computed after ordered logit models. Standard errors in parentheses. Covariates are the preference towards correlation, risk preference, time preference, gender, income, health status and complementary health insurance coverage.
*** p<0.01, ** p<0.05, * p<0.1.

the less expensive treatment (Treatment 1) and by 1.4% the probability not to choose a treatment. Our results are in line with the first prediction.

5.3.2 Prediction 2 and 3: The relationship between preference for correlation and the joint treatment and health insurance decision

Prediction 2 yields that correlation averse are more likely to choose overinsurance (I>T) than those in the two other groups, and prediction 3 states that correlation seekers are more likely to choose partial insurance (I<T) than correlation averse among those choosing to treat.

We estimate a multinomial logit models explaining our outcome variable (the difference between health insurance indemnity and treatment cost) with our variables of interest: preference toward correlation, risk preference and health preference relative to money. We then compute the marginal effects of correlation aversion of choosing each level of coverage. Prediction 2 is confirmed if the sign of the marginal effect of correlation aversion on the probability of choosing more than full coverage ($I > T$) is positive and significant. The same analysis is conducted on the subsample of subjects who chose a treatment (N=246) to test prediction 3. This prediction is confirmed if the sign of the marginal effect of correlation aversion on the probability of incomplete insurance ($I < T$) is negative and significant.

As shown in Table 8, correlation averse subjects, compared to correlation seekers, are 12% more likely to choose more than full coverage, at a 5% level. This result does not extend to the comparison of correlation averse subjects to correlation neutral ones but is robust to the introduction of covariates (Panel B of Table 8). Nevertheless, this result provides support to the second prediction. For prediction 3, no marginal effects are statistically significant so we cannot confirm this prediction.

Given the detailed level of prediction for each category of risk preference and preference towards correlation, we can also compare directly the theoretical prediction with the joint treatment and health insurance decision. The small samples for each category of preferences do not allow to draw significant conclusion (Tables A.12, A.13, A.14).

We also looked at the overall percentage of correct predictions of our theoretical model. There is a match between predictions and choices for 37% of our sample (Table 9). The percentages of individuals who made the expected choice among those who should have made this choice vary across the type of expected decision from 24% for more than full insurance to 42% for full insurance.

Table 8: Estimated effects of preference for correlation on the joint treatment and health insurance choice

	Panel A			Panel B		
	I<T	I=T	I>T	I<T	I=T	I>T
Prediction 2						
Preference for correlation (ref: corr. seeker)						
Corr. averse	-0.038	-0.082	0.12**	-0.0404	-0.0736	0.114*
	(0.069)	(0.071)	(0.062)	(0.0682)	(0.0719)	(0.0617)
Corr. Neutral	-0.035	-0.048	0.083	-0.021	-0.066	0.087
	(0.071)	(0.074)	(0.062)	(0.0712)	(0.0737)	(0.0630)
Covariates		No			Yes	
N		270			270	
Prediction 3						
Preference for correlation (ref: corr. seeker)						
Corr. averse	-0.038	-0.054	0.092	-0.031	-0.038	0.069
	(0.0739)	(0.0756)	(0.0597)	(0.0737)	(0.0757)	(0.0591)
Corr. Neutral	-0.040	-0.023	0.063	-0.017	-0.044	0.061
	(0.0760)	(0.0781)	(0.0598)	(0.0761)	(0.0770)	(0.0613)
Covariates		No			Yes	
N		245			245	

Note: Marginal effects computed after multinomial logit. Standard errors in parentheses. Covariates are preference for health relative to money, risk preference, gender, income, health status, complementary health insurance coverage and time preference.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Comparison joint treatment and health insurance predictions and choices

	Choice			
	I<T	I=T	I>T	Total
Prediction				
I<T	44	49	13	106
	41.5%	46.2%	12.3%	
I=T	9	18	18	45
	20%	40%	40%	
I>T	29	34	27	90
	32.2%	37.8%	30%	
Total	82	101	58	241
	34%	42%	24%	

Note: individuals with prediction "indifference" are excluded from this table, that is to say 29 risk neutral/correlation neutral individuals

5.3.3 Prediction 4: The relationship between insurance indemnity and treatment intensity

This prediction is different for two subgroups. For every part of the prediction, the analysis implemented is the same. It differs in the expected results at the end. We estimate ordered logit models explaining the treatment choice with the indemnity level, controlling for preference for health relative to wealth. The sign of the coefficient of indemnity level, indicates whether the probability to choose a higher treatment is increased or decreased when the indemnity level increase.

This model is run for two groups based on prediction 4. For risk averse/correlation neutral, risk averse/correlation seeker, risk neutral/correlation averse and risk seeker/correlation averse individuals, prediction P4a is confirmed if the coefficient of the indemnity level is positive and significant. Prediction P4b for risk seeker/correlation neutral, risk neutral/correlation seeker and risk seeker/correlation seeker is confirmed if the coefficient of the indemnity level is equal to zero, so not significant.

Table 10 displays the coefficients of the ordered logit models for each subgroups defined in prediction 4.

The first two columns are the test results of the prediction for risk averse/correlation neutral, risk averse/correlation seeker, risk neutral/correlation averse and risk seeker/correlation averse individuals. The coefficient of the insurance indemnity level is positive and significant

and robust to the introduction of covariates. It supports the first part of prediction 4 (P4a). The two following columns are the test results of the prediction for risk seeker/correlation neutral, risk neutral/correlation seeker and risk seeker/correlation seeker individuals. The coefficient of interest is positive and significant, this does not confirm the second part of prediction 4 (P4b).

The mixed support may be attributable to the endogeneity of the health insurance and treatment decisions. For instance, a better design to assess the validity of this prediction would have randomly assigned various treatment levels to observe indemnity level choices.

Table 10: Prediction 4: Sign of the relationship between treatment and insurance indemnity

	Prediction 4a: positive		Prediction 4b: null	
	Treatment	Treatment	Treatment	Treatment
Insurance indemnity	.007***	.007***	.008***	.009***
	(0.0013)	(.0014)	(0.0020)	(0.0020)
log WTP for health	0.303**	.281**	0.124	0.209
	(0.1284)	(0.1379)	(0.1784)	(0.1952)
Covariates	No	Yes	No	Yes
N	121	121	73	73

Note: Coefficients of ordered logit models.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Covariates are gender, income, health status, complementary health insurance coverage and time preference.

5.4 Robustness checks

All of our results are robust to dropping observations of subjects who took the more than full coverage option for treatment 1, who are in the bottom 1% or 10% of the distribution of time spent to do the experiment as they are suspected of having put relatively less effort during the experiment. For the same reason, we also excluded subjects whose responses were consistent with risk neutrality, correlation neutrality and whose willingness to pay for health was 500 (middle point between 0 and 1000€). Our results are qualitatively the same. Tables are available upon request.

6 Discussion

The novelty of our work is to take into account two specific features of health insurance to examine the determinants of health insurance demand. The first one is its impact in both

the financial and health domains. The second is the possibility for the individual to buy a treatment in order to decrease, after the health risk occurs, the extent of the health damage of a disease. These two features have important implications for modeling health insurance decisions. Our paper presents a model incorporating those features and yield new results: health preference relative to money has an impact on health insurance decision, through its impact on treatment choice. In addition, the treatment and health insurance decisions are jointly made and the sign of the correlation between these decisions depends on preferences. We derive testable predictions on the effects of preferences on the treatment and health insurance decision. We develop new measures of health preference relative to money and preference for correlation in a lab experiment and elicit joint treatment and health insurance decisions. Although the theoretical predictions are only partially verified empirically, our results indicate that health preference relative to money and preference toward correlation matter in health insurance decisions. More specifically, we find that correlation seekers are more likely to buy more than full coverage than correlation averse individuals. This result shed some lights on possible explanations of the low take-up of long-term care insurance contracts. If individuals are correlation seekers, their marginal utility of consumption is higher when they are in good health. As a result, they are less likely to allocate income to purchase long-term care insurance when they are still in good health.

We believe that another interesting result is that despite subject sociodemographic homogeneity, we observe a large heterogeneity of preferences. For instance, almost a third of the sample is correlation averse, correlation neutral and correlation seeking. We can speculate that such a heterogeneity will also be observed in a representative sample of the population. This is relevant for the welfare evaluation of policies extending mandatory health insurance, or setting the same level of coverage for the whole population. These health policies generate gains or losses in well-being according to the preferences of individuals. Someone who is averse to correlation will experience an increase in well-being if the level of health insurance is increased, while someone who is averse to correlation will experience a decrease in well-being. Although taking these preferences into account in welfare evaluation is challenging, these results are food for thoughts on the welfare implications of the Affordable Care Act in the United States and the extension of mandatory complementary health insurance to all employees in France.

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A Appendix

A.1 Correlation of individual's characteristics with choices

Table A.11: Correlation of individual's characteristics with treatment, insurance, preference for health relative to wealth and preference for correlation

	Outcome					
	Treatment	Insurance	IT	Preference for health	Preference for correlation (ref: seeker)	
					averse	neutral
Is a man	.072	-.019	.043	.258	.020	-.244
SAH:						
Bad-average	ref	ref	ref	ref	ref	ref
good	-.369	-.222	-.243	-.423	.744	-.027
very good	-.325	-.052	-.121	-.127	.583	-.504
Has physical limitation	-.136	.323	.454	-.139	-.130	.000
Chronic disease						
Yes	ref	ref	ref	ref	ref	ref
No	.034	.097	-.051	.216	-.124	-.944**
Doesn't know	.035	.559	.414	.316	.559	-1.232*
Has a health insurance	.043	-.151	-.224	.089	.539	.398
Income	.00018	.00019	.0002	.0003*	.0004	.0006*
GP visit	.047	.345	.414	.144	-.889**	-.435
Specialist visit	.198	.110	.152	.230	-.338	.305
Dentist visit	.171	.054	.097	.260	-.534*	-.032
Need glasses	-.063	.590***	.635***	-.017	-.108	-.391

Note: The treatment variable has three categories (no treatment, treatment 1, treatment 2), the insurance one four categories (none, incomplete, full, more than full coverage), the IT one three categories (I<T, I=T, I>T), the preference for correlation one three categories (correlation aversion, correlation neutral, correlation seeker), the preference for health relative to wealth one is the log of the willingness to pay.
Each cell displays the coefficient of a model where the outcome is the variable at the top of the column and the only independent variable the one at the beginning of the line. These

are coefficients of ordered logit models for treatment, insurance, IT. For preference for correlation these are coefficient of multinomial logit models and for preference for health of linear regression models.
*** p<0.01, ** p<0.05, * p<0.1
The healthcare use variables refers to having a visit at a practitioner in the past 12 months.

A.2 Detailed results predictions 2 and 3

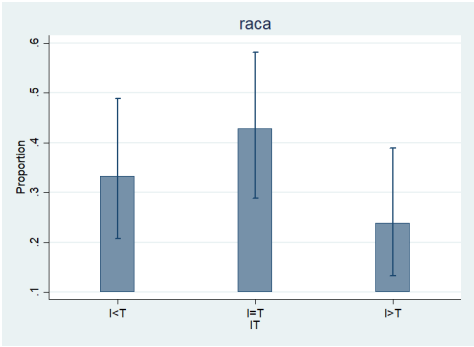
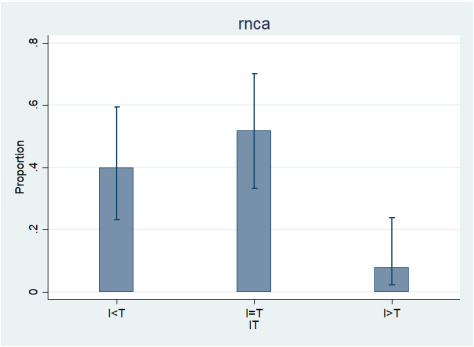
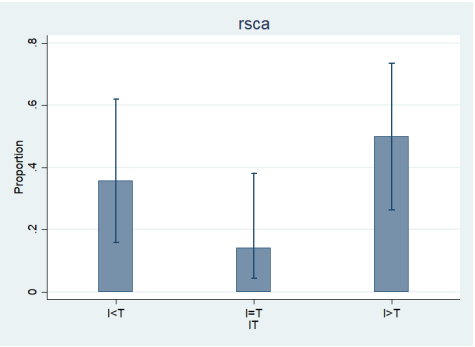
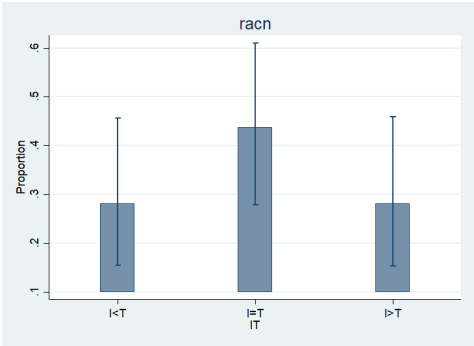
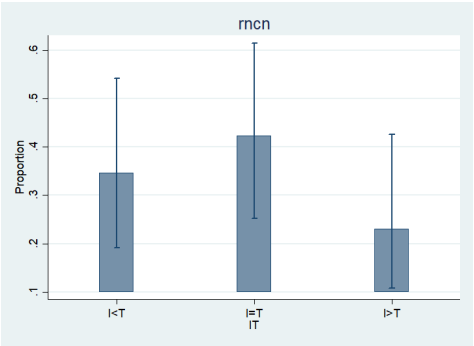
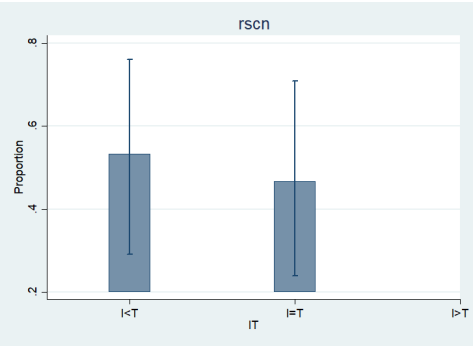
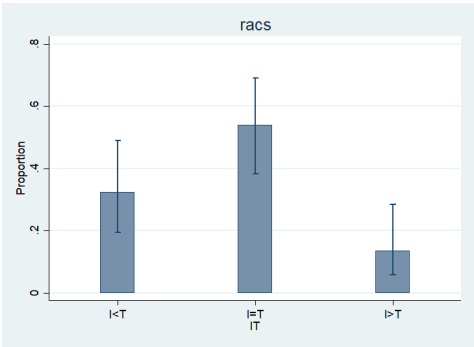
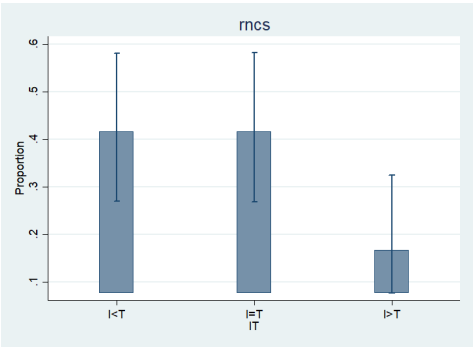
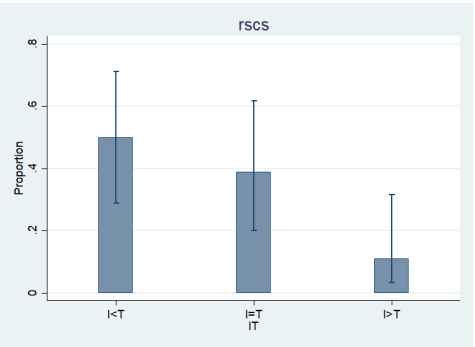
Table A.12: Frequency choices by risk aversion and preferences towards correlation categories for those with treatment
Note: **if number in bold: prediction**, if nothing in bold, prediction is indifference

	I<T	I=T	I>T	N
Risk averse & Correlation averse	14	18	**10**	42
Risk averse & Correlation neutral	9	**14**	9	32
Risk averse & Correlation seeker	**12**	20	5	37
Risk neutral & Correlation averse	10	13	**2**	25
Risk neutral & Correlation neutral	9	11	6	26
Risk neutral & Correlation seeker	**15**	15	6	36
Risk seeker & Correlation averse	5	2	**7**	14
Risk seeker & Correlation neutral	**8**	7	0	15
Risk seeker & Correlation seeker	**9**	7	2	18
Total	91	107	47	245

Table A.13: Frequency choices by risk aversion and preferences towards correlation categories for those without treatment
Note: **if number in bold: prediction**, if nothing in bold, prediction is indifference

	I=T	I>T	N
Risk averse & Correlation averse	1	**3**	4
Risk averse & Correlation neutral	**0**	4	4
Risk averse & Correlation seeker	**2**	3	5
Risk neutral & Correlation averse	0	**4**	4
Risk neutral & Correlation neutral	1	2	3
Risk neutral & Correlation seeker	**2**	2	4
Risk seeker & Correlation averse	0	**1**	1
Risk seeker & Correlation neutral	0	**0**	0
Risk seeker & Correlation seeker	**0**	0	0
Total	6	19	25

Table A.14: Choices by risk aversion and preferences towards correlation categories for those with treatment (bootstrapped standard errors, replication: 10,000)

Correlation averse	Risk aversion prediction: I>T N=42	Risk neutral prediction: I>T N=25	Risk seeker prediction: I>T N=14
			
Correlation neutral	prediction: I=T N=32	prediction: indifference N=26	prediction: I<T N=15
			
Correlation seeker	prediction: I<T N=37	prediction: I<T N=36	prediction: I<T N=18
			

A.3 Instructions

A.3.1 Health preference relative to wealth measure

Imagine that you have a monthly income of **1000€** (once your rent is paid). You fall ill for a month. Your health state is then the following:

- I am unable to walk about
- I am unable to wash or dress myself
- I am unable to do my usual activities
- I have moderate pain or discomfort
- I am not anxious or depressed

Would you be willing to pay to no longer have this health problem during a month and therefore have perfect health?

- Yes
- No

Filter: If Yes

How much are willing to pay (of your 1,000€) to no longer have this health problem during one month and thus have a perfect health state ?

Move the cursor to indicate your choice.

A.3.2 Correlation aversion measure

Imagine that you have a monthly income of **1,000€** (once your rent is paid) and that you have accident leading to a 2-month sick leave. You have to undergo surgery but it will happen only in a month.
During the month before the surgery, your health state will be the following:

- I am **unable** to walk about
- I have **slight problems** washing or dressing myself
- I am **unable** to do my usual activities
- I have moderate pain or discomfort
- I am not anxious or depressed

During the month of sick leave after the procedure, you are recovering and your health state will be the following:

- I have **slight problems** in walking about
- I have **no problems** washing or dressing myself
- I am **slight problems** to do my usual activities
- I have moderate pain or discomfort
- I am not anxious or depressed

Previously to the accident you had no health problems and the surgery won't have any consequences on your health in the long run. After the 2-month sick leave, you will be in good health again and able to go back to work. You have no expenses linked to the surgery and your income is entirely preserved (equal to 1,000€). You have no health insurance.
Your employer subscribed to a provision contract which grants you purchase vouchers for 200€ for your sick leave. These purchase vouchers can only be used for certain types of activities: meal of a restaurant either on-site or delivered at home, subscription to a platform of films and/or series during a month, tickets for a sport event, show or concert, subscription to tv channels of your choice during a month, movie tickets.
The purchase vouchers are only valid a month and are provided at the beginning of the month. So you can only use each month the amount of vouchers received at the beginning of the month. In particular, the purchase voucher obtain at the beginning of the first month and non-used can not be used the second month.
You have to choose for the allocation of the purchase voucher between the two months.
Indicate which amount you want for each month by moving the cursor.


Amount for the first month (in €) →
80
120
← Amount for the second month (in €)

A.3.3 Risk aversion measure

You must make a choice between two urns (left or right) **for each line** of the following table. So you have to make 10 decisions.

Each urn contains 10 balls, among which one will be drawn randomly. Each ball represents a loss of money. The amount of the loss depends on the color of the ball.

For the left urns: green balls indicate a loss of 320€ and blue balls a loss of 480€.

For the right urns, yellow balls indicate a loss of 720€ and brown balls a loss of 80€.

So for each urn, the probability of losing a given amount depends on the number of balls of each color.

Imagine that once all the 10 decisions are taken, one of them will be drawn randomly. You will have to face only the consequences of this decision: you will lose the amount indicated on the ball randomly drawn in the chosen urn.

Example:

The first line of the table - left urn:

The urn is filled with 10 blue balls (-480€). The probability of drawing a blue ball is therefore 100% and that of drawing a green ball is 0%. In other words, there will be a 100% risk of losing 480€ and a 0% risk of losing 320€. You will lose 480€ with certainty if you choose this option.

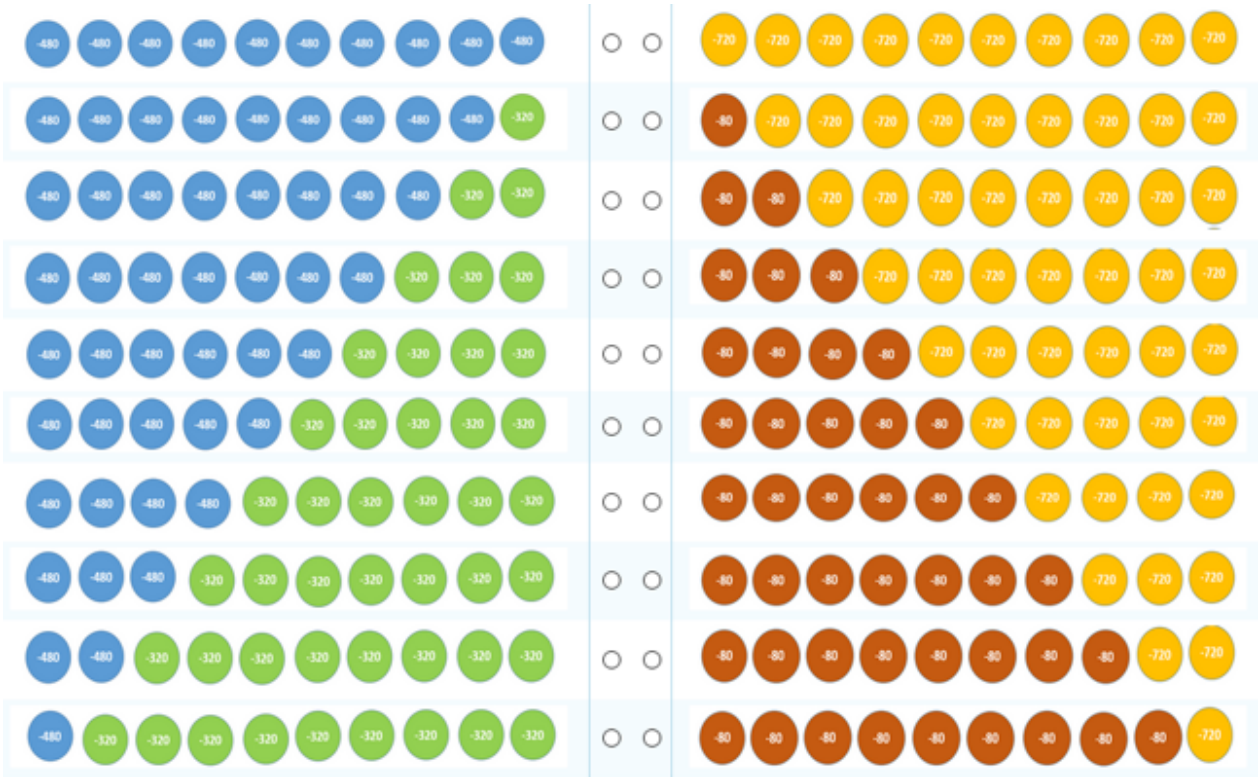
The first line of the table - right urn:

The urn is filled with 10 yellow balls (-720€). The probability of drawing a yellow ball is therefore 100% and that of drawing a brown ball is 0%. In other words, there will be a 100% risk of losing 720€ and a 0% risk of losing 80€. You will lose 720€ with certainty if you choose this option.

You have to choose between the left and right urn. If you choose the left urn and if this decision is drawn randomly among the 10 decisions, a ball will be drawn randomly in the left urn. You will loose 480€.

On each line you must indicate whether you prefer the left or the right urn.

You will notice that the loss amounts do not change, only the probabilities associated with each loss (since the number of balls of each color changes at each line).



One that you have made ten choices, click on the "Next" button.

A.3.4 Time preferences measure

We only present here a possible path where the subject always chooses "In 12 months". The full set of question is introduced in Falk et al. (2016).

Suppose you were given the choice between the following: receiving a payment today or a payment in 12 months. We will now present to you five situations. The payment today is the same in each of these situations. The payment in 12 months is different in every situation. For each of these situations we would like to know which you would choose. Once you have chosen for a situation, the following appears.

Please assume they are no inflation, that is to say that prices stay the same.

1. Please consider the following situation : would you rather receive 100 euros today or 154 euros in 12 months ?
   - Today
   - In 12 months -> *go to question 2*
2. Would you rather receive 100 euros today or 125 euros in 12 months ?
   - Today
   - In 12 months -> *go to question 3*
3. Would you rather receive 100 euros today or 112 euros in 12 months ?
   - Today
   - In 12 months -> *go to question 4*
4. Would you rather receive 100 euros today or 106 euros in 12 months ?
   - Today
   - In 12 months -> *go to question 5*
5. Would you rather receive 100 euros today or 103 euros in 12 months ?
   - Today
   - In 12 months

A.3.5 Health insurance and treatment question

You have a monthly income of 1,000€ (once your rent is paid). Your probability of having an accident is 15%. In case of accident, your state of health would be the following:

- I am unable to walk about
- I have slight problems washing or dressing myself
- I am unable to do my usual activities
- I have moderate pain or discomfort
- I am not anxious or depressed

You will regain perfect health after one month. During the month following your accident, you will be on sick leave and your employer will pay your salary. You will therefore not lose any income in the event of an accident: you will always have 1,000€.

Medical treatment

In the event of an accident, you will be able to choose whether or not to receive medical treatment. There are different types of treatments that vary according to their level of effectiveness to improve health during the sick leave. The cost of treatments varies according to their effectiveness.

Whether you choose to be treated or not and whatever the chosen treatment, you will always regain perfect health after one month.

Insurance contract

You can also choose whether or not to subscribe to a health insurance contract. A health insurance contract is defined by two elements: an indemnity (i.e. the amount received in the event of an accident) and a premium (i.e. the price you have to pay each month to benefit from the insurance). You will only receive the indemnity in the event of an accident and if you paid the premium before the accident occurred.

You have the choice between several health insurance contracts: the higher the indemnity received in case of accident, the higher the premium associated.

You have two choices to make: a choice concerning the possible treatment you wish to have in case of an accident, and a choice concerning the possible health insurance contract you wish to subscribe to.

Your choice of treatment has consequences on your health and financial situation in the event of an accident. Your choice of health insurance has consequences on your financial situation whether or not you have an accident.

The consequences of different possible choices are going to appear at the bottom of the page. The treatment choice is presented first and the health insurance choice only appears

once the treatment has been chosen.
You can test the different combinations of treatment and health insurance before choosing the one you prefer.
You must test at least two combinations of treatment and health insurance before choosing a particular combination.

Treatment choice

Treatment	Cost	Health state	Choice
No treatment	0€	• I am **unable** to walk about • I have **slight problems** washing or dressing myself • I am **unable** to do my usual activities • I have **moderate** pain or discomfort • I am not anxious or depressed	○
Treatment 1	200€	• I have **moderate problems** in walking about • I have **no problems** washing or dressing myself • I have **moderate problems** doing my usual activities • I have **moderate** pain or discomfort • I am not anxious or depressed	◉
Treatment 2	400€	• I have **no problems** in walking about • I have **no problems** washing or dressing myself • I have **no problems** doing my usual activities • I have **moderate** pain or discomfort • I am not anxious or depressed	○

Insurance choice

Insurance	Indemnity	Insurance premium	Choice
No health insurance	0€	0€	○
Contract A	100€	15€	◉
Contract B	200€	30€	○
Contract C	400€	45€	○

You choose:

Treatment 1, for your treatment choice
and
Contract A, for your insurance choice.

	Consequences if you have an accident (15% probability)	Consequences if you do not have an accident (85% probability)
Final income (in €)	885	985
Health state	• I have moderate problems in walking about • I have no problems washing or dressing myself • I have moderate problems doing my usual activities • I have moderate pain or discomfort • I am not anxious or depressed	• I have no problems in walking about • I have no problems washing or dressing myself • I have no problems doing my usual activities • I have no pain or discomfort • I am not anxious or depressed

Once you have made your choice of treatment and of health insurance, click on the "Next" button.

As a reminder, you can only move on to the next question after you tried two combinations.

The subject can choose among three treatments and four insurance options (only three when no treatment is chosen). Here is an example for the treatment 1 and contract A choice.