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Voluntary Pooling of Genetic Risk: A Health Insurance Experiment*

Wanda Mimra[†] Janina Nemitz[‡] Christian Waibel[§]

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Abstract

Scientific and technological advances increasingly allow for better tailoring of health insurance plans to individual health risk profiles. This development questions the sustainability of health plans that feature strong cross-subsidization across different health risk types and health behaviors. An important observation is that the willingness to cross-subsidize risks in health plans might depend on whether the risk is uncontrollable by individuals, such as genetic risk, or modifiable via health behaviors. This paper provides the results of an experiment on the willingness to pool genetic risk in health insurance. Subjects' overall health risk has an assigned, uncontrollable genetic risk part that differs across individuals as well as a behavioral risk part, which can be reduced by costly effort. Participants can decide between a pooling, community-rated group insurance scheme and an insurance with a fully individually risk-adjusted premium. In the experimental variation, the group insurance scheme either includes behavioral risk or separates it out via individual premium discounts. Although we observe social preferences for pooling, only a low level of actual genetic risk pooling emerges across the experimental conditions. This is due to both large heterogeneity in social preferences across subjects, and the dynamics of the willingness to pay for group insurance in the different experimental markets.

JEL classification: I13, C92, D64

Keywords: health insurance, genetic risk, pooling, effort

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1 Introduction

In the last two decades, scientific and technological advances in detecting, estimating, and monitoring health risks allow for an increased precision of information on individual health risk profiles. The price of sequencing an average human genome has plummeted from about US\$10 million in 2007 to a few thousand dollars in the last years. Inexpensive and easily practicable genetic tests are increasingly available for individuals. For example, the US company 23andMe charges people US\$99 to see if they have gene variants that put them at higher risk for 120 diseases and whether they carry a known heritable mutation in an additional 50, including cystic fibrosis, sickle cell disease, and Tay-Sachs disease.¹ Genetic markers become a far greater part of health care in the future than it is now (NHGRI, 2017). On the behavioral side, smart technologies allow to better track and incentivize health behavior.

These advancements technically enable health insurers to better tailor individual health insurance plans to an individual's particular health risk profile. For the genetic risk part, current legislation in most countries prohibits premium differentiation in health insurance.² However, information on health behaviors is increasingly used in pricing. Health insurers in the US and Europe start to provide monetary incentives that are tied to health behaviors that are monitored via, for example, mobile devices. Wearers of devices agree to track their physical activity, such as steps taken, and rewards take the form of credits towards health saving or health reimbursement accounts, lower deductibles, or direct premium discounts.³ For policymakers, this development poses several questions. Should the pricing of health insurance plans, in both public and private markets, be generally allowed to condition on tracked health behaviors? Should the general prohibition of using genetic information in health insurance be upheld? Regarding the latter, increasing availability of inexpensive genetic tests could lead to a call for optional revelation of genetic risk information by policyholders. Theoretically, this could trigger information unraveling in the sense of Milgrom (1981), i.e. the best (lowest genetic risk) types voluntarily disclose

¹See <https://www.23andme.com/dna-reports-list/>. Costs of genetic testing for individuals are strongly influenced by the market structure and patent protecting in particular countries. For instance, the cost of BRCA testing ranges from US\$475 to about US\$4,000.

²In the US, the 2008 Genetic Information Nondiscrimination Act (GINA) prohibits discrimination by health insurance plans based on an individual's genetic information. The GINA does not extend to life insurance, however.

³The US health insurance provider UnitedHealth, for example, offers policyholders on the Motion F.I.T. program up to US\$4 per day in credits applied towards their health saving or reimbursement account if they use a Fitbit to track their physical activity and reach one or more fitness oriented goals. Premium discounts of up to 15 percent are granted by another major US health insurance provider upon tracking exercising progress and reaching activity goals.

their genetic information to receive a lower premium or other improved terms, and then the next best types have an incentive to do so as well. This form of unraveling with pure hidden information is actually efficient, and even allows for additional efficiency increases resulting from a better adjustment of health behaviors. However, it might entail severe distributional consequences, further punishing individuals that were already unlucky in the genetic lottery. This latter point provides one of the motivations behind the current legislation of prohibiting the use of genetic information in health insurance plans.

In this paper, we examine this problem in an incentivized health insurance experiment and analyze the willingness to pool genetic risk when a fully individually risk-adjusted health insurance plan is available. Thus, in its simple form we test for social preferences in the context of health insurance choice. Our experiment further makes use of the observation that better health risk detection and monitoring allow to separate health risks that are uncontrollable by an individual, such as the genetic predisposition, from health risks that stem from an individual's health behavior.

In the experiment subjects face the risk of illness, which has two components: a genetic risk component and a behavioral risk component. Subjects are exogenously assigned an either high or low genetic risk and decide on a costly preventive effort, which reduces their behavioral risk. To make the health context salient, by choosing a higher effort level, subjects do not only reduce their health insurance premium in the experiment, but they also increase the probability of winning a voucher for an actual preventative health screening at the local sports facilities. There are two different health insurance options available: a *group insurance*, that pools some or all of the health risks of its members with a uniform premium (community-rating), or a so-called *individual insurance*, for which the premium is the actuarially fair one for the subject's individual health risk profile.⁴ With the experimental variation, we vary the extent of risk pooling in the group health insurance between *full pooling (FP)*, in which the total health risk of group insurance participants is pooled, and *genetic pooling only (GPO)*, in which the genetic risk component is pooled, but participants in group insurance receive individual premium discounts based on their preventive effort. Subjects state their willingness to pay (WTP) for the group insurance scheme that pools health risks of its members, and decide on *individual insurance* or no insurance for the case that they might not be included in the group insurance. The group

⁴For simplicity, we refer to the insurance that is priced at the actuarially fair value for the individual according to her individual health risk profile, as *individual insurance* in what follows. The idea behind this is that an insurer still insures a pool of individuals, but charges each individual her actuarially fair premium. This is in contrast to group insurance, in which the premium for an individual depends not only on her own risk profile but also on that of the group.

insurance premium is endogenously determined ex post. Subjects who indicate a WTP that is at least as high as the group insurance premium that would result if they were included in group insurance, participate in group insurance.

Why might group insurance that pools genetic risks (mixed group insurance) emerge and why do we expect differences in group insurance participation between *FP* and *GPO*? If individuals do not have social preferences, low genetic risk types are never willing to cross-subsidize high genetic risk types in a group insurance scheme and purchase individual insurance. Hence, there should be no mixed group insurance and no difference in group insurance participation between *FP* and *GPO*. However, if individuals exhibit social preferences in the form of inequity aversion, group insurance may well emerge and coexist with individually priced health insurance. Low risk genetic types might be willing to pool with and thereby cross-subsidize high genetic risk types to reduce premium inequalities, depending on the extent of social preferences. The interesting difference between *FP* and *GPO* is that under *FP*, the group insurance premium includes the behavioral risk part of all members such that there are free-riding incentives with respect to preventive effort. Separating out risk components that are the result of an individual's effort decisions under group insurance in *GPO* however eliminates these free-riding incentives. This might induce more people to be willing to participate in group insurance that mutualizes genetic risk.

To measure social preferences for pooling, we analyze whether a subject has a positive net WTP for group insurance, i.e. a WTP for group insurance that exceeds the individual (actuarially fair) insurance premium. We find that, among subjects assigned a low genetic risk, the share of positive net WTP for group insurance is at 20% overall.⁵ When behavioral risk is separated out, low genetic risk subjects are roughly ten percentage points more likely to indicate a WTP that exceeded their individual insurance premium than under full pooling, with this difference being particularly large in the first five periods. Turning to the societal level, we however observe only a low level of actual, voluntary genetic risk pooling in the experiment, across experimental conditions. This is due to both large heterogeneity in social preferences in terms of the WTP for group insurance, as well as the dynamics of the WTP for group insurance in the different experimental societies. These results highlight the difficulty of achieving pooling of heterogeneous risks when private markets with fully risk-adjusted premiums are available. Our results are thus consistent with the view that mandatory pooling might be needed if, under the veil

⁵About half of the subjects assigned a low genetic risk show this positive net WTP for group insurance in at least one decision.

of ignorance, a society nevertheless wishes to pool certain forms of heterogeneous risk exposure, such as genetic risk.

The remainder of this paper is organized as follows: Section 2 discusses the related literature. Section 3 presents the experimental set-up including parametrization and theoretical predictions. The results are shown and discussed in Section 4. Section 5 draws implications and concludes.

2 Related Literature

Our health insurance experiment is related to four different strands of literature: The literature on the ethical and economic consequences of using genetic testing and health behavior information in (insurance) markets, the (experimental) literature on preferences for redistribution, the literature on the role of heterogeneous endowments in public goods games, and the new experimental literature on health insurance demand. Our paper combines the question of fairness and inequality views with that of incentive problems in the context of health insurance choice. In terms of regulatory and informational environment, we consider the scenario that genetic testing results and health behavior information can a priori be used for pricing, i.e. a *laissez-fair* regime.⁶

The theoretical literature on genetic testing in health insurance markets focuses on testing decisions and the efficiency and welfare consequences of different regulatory regimes and insurance market structures in either pure adverse selection models or models including prevention (e.g. Hoy et al. 2003, Hoel and Iversen 2002, Hoy and Ruse 2005, Bardey and De Donder 2013, Peter et al. 2017). In this experiment, we add the perspective of the role of social preferences for the sustainability of pooling outcomes.

The literature on preferences for redistribution suggests that people are averse to deviations from both an equal income distribution (e.g., Fehr and Schmidt 1999, Bolton and Ockenfels 2000, Engelmann and Strobel 2004) and an income distribution that is proportional to work effort (e.g., Konow 2000, Frohlich et al. 2004, Cappelen et al. 2007, 2010, 2013).⁷ In the context of risky situations, Cappelen et al. (2013), for instance, analyze fairness views in an experiment in which subjects *ex ante* face the same choices between a

⁶In this paper, we do not touch upon the important ethical concerns regarding potential discrimination and loss of privacy rights from using genetic testing and health behavior information in insurance markets, nor on spillover effects to other markets or decisions. For an excellent survey and discussion of moral, ethical, market efficiency and welfare considerations with respect to a ban of using genetic testing results in insurance markets, see Durnin et al. (2012).

⁷However, Ku and Salmon (2013), varying the source of initial inequality between random, meritocratic, and rewarding uncooperative behavior, find that random assignment leads to the most tolerance for disadvantageous inequality.

risky and a safe alternative, and there is a redistribution choice for ex-post income. The authors find that most participants favor not equalizing ex-post inequalities that result from different choices, but that the converse holds true for ex-post inequalities resulting from differences in luck among risk-takers. Mollerstrom et al. (2015) conduct a laboratory experiment in which spectators redistribute ex-post resources between two agents facing a situation in which part of the outcome is controllable, whereas another part is not. They find that many spectators condition their allocation for bad uncontrollable luck on an agent's decision on controllable luck exposure, even though the two types of luck are independent. Our experiment differs from these and related works in three important ways. First, we consider ex-ante heterogeneity in risk exposure and social preferences with respect to it. Second, contrary to including an explicit ex-post redistribution stage as in the previous literature, which makes redistribution particularly salient, redistribution in our experiment is implicit in the choice of health insurance schemes. Third, in our experimental variation, we compare two health insurance systems that by design either include or fully exclude controllable risk exposure in its redistributive scheme. Moreover, we also compare the health insurance and redistribution choices in the incentivized experiment with a subject's preferences for distinct health insurance systems expressed in a post-experimental survey.

The role of heterogeneity in and origin of endowments for contributions in public goods games is analyzed in Cherry et al. (2005), Oxoby and Spraggon (2013), and Kingsley (2016). Cherry et al. (2005) show that individuals provide less to the public good in a group with heterogeneous than homogeneous endowments. The authors find no evidence that the origin of endowment influences the level of contributions, however, thereby challenging the hypothesis that positive contributions in a public goods game are an artifact of endowment origin. Oxoby and Spraggon (2013) show that heterogeneous origins of endowment may lead to a lower public goods provision if minorities exist. The authors argue that the lack of identification among minorities causes the decrease in contributions. Kingsley (2016) studies the effectiveness of punishment under heterogeneous and homogeneous endowments. Whereas contributions increase when introducing punishment under homogeneous endowments, contributions do not change when endowments are heterogeneous. In contrast to the public goods literature, our paper focuses on a health care setting with ex-ante homogeneous endowments but heterogeneous risk exposure. Hence, our experiment mirrors a situation with ex-post instead of ex-ante heterogeneously distributed wealth.

In the experimental health insurance literature, Buckley et al. (2012) analyze experi-

mentally how characteristics of the public health system affect a subject’s WTP for parallel private health insurance. Buckley et al. (2012) find that average WTP is lower when the public system allocates health care based on need rather than randomly. Closest to our paper in experimental set-up is Gajdos et al. (2017). They consider an experimental health insurance game in which subjects differ with respect to wealth, health risk profile, and observable effort choice. Subjects provide their WTP for a mutual insurance in which the overall health risk of members of this insurance is pooled. In a within-subject design, Gajdos et al. (2017) consider the effect of an informational boost after some periods, in the form of both a contribution simulator to see how mutual insurance works and how a subject’s contribution was shared, but they also investigate the effect of a health insurance framing relative to an originally neutral framing. Gajdos et al. (2017) find that the informational boost temporarily increases the WTP for mutual health insurance. Due to multiple simultaneous variations, the causes of this effect cannot be disentangled, however.

3 Experiment

We start by discussing the experimental set-up. Then, we present a simple theoretical framework to illustrate the role of social preferences in the health insurance context. Based on this framework, we derive our main testable hypothesis.

3.1 Experimental Design

We apply a between-subject design to vary the degree of risk pooling between *full pooling (FP)* and *genetic pooling only (GPO)*. Subjects are randomly assigned to one of the two conditions.⁸ Matching groups of eight subjects, which are called societies, are implemented in both conditions. The assignment to a matching group is random and does not change throughout the experiment. Within a matching group, four subjects are randomly assigned a low genetic risk, while the other four subjects are assigned a high genetic risk. The distribution of genetic risk types within a matching group is common knowledge whereas subject’s individual risk type is private information. In both conditions, there are six matching groups.

The experiment involves ten periods. In each period and in both conditions, subjects have an initial endowment of 1000 ECU.⁹ Subjects face the risk to turn ill. Illness requires costly treatment of 700 ECU. The overall probability to turn ill is given by the sum of

⁸Note that we refer to conditions instead of treatments to distinguish between the treatment for subjects that turned ill in a given period and experimental conditions.

⁹The exchange rate for payoffs is 1 CHF per 20 ECU, where 1 CHF is about US\$1.

the genetic risk and a behavioral risk component. Whereas genetic risk is non-modifiable, behavioral risk depends on a subject’s preventive effort. Low genetic risk types have a genetic risk of 20% to turn ill, high genetic risk types of 40%. The initial behavioral risk amounts to 20% for both genetic risk types, such that the overall probability to turn ill before preventive effort is 40% for a subject that is assigned the low genetic risk, and 60% for a subject that is assigned the high genetic risk.

In each period and in both conditions, subjects make the same three decisions. First, each subject chooses a level of preventive effort ranging from zero to ten. Preventive effort linearly reduces a subject’s behavioral risk but is costly. Effort costs are convex in the level of preventive effort. A unique feature of our experimental design is that the subject’s effort choice is tied to the probability of winning a voucher for a health preventative measure that aims at detecting inefficient and harmful movement patterns.¹⁰ The voucher has a monetary value of US\$65 and entitles the winner to take the preventative measure free of charge. We use the voucher to make the health prevention decision more salient and to increase heterogeneity in subjects’ effort choices in order to improve external validity. The central parts of the analysis, in particular the measure of social preferences and the prediction for the direction of the difference across experimental conditions, are unaffected by the presence of this voucher.¹¹ Table 1 provides an overview of the range of effort levels and the corresponding reductions in behavioral risk, probabilities of winning the voucher, and costs of providing preventive effort.

Second, subjects make their health insurance choice. This choice involves two simultaneous decisions. Each subject states her WTP for group insurance. Subjects who indicate a WTP that is at least as high as their group insurance premium are group insured.¹² Moreover, each subject decides whether to purchase individual insurance at her actuari-

¹⁰More specifically, the health prevention voucher is for a “Functional Movement Screen”. The Functional Movement Screen is a test, which was developed in the United States. It is used to detect weaknesses in movement orders and to improve the course of motion in order to prevent degeneration and damage of the musculoskeletal system. In the long run, degeneration as well as damage of the musculoskeletal system causes strong pain and may lead to high treatment costs (e.g., due to the treatment by an orthopedic specialist or a physiotherapist).

¹¹Our measure of social preferences is a positive net willingness to pay (Net WTP) for group insurance, a stated WTP above the individual insurance premium *given* the chosen effort level, thus separating out effort. A detailed discussion of the role and effect of the voucher is provided in the discussion section 4.4 subsequent to the presentation of results. An additional experiment without the voucher was conducted and is available from the authors upon request. See section 4.4 for an overview of the results of the additional experiment and a discussion.

¹²The group insurance premium that is relevant for comparison with a subject’s WTP is the one that would result if the subject was included in the group insurance. The algorithm used to compute the group insurance premium maximizes (i) the number of subjects participating in the group insurance, (ii) the number of subjects with high genetic risk in group insurance, and then randomly selects among the remaining possible group insurance candidates.

TABLE 1. OVERVIEW OF PREVENTIVE EFFORT PARAMETERS

Level of preventive effort	Reduction in behavioral risk (in percentage points)	Probability to win the voucher (in percent)	Costs for health prevention (in ECU)
0	0	0	0
1	2	1	8
2	4	2.5	18
3	6	4.5	30
4	8	7	46
5	10	10	66
6	12	13.5	90
7	14	17.5	118
8	16	22	150
9	18	27	186
10	20	33	226

ally fair premium or to stay uninsured for the case that she might not be included in the group insurance. Both types of health insurances provide full coverage for individuals.¹³

Insurance premiums for the group insurance are calculated such that the group insurance makes zero profits in expectation, i.e. the sum of the group insurance premiums exactly covers the expected treatment costs of the subjects in a matching group that are insured by group insurance. The crucial difference between our two experimental conditions is the degree of risk pooling in group insurance. In the *FP* condition, genetic risk *and* behavioral risk post effort are pooled, whereas in the *GPO* condition, only genetic risk is pooled while behavioral risk is individually priced. That is, in the *FP* condition, there is community-rating for total health risk such that all members of the group insurance pay the same premium. This premium is given by the average total risk of illness of group insurance members and includes preventive effort choices of all group insurance members. In the *GPO* condition, the group insurance premium consists of two parts. The first part is identical for all group insurance members and is based on their average genetic risk of illness, i.e. there is community-rating on genetic risk. The second part gives group insurance members individually priced premium adjustments for behavioral risk. It appears as an individual premium discount for subjects, which depends on their individual preventive effort decision. Table 2 summarizes the above outlined decision sequence and highlights the differences between the two conditions. In each period and in both conditions, subjects' payoffs depend on the level of preventive effort, the insurance status, and, if they are not insured, on the health state. Insured subjects receive the initial endowment and pay their insurance premium as well as their effort cost for

¹³Figures A1 and A2 in Appendix A show the decision screens for the preventive effort decision and the health insurance decisions.

TABLE 2. OVERVIEW OF EXPERIMENTAL CONDITIONS

	<i>FP</i> condition	<i>GPO</i> condition
Preventive effort	Yes	Yes
Premium <i>group</i> <i>insurance</i>	full community rating (pooling of genetic + behavioral risk)	community rating for genetic risk only + individually priced behavioral risk
Premium <i>individual</i> <i>insurance</i>	actuarially fair price for the <i>individual's</i> health risk (genetic + behavioral)	
Outside options	individual insurance, no insurance	

health prevention. Non-insured subjects receive the initial endowment and pay the cost for prevention. In addition, non-insured subjects pay the treatment cost of 700 ECU if they turn ill. To avoid income effects, at the end of the experiment one of the ten periods is randomly selected to be payoff-relevant.

At the end of each period, subjects observe a summary screen of the current period (see Figure A3 in Appendix A). This summary screen also provides information on group insurance: existence of group insurance, number of members, number of members with high genetic risk, and premium. This feedback allows subjects to learn about the other subjects' social preferences for pooling of health risk in their matching group over time.

3.2 Experimental Procedure

The experimental sessions were conducted in October and November 2017 at the ETH Decision Science Laboratory. 96 subjects participated in the experiment, 48 in each condition. Participants were, on average, 22 years old. 53.1% of the participants were female. All participants were enrolled students. More than one third of the participants were enrolled for natural sciences, roughly one fifth for engineering, 7.2% for medicine, 6.2% for humanities, and 13.5% for economics. The remaining 15.6% of participants were enrolled in other subjects.

We performed the experiment using z-Tree (Fischbacher 2007). Subjects participated in exactly one session. The average time per session was about two hours. Participants earned 50 CHF, on average. A comprehensive set of control questions ensured that all participants understood the sequence of decisions in the experiment and the payoff consequences.

After the main experiment, we launched a post-experimental questionnaire to collect information on subjects. We used items of the Falk preference module to obtain additional

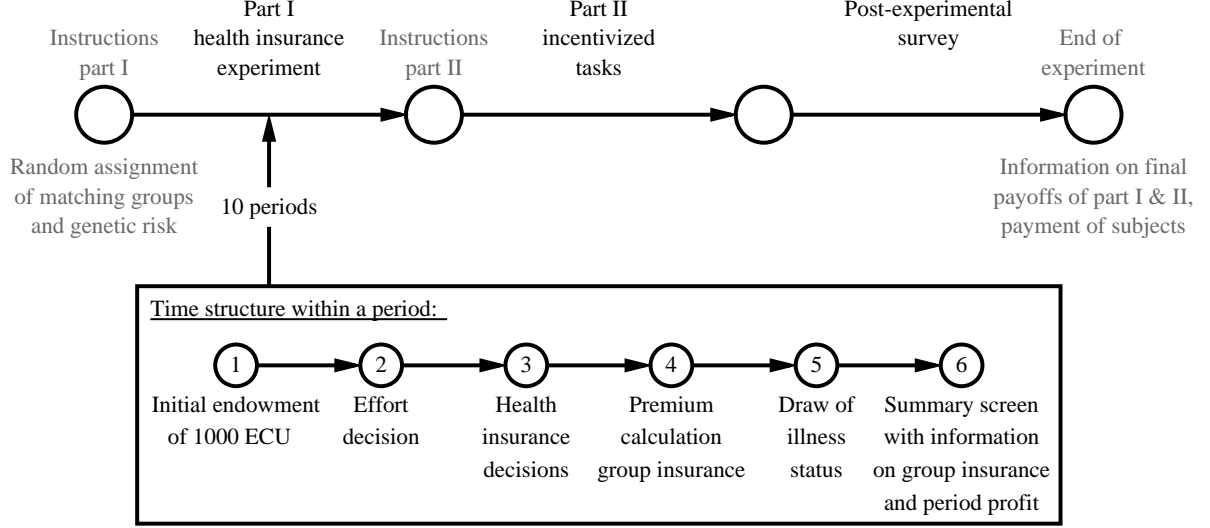


FIGURE 1. EXPERIMENTAL TIMELINE

information on risk aversion, altruism, and reciprocity (Falk et al. 2016).¹⁴ Moreover, we collected information on demographics (e.g., age, gender, major). Importantly, we also asked subjects how they would vote on four different health insurance systems that differed with respect to the degree of risk pooling, whether they were using a health app, and whether they would be willing to share information about their health with their health insurance provider. The information on voting preferences will allow us to compare stated with revealed preferences.¹⁵ Figure 1 summarizes the timeline of the experiment.

3.3 Framework and Predictions

Consider a society of N individuals. Each individual has wealth $y > 0$ and faces the risk of illness. Individuals differ with respect to their genetic predisposition to turn ill, i.e. they may be either a high genetic risk type (H) or a low genetic risk type (L). The overall probability of illness, p_θ , for an individual of type θ , $\theta \in \{H, L\}$, depends on both the genetic risk π_θ , where $0 < \pi_L < \pi_H < 1$, and a preventive effort decision e in the following

¹⁴We also elicited risk preferences using the Holt-Laury task (Holt and Laury 2002) and altruism using the dictator game (e.g., Kahneman et al. 1986, Engel 2011). One of the two games was randomly selected to be payoff-relevant. Both tasks were completed before showing the final payoffs and the randomly selected period from the experiment in order to mitigate income effects and interference with the main part of the experiment. In the analysis in Section 4.2, we nevertheless use the risk preference and altruism measures based on responses to the items from the Falk preference module.

¹⁵See Appendix D for the exact wording of the survey questions and answer possibilities.

way:

$$p_{\theta}(e) = \underbrace{\pi_{\theta}}_{\text{genetic risk component}} + \underbrace{z - h(e)}_{\text{behavioral risk component}}. \quad (1)$$

The genetic risk component, π_{θ} , is non-modifiable, but the behavioral risk component, $z - h(e)$, can be reduced by costly preventive effort $e \in [0, 1]$. Thus, z denotes the initial or inherent behavioral health risk, i.e. the behavioral health risk that would result in the absence of preventive effort. As in our experiment, we assume that effort reduces the initial behavioral health risk linearly and type-independently, i.e. $h(e) = a \cdot e$, $a \in (0, z]$.¹⁶ Effort costs, $c(e) > 0$, are increasing and convex.

Individuals who turn ill incur monetary costs M , where $0 < M < y$. To ensure against this loss, they can purchase health insurance. Two different forms of health insurance are available, an insurance that we will call, for simplicity, individual insurance, and a group insurance. Both insurances provide full coverage, but they differ with respect to their premium: The individual health insurance prices both components of health risk according to the actuarially fair rate for an individual, such that the total premium of a θ -type individual with preventive effort e for the individual insurance is $P_{\theta}^I(e) = (\pi_{\theta} + z - a \cdot e) M$. That is, the underlying assumptions are that for an individual both the type and effort is observable to insurance providers, and that effort information is used to charge a premium that fully internalizes the risk reduction resulting from preventive effort. Group insurance pools its members with community rating either on the genetic risk component only (*GPO* condition) or on overall risk, i.e. both the genetic and the behavioral risk components (*FP* condition). Assuming that the group insurance is overall making zero expected profits, the group insurance premiums for a θ -type individual with effort e are given by

$$\begin{aligned} P_{\theta}^{G,GPO}(e) &= (\bar{\pi} + z - a \cdot e) M && (GPO \text{ condition}) \\ P_{\theta}^{G,FP}(e) &= (\bar{\pi} + z - a \cdot \bar{e}) M && (FP \text{ condition}), \end{aligned}$$

where $\bar{\pi}$ denotes the average genetic risk of group insurance members and \bar{e} denotes the average effort of group insurance members. Thus, under *GPO*, the premium of an individual fully internalizes the individual's preventive effort whereas, under *FP*, risk

¹⁶We only consider the simple case in which the marginal benefit of effort in terms of a reduction of the probability of turning ill is the same across types. This may well be different. For instance, the marginal benefit of effort might be higher for *H*-types, such that effort decreases the difference in the overall probabilities of turning ill across types.

reduction from preventive effort is pooled across the group insurance members, such that there are free-riding incentives.¹⁷

In this paper, our focus is on whether individuals voluntarily select group insurance. Given the outside option of the individual insurance with an actuarially fair premium that is fully risk-adjusted and fully internalizes preventive effort, it is easy to see that if an individual's utility only takes into account her own payoff, *L*-type individuals who have a choice between individual and group insurance are not willing to pool with and thereby cross-subsidize *H*-type individuals in group insurance.

To model social preferences in this context, we assume that agents are inequity averse with respect to genetically caused income differences, using a variant of the Fehr-Schmidt-model (Fehr and Schmidt 1999). To highlight the role of inequity aversion with respect to genetically caused income differences, we consider the benchmark case of a society of $N = 2$ individuals, where one individual is an *H*-type and the other individual is a *L*-type. For simplicity, we also assume that utility is linear in consumption.¹⁸ Therefore, in the case of a society with two individuals, the utility function for individual i is given by

$$U_i \left(\Pi_i^k, \Pi_{-i}^{gen,l}, \Pi_i^{gen,k} \right) = \Pi_i^k - \alpha_i \max \left(\Pi_{-i}^{gen,l} - \Pi_i^{gen,k}, 0 \right) - \beta_i \max \left(\Pi_i^{gen,k} - \Pi_{-i}^{gen,l}, 0 \right), \quad (2)$$

where $\Pi_i^k = y - P_i^k - c(e_i)$ is the consumption of individual i given her insurance choice k , $\Pi_{-i}^{gen,l}$ is the genetic income component of the other individual $-i$ given the other individual's insurance choice l , and $\Pi_i^{gen,k}$ is the genetic income component of individual i given her insurance choice k . In equation (2), the second (third) term measures the loss from disadvantageous (advantageous) income inequality that stems from differences in genetic risk exposure. Under the standard assumption, $\alpha_i \geq \beta_i \geq 0$, advantageous inequality is not more important than disadvantageous inequality. The crucial difference between group insurance and individual insurance comes into play with respect to these two inequity terms: If both individuals have group insurance, either of the *GPO* or *FP* form, both inequity terms are equal to zero, since the insurance premium part for the genetic risk component is the same across both individuals, such that genetically determined income differences are equalized. Under individual insurance, however, the second term is non-zero for the *H*-type individual and the third term is non-zero for the *L*-type

¹⁷Note that the situation considered here is different from the standard moral hazard problem under insurance where the insurance premium cannot be based on effort due to unobservability of effort.

¹⁸This assumption is only made for ease of exposition and it does not affect the results on the role of inequity aversion.

individual.¹⁹

We analyze the case in which the individuals make the following two decisions: They decide on whether to purchase individual or group insurance, and they decide on their preventive effort to reduce their risk of illness.²⁰ A group insurance that pools the individuals on genetic risks will exist if both individuals prefer the group insurance to the individual insurance. This will be the case if for both individuals the utility with group insurance is at least as high as the utility with individual insurance.

Now, first consider optimal effort choices, given that an individual is insured under either group or individual insurance. Under individual insurance, both individuals will choose the same optimal effort level, e^* , which is determined by $c'(e^*) = a \cdot M$, since effort is fully internalized in the premium adjustment and effort technology does not depend on genetic risk type. Under group insurance, the optimal effort choice depends on whether there is group insurance of the *GPO* or the *FP* form. In the *GPO* case, effort incentives under group insurance are identical to those under individual insurance. Hence, both individuals provide effort e^* . In the *FP* case, effort incentives under group insurance differ from those under individual insurance because of the free-riding incentives that exist under pooling of behavioral risk. In this case, if both individuals are insured with group insurance of the *FP* form, both individuals will choose $e^o < e^*$, which is determined by $c'(e^o) = \frac{1}{2} \cdot a \cdot M$. Marginal benefits of effort are reduced by the factor $\frac{1}{2}$ because, under *FP*, benefits of effort are split equally among both group insurance members.

Next, consider optimal insurance choices. We start with the *benchmark case of no social preferences*, i.e. $\alpha_i = \beta_i = 0$ for both individuals. In this case, as indicated above, a group insurance exists neither under *GPO* nor *FP* because the *L*-type individual is never willing to pool genetic risk. This is because her utility with group insurance is strictly lower than her utility with individual insurance. Thus, without social preferences both individuals purchase individual insurance and provide the optimal effort level e^* . Now, consider the *case with social preferences*. Again, the crucial individual is the *L*-type individual, since this individual needs to cross-subsidize the *H*-type individual under group insurance. Thus, the predictions depend on the advantageous inequity aversion parameter of the *L*-type individual, β_L , and differ between the two experimental conditions *GPO* and *FP*. The *L*-type individual is willing to select group insurance over individual insurance if she is sufficiently inequity averse, i.e. if $\beta_L \geq \underline{\beta}$. In the *GPO* condition, $\underline{\beta} = \frac{1}{2}$

¹⁹See Appendix B for the utility functions of the *H*-type and *L*-type individuals under group and individual insurance.

²⁰Under the assumption of linear consumption utility, individuals receive the same utility from individual insurance as without insurance, such that we discard the no insurance option here.

and, in the *FP* condition, $\underline{\beta} = \frac{1}{2} + \kappa(e^*, e^o)$ with $\kappa(e^*, e^o) = \frac{(ae^*M - c(e^*)) - (ae^oM - c(e^o))}{(\pi_H - \pi_L)M} > 0$. That is, in the *FP* condition the *L*-type individual must have a higher advantageous inequity aversion parameter, β_L , than in the *GPO* condition to select group insurance over individual insurance. This effect is due to the efficiency loss from free-riding under *FP* group insurance, which lowers the utility under *FP* group insurance.

This simple analysis based on a society with one low and one high genetic risk type individual and stylized insurance and effort choice demonstrates the importance of advantageous inequity aversion of subjects with low assigned genetic risk for the emergence of group insurance. While the analysis for more than two subjects per society and stated WTP for group insurance is more involved, the key parameter remains advantageous inequity aversion of subjects with low assigned genetic risk. In our experiment, a WTP for group insurance that exceeds the insurance premium for individual insurance, both under *GPO* and *FP*, indicates the presence of social preferences as the outside option of individual insurance is always available. In Section 4, we will therefore start with the analysis of whether net WTP, the WTP above the individual insurance premium, is strictly positive, with a focus on the crucial *L*-type individuals. Furthermore, the stylized analysis above of the difference in threshold values for β_L between the two experimental conditions also motivates our main hypothesis for differences across the two conditions:

Hypothesis. *Under GPO, there is on average more group insurance pooling high and low genetic risk types than under FP.*

4 Results

We begin by giving a brief overview of the results before investigating in depth (1) how social preferences manifest at the individual level in the health insurance context and (2) how this translates to voluntary pooling of heterogeneous health risks at the societal level. Then, we analyze whether there is a discrepancy between incentivized choices in the experiment and non-incentivized voting decisions elicited in the post-experimental survey.

4.1 Overview of Results

Table 3 summarizes insurance and preventive effort choices, and resulting insurance outcomes at the societal level. On average, subjects are willing to pay 250 ECU for group insurance. To put this in context, the range of insurance premiums for individual insurance is between 140 ECU (highest effort level) and 280 ECU (lowest effort level) for low genetic risk types and correspondingly between 280 ECU and 420 ECU for high genetic

TABLE 3. CHOICES AND INSURANCE OUTCOMES, TOTAL AND BY GENETIC RISK TYPE AND EXPERIMENTAL CONDITION

	Total	Low risk types		High risk types	
		FP condition	GPO condition	FP condition	GPO condition
WTP for group insurance (in ECU)	250	163.3	175.3	332.3	329.3
Existence of group insurance (in %)	69.2	53.3	85.0	53.3	85.0
Participation in group insurance (in %)	23.1	12.9	16.7	17.9	45.0
Preventive effort	4.9	4.9	4.6	4.9	5.2
Observations	960	240	240	240	240

Notes: Subject-period-observations (e.g., 960 = 96 subjects \times 10 periods). 20 ECU = 1 CHF. Possible group insurance premiums range between 140 ECU (low risk subjects with effort of ten only) and 420 ECU (high risk subjects with effort of zero only).

risk types. In both conditions, subjects with high genetic risk have, on average, a higher WTP for group insurance than subjects with low genetic risk (p-value = 0.0277, Wilcoxon signed-rank test), which is expected given their higher overall risk. Moreover, for subjects with low genetic risk, average WTP is higher in the *GPO* than the *FP* condition. The difference is not statistically significant, however.

Turning to the resulting health insurance outcomes, a group insurance is 1.6 times more likely to exist in the *GPO* condition, when compared to the *FP* condition. The share of subjects participating in group insurance is also higher in the *GPO* condition. Differences in participation are particularly striking for subjects with high genetic risk. In the *GPO* condition, almost every second subject with high genetic risk participates in a group insurance whereas, in the *FP* condition, less than one subject with high genetic risk per society participates, on average. The difference in participation shares across experimental conditions reflects both a higher propensity of existence of a group insurance (extensive margin) and a larger size of group insurance conditional on existence (intensive margin) in the *GPO* condition. In the *GPO* (*FP*) condition, 2.8 (2.2) subjects participate in a group insurance, on average. Among them, roughly 2 (1.4) have a high assigned genetic risk of illness.

In this paper, we are particularly interested in whether mutualization of heterogeneous genetic risk can be achieved when people also have the choice of fully individually risk-adjusted insurance premiums. The descriptive results presented before do not distinguish between group insurance that pools different high and low genetic risk types and group insurance that does not, however. In Figure 2, we therefore distinguish between mixed (i.e., a group insurance that pools different genetic risk types) and non-mixed (i.e., a group insurance which does not pool different genetic risk types) group insurance when

presenting insurance shares by genetic risk type and experimental condition. We observe that patterns for participation in mixed and non-mixed group insurance are similar to those previously described for group insurance overall. Mixed group insurance exists in both experimental conditions, confirming that some subjects are willing to cross-subsidize other participants in group insurance, independent of the exact pooling scheme. However, under *GPO*, we observe a higher participation of low genetic risk types, as well as an overproportional increase in the share of cross-subsidized high genetic risk types. Yet, Figure 2 also shows that the large majority of subjects ends up with individual or no insurance if participation in group insurance is voluntary. Overall, while the results point in the direction of more mixed group insurance under *GPO* than under *FP*, differences are not statistically significant and our hypothesis regarding condition differences cannot be supported.

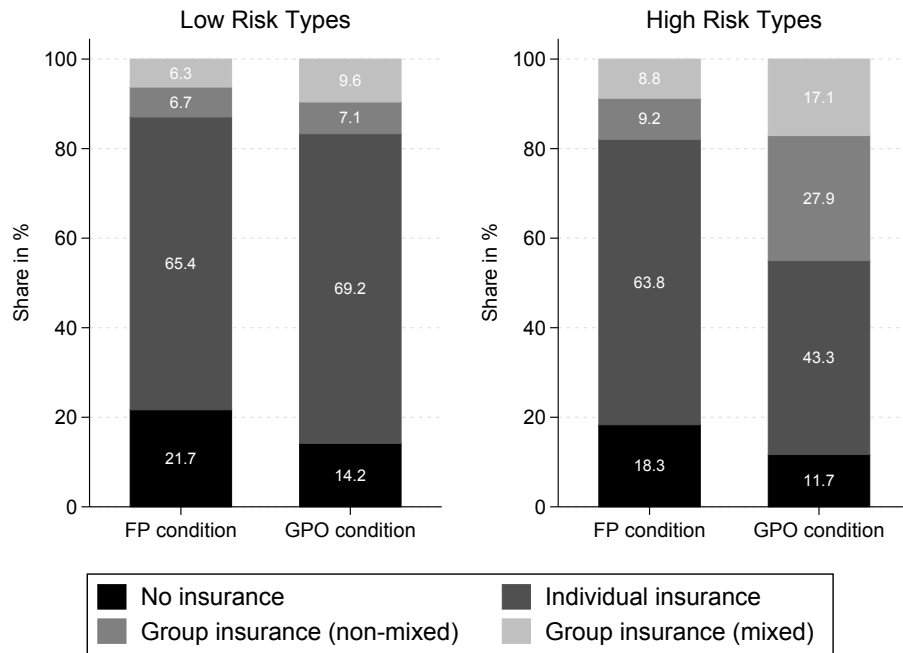


FIGURE 2. INSURANCE SHARES BY GENETIC RISK TYPE AND EXPERIMENTAL CONDITION

Finally, we find that average effort amounts to 4.9, and neither differs substantially across genetic risk types nor experimental conditions. This result seems surprising at first, but can be explained by the distribution of insurance choices. In particular, our modelling of health risk implies that for a given insurance choice, the cost and returns to effort do not depend on genetic risk type and should thus not vary systematically across genetic risk type. In fact, differences in effort should only play out via differences in the choice of group insurance under *FP*, as this is the insurance scheme in which free-riding

incentives to reduce effort exist. Looking into the insurance choices, the observation that the shares of subjects with high and low genetic risk that are included in group insurance (either mixed or non-mixed) in the *FP* condition are relatively similar and overall low ($8.8+9.2 = 18\%$ for high genetic risk types and $6.3 + 6.7 = 13\%$ for low genetic risk types) thus explains why there are no differences in effort across genetic risk type. A similar reasoning is underlying the result of no significant differences in effort across conditions: The low overall level of group insurance under *FP* implies that strong free-riding incentives are not present in the *FP* condition and thus no significant differences in effort across the experimental conditions emerge. Zooming in on effort for high genetic risk types, whose shares in group insurance differ more strongly across the experimental conditions, we however observe an effort difference in the predicted direction, dropping from 5.41 under group insurance in the *GPO* condition to 4.72 under group insurance in the *FP* condition.²¹ This difference is however not statistically significant.

To better understand our overall results on pooling, in the following we will analyze the manifestation of social preferences at the individual level, before turning to the societal level.

4.2 The Willingness to Cross-Subsidize Health Risk

Social preferences for redistribution in our health insurance set-up translate to a willingness to cross-subsidize. In the following, to analyze these social preferences, we use the dichotomous measure of whether a subject has a positive net WTP for group insurance. The net WTP is the difference between a subject's WTP for group insurance and her premium under individual insurance given chosen effort level. A positive net WTP of subjects with low genetic risk indicates their willingness to cross-subsidize, since they are willing to sacrifice some fraction of their income in order to reduce premium differences within their society. In particular, a positive net WTP of subjects with low genetic risk indicates a willingness to cross-subsidize high genetic risk types.²² We use the dichoto-

²¹Furthermore, at the individual level, we observe that some subjects free-ride on others by providing little effort throughout or reducing their effort upon participation in a group insurance. Moreover, we also observe behavior consistent with a reaction to free-riders in the form of a reduction of WTP for group insurance. In the case of subjects with low genetic risk, the reduction in WTP may prevent pooling with high genetic risk subjects.

²²In the *GPO* condition, cross-subsidization can only take the form of cross-subsidizing the high genetic risk component of other subjects. Under *FP*, besides cross-subsidization of the high genetic risk component of other subjects, a positive net WTP could theoretically additionally stem from a willingness to cross-subsidize low effort of other subjects. The literature reviewed in Section 2 however indicates that, if social preferences with respect to effort of other participants are present, they go in the opposite direction, i.e. a disutility from income equalization that stems from differences in effort instead of a willingness to cross-subsidize low effort of others.

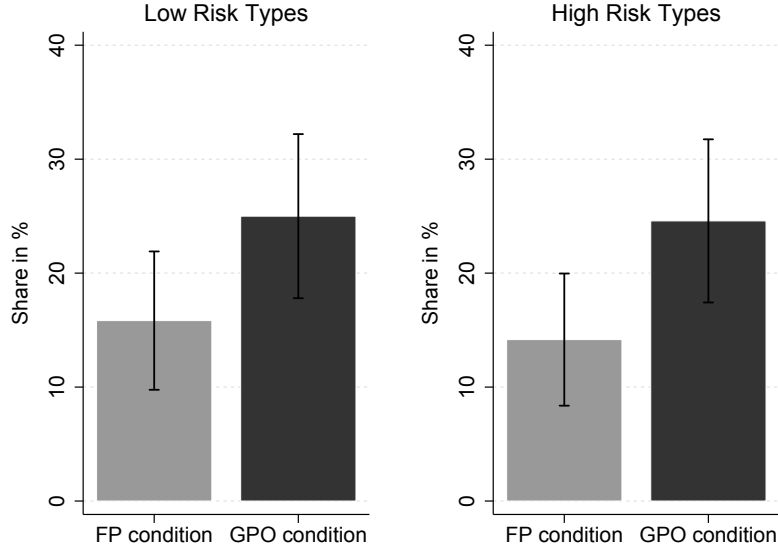


FIGURE 3. SHARE OF SUBJECTS WITH POSITIVE NET WTP BY GENETIC RISK TYPE AND EXPERIMENTAL CONDITION

Notes: The net WTP equals the WTP for group insurance minus the premium for individual insurance.

mous measure of whether there is a positive net WTP rather than continuous net WTP as we are primarily interested in the existence of social preferences. Furthermore, this measure addresses the point that the incentive scheme does not allow the interpretation of differences in stated WTP beyond certain cut-off values. As the key example, low genetic risk types, given their effort level, generally cannot increase their utility (including inequity aversion for genetically caused income differences) by stating a particular WTP below their individual insurance premium—given that it is below the individual insurance premium—such that the magnitude of the WTP below the individual insurance premium should not be used.

Figure 3 shows the share of subjects with positive net WTP pooled across societies and periods by genetic risk type and experimental condition. Overall, the share of subjects indicating a positive net WTP is with 20% considerable.²³ Again, we observe differences across experimental conditions that are in line with the theoretical predictions. In the *FP* condition, roughly 15% of the WTP responses are such that they exceed a subject's individual insurance premium. In the *GPO* condition, this share is at 24.9% roughly 1.7 times larger. This difference in positive net WTP shares across experimental conditions is statistically significant (p -value = 0.0247, Mann-Whitney U-test). In both experimental conditions, positive net WTP shares do not differ between subjects with low and high

²³On average, subjects with positive net WTP are willing to give up 95.80 ECU.

genetic risk of illness. This finding is interesting, since high genetic risk types cannot increase their utility out of inequity aversion for genetically caused income differences with a positive net WTP, as they are the genetic risk types that are cross-subsidized. One explanation for the finding is that by stating a high WTP for group insurance, leading to a positive net WTP, subjects with high genetic risk can nevertheless express their preferences for pooling.²⁴

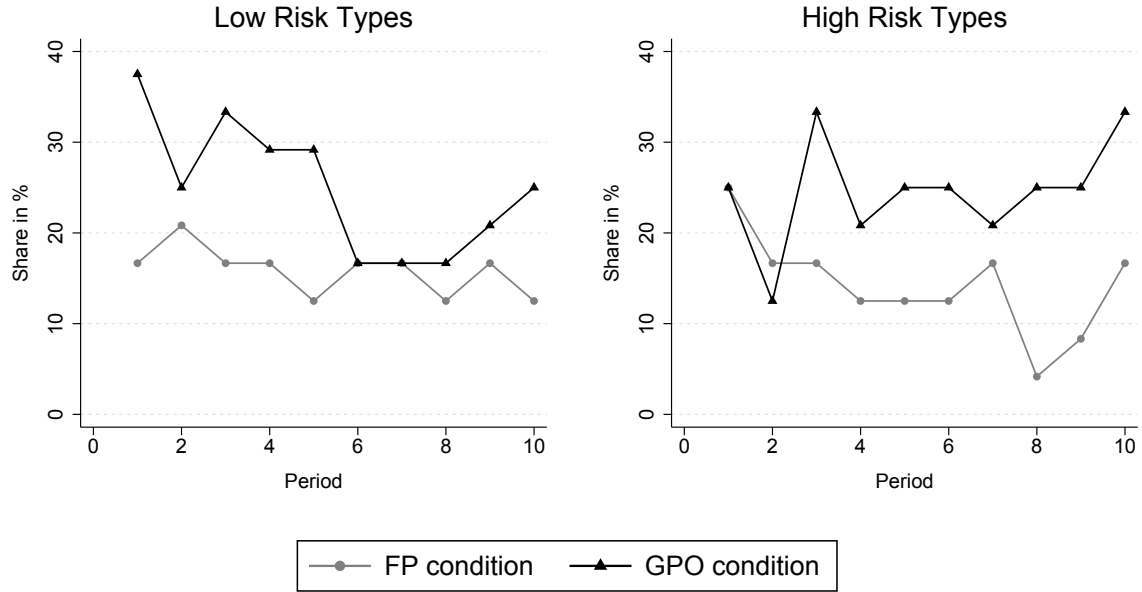


FIGURE 4. SHARE OF SUBJECTS WITH POSITIVE NET WTP OVER TIME BY GENETIC RISK TYPE AND EXPERIMENTAL CONDITION

Notes: The net WTP equals the WTP for group insurance minus the premium for individual insurance.

Figure 4 depicts the share of subjects with positive net WTP over time, again by genetic risk type and experimental condition. It shows for both genetic risk types that the difference across experimental conditions also holds over time: In all but two periods, the share of subjects with positive net WTP is larger in the *GPO* than in the *FP* condition, although for low genetic risk types the difference between the two experimental conditions decreases over time. In addition, Figure 4 also shows patterns that are – at a first glance – consistent with learning as well as with fatigue. While the pattern of an overall declining positive net WTP share for high genetic risk types in the *GPO* condition, for example, clearly speaks in favor of learning, the relatively constant positive net WTP share for high genetic risk types in the *GPO* condition may also be interpreted as a sign of fatigue.

²⁴An interesting observation is that the results show that advantageous inequity aversion with respect to income differences caused by effort, that is a motive of cross-subsidizing low effort of others, is not present. If it were, the share of positive net WTP for high genetic risks would tend to be higher under *FP* than *GPO*, and not lower.

A closer view at the data, however, reveals that the level of effort decreases over time in both conditions (Figure A4 in Appendix A). Furthermore, we observe an increase in profits over time for high genetic risk types (Figure A5 in Appendix A). Such changes in behavior and profits—including periods 6–10—are more consistent with learning over time.

In what follows, we will focus on subjects with low genetic risk as their willingness to cross-subsidize is crucial for the existence of a mixed group insurance. Table 4 shows the estimation results of linear probability models for the propensity of having a positive net WTP.²⁵ All models include an interaction term between the experimental condition indicator and an indicator for the last five periods to account for the smaller differences in the propensity of having a positive net WTP between the experimental conditions in the last five periods (see Figure 4). In the regression table, we report both cluster-robust standard errors and p-values for tests of the null of a zero coefficient computed using the wild cluster bootstrap-t procedure (Cameron et al. 2008). The p-values account for the fact that usual cluster-robust standard errors tend to be downward biased with 12 clusters.

Table 4 shows, in line with the descriptive results, that for the first five periods the propensity of a positive net WTP is 12.6 to 14.2 percentage points higher in the *GPO* condition. After controlling for a subject’s characteristics²⁶, the difference between the two experimental conditions is statistically significant at the 10% level. Also in line with the descriptive results, the difference between the two experimental conditions is smaller in the last five periods. The coefficient on the interaction term is negative, but just lacking statistical significance at the 5% level. Thus, the results also suggest that learning effects for low genetic risk types play out more strongly in the *GPO* than the *FP* condition. One possible explanation for this result is that due to the absence of free-riding incentive in the *GPO* condition initially more subjects with low genetic risk are willing to participate in a mixed group insurance, but as they fail to coordinate with other low genetic risk types and learn about the other subject’s preferences in their society, they tend to reduce their WTP for group insurance more frequently than subjects in the *FP* condition, leading to

²⁵Again, we use the dichotomized net WTP measure as outcome variable to account for the fact that very low WTP below the individual insurance premia may not necessarily reflect a low genetic risk type’s true WTP for group insurance. The following estimation results are robust if we estimate probit or logit (including the Firth-Logit, Firth (1993)) models instead of linear probability models.

²⁶There is an imbalance of economics students across experimental conditions. Despite random assignment of participants to experimental conditions, economics students were 22.5 percentage points more likely to be assigned to the *FP* condition.

this stronger reduction in the propensity of a positive net WTP in the GPO condition.²⁷

TABLE 4. REGRESSION RESULTS FOR THE PROPENSITY OF A POSITIVE NET WTP

	(1)	(2)	(3)
	Dependent variable: Prob(WTP > indiv. premium)		
Constant	0.167** (0.067) [0.148]	0.069 (0.698) [1.000]	0.089 (0.666) [1.000]
GPO condition	0.142 (0.087) [0.114]	0.126* (0.068) [0.070]	0.135* (0.068) [0.062]
Last 5 periods	-0.017 (0.029) [0.642]	-0.017 (0.030) [0.642]	-0.017 (0.030) [0.642]
GPO condition × Last 5 periods	-0.100* (0.050) [0.105]	-0.100* (0.050) [0.105]	-0.100* (0.050) [0.105]
Male		0.041 (0.099) [0.721]	0.043 (0.099) [0.729]
Age (in years)		0.004 (0.032) [0.903]	0.002 (0.033) [0.957]
Economics student		-0.220*** (0.069) [0.028]	-0.228*** (0.064) [0.010]
Use of health app		0.079 (0.114) [0.521]	0.071 (0.112) [0.543]
High risk tolerance			-0.033 (0.096) [0.771]
High altruism			0.078 (0.093) [0.478]
Observations	480	480	480

Notes: Linear probability model estimates. Cluster-robust standard errors are reported in parentheses. Wild cluster-robust p-values, computed using the wild cluster bootstrap-t procedure described in Cameron et al. (2008), are reported in squared brackets. Subjects whose willingness to take risk lies between 0 to 2 (3 to 10) have a low (high) risk tolerance. Subjects whose willingness to share lies between 0 to 3 (4 to 10) exhibit low (high) altruism. The sample is restricted to subjects with low assigned genetic risk of illness.

* p<0.1 ** p<0.05 *** p<0.01.

The effects of several covariates are worth mentioning. In line with other experimental evidence in the literature (e.g., Bauman and Rose 2011, Frank et al. 1993, Gerlach 2017,

²⁷Controlling for a linear time trend or up to five period categories, we find that our results are robust. With several period indicators, we additionally observe that the decline in the propensity of a positive net WTP is not only stronger, but also more persistent in the GPO condition, which corroborates the findings from aggregate level (see Figure 4). The faster convergence to the equilibrium with little or no pooling in the FP condition can be explained by the free-riding incentive, although these results should be interpreted with caution given that coefficient estimates for period indicators do not reach statistical significance.

Haucap and Müller 2014, Marwell and Ames 1981, Selten and Ockenfels 1998), students with economics as major make more selfish choices.²⁸ In our experiment, they are more than 20 percentage points less likely to have a positive net WTP than other students. Moreover, in line with expectations, the propensity of a positive net WTP is positively related to altruism as measured by the questionnaire of Falk et al. (2016). However, this relationship is not statistically significant. Furthermore, the risk preference coefficient points to towards a negative relationship between high risk tolerance and the probability of having a positive net WTP but is again not statistically significant.

We observe a large heterogeneity in the willingness to pool across subjects with low genetic risk. Figure 5 exemplifies this heterogeneity by displaying WTP over time for four different subjects. Subject 74 is a subject with strong social preferences. Her WTP is substantially larger than her individual insurance premium in all periods. She participates in a mixed group insurance over all ten periods and is willing to cross-subsidize up to three subjects with high genetic risk of illness (periods 5 to 10). Subject 96 displays a moderate willingness to pool. Her WTP is lower than the WTP of subject 74, and in line with conditional participation in group insurance, i.e. participation that depends either on other low genetic risk types' willingness to cross-subsidize or the level of cross-subsidization. In particular, subject 96 is not willing to cross-subsidize more than one high genetic risk type. This is nicely seen from behavior in period 5, when subject 96 returns to her WTP level of period 3 after cross-subsidizing two high genetic risk types in period 4. Subjects 79 and 95 both display no disutility from advantageous inequality resulting from their lower genetic risk. Subject 79 always exactly states her individual insurance premium as WTP, such that she would only be included in a group insurance if she was cross-subsidized. Subject 95's choices show that this subject is not willing to pool at all.²⁹

How these heterogeneous social preferences translate to existence and level of voluntary pooling of health risks at the societal level depends on the distribution of social

²⁸When compared to students of other disciplines, economics students made e.g. more selfish decisions in a third-party punishment game (Gerlach 2017), were less likely to make donations to social programs (Bauman and Rose 2011) and contributed less of their private savings to the common pot in public goods games (Marwell and Ames 1981). In the solidarity experiment of Selten and Ockenfels 1998, students with economics as major were less willing to make conditional gifts, the effect being driven by male economics students. In addition, economists appear to behave less cooperatively in a prisoner's dilemma than non-economists (Frank et al. 1993) and less trusting as well as less trustworthy than law students in a trust game (Haucap and Müller 2014).

²⁹This conclusion can be drawn even though subject 95 indicates a positive WTP for group insurance in period 1 as her WTP (60 ECU) is far below her smallest possible group insurance premium (266 ECU). Moreover, she reduces her WTP to zero after observing the consequences of being included in a group with one high genetic risk type for another subject with low genetic risk.

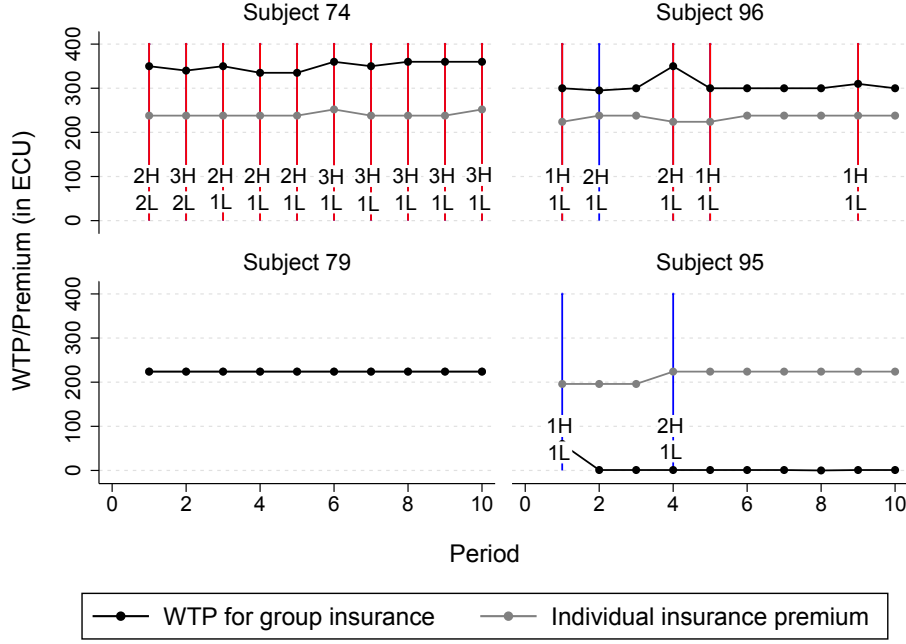


FIGURE 5. HETEROGENEITY OF SOCIAL PREFERENCES

Notes: All subjects have a low assigned genetic risk of illness and were assigned to the *GPO* condition. All subjects prefer individual insurance to no insurance if not included in group insurance. H (L) indicates the number of subjects with high (low) genetic risk who participate in group insurance. Red (blue) vertical lines indicate periods with a mixed group insurance in which the subject (does not) participate(s).

preferences of low genetic risk types in a society. For example, a high share of unconditional participants with generally high net WTP (e.g., subject 74) among low genetic risk subjects should lead to more pooling of genetic risk. Less mutualization should be observed in societies with a high share of conditional participants (e.g., subject 96), and it becomes even more unlikely in these societies if either no unconditional participant is present or conditional participants fail to coordinate. Very little or even no pooling of genetic risk should be observed in societies with a negligible share of low genetic risk subjects who have a positive net WTP in at least some periods. In the next section, we will analyze in more depth how the heterogeneity of social preferences at the individual level affects pooling of genetic risk at the societal level.

4.3 Pooling at the Societal Level

Figure 6 presents the number of subjects with mixed, non-mixed, individual, and no insurance for each of the 12 societies over time. We observe that there exist three types of societies: societies that never experience a mixed group insurance (societies 3, 10, 13, and 20), societies that occasionally experience a mixed group insurance (societies 1,

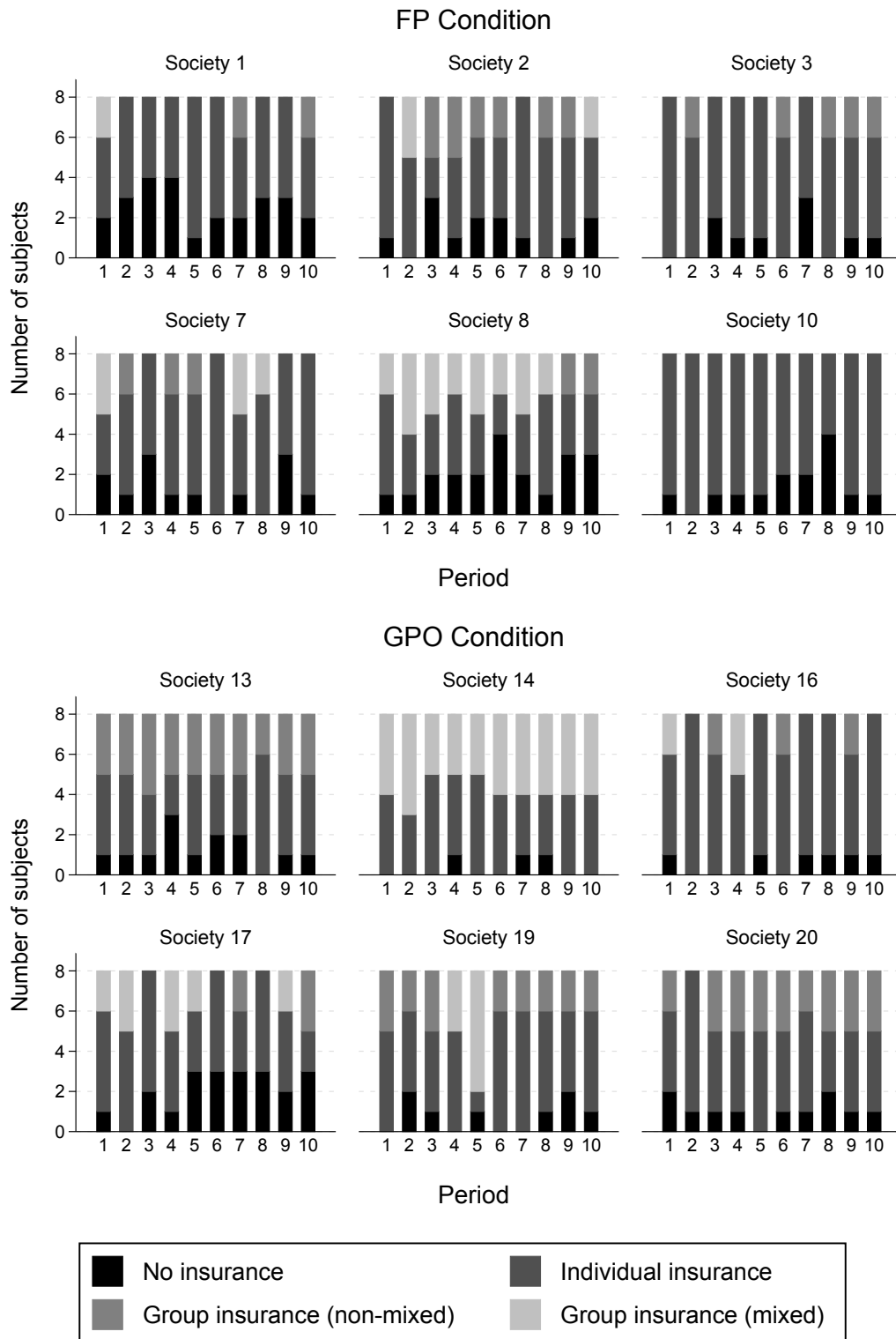


FIGURE 6. INSURANCE STATUS OVER TIME BY SOCIETY

2, 16, and 19), and societies that often or always experience a mixed group insurance (societies 7, 8, 14, and 17). For societies that never experience a mixed group insurance, the share of low genetic risk subjects who have a positive net WTP in at least one period is at 18.8%, and this share is significantly lower than in societies that experience a mixed group insurance in at least one of the ten periods (share for the latter = 65.6%, p-value = 0.0128, Mann-Whitney U-test). Moreover, the share of subjects among low genetic risk subjects who always have a positive net WTP is highest for societies that often or always experience a mixed group insurance. At 18.8%, it is 15.6 percentage points higher than for societies that experience few or no pooling of genetic risk (p-value = 0.0382, Mann-Whitney U-test). Looking at the correlations between individuals having a positive net WTP and being in a given type of society shows: Being a member of a society that never experiences mixed group insurance is negatively correlated (-0.194), being a member of a society that occasionally experiences a mixed group insurance is almost uncorrelated (0.015), and being a member of a society that often or always experiences a mixed group insurance is positively correlated (0.179) with a positive net WTP.

A comparison of societies across experimental conditions reveals that there is a tendency towards more pooling of genetic risk in the *GPO* condition. Although the share of societies that ever experience a mixed group insurance is balanced across conditions, in the *GPO* condition societies are more likely to have a mixed group insurance. Moreover, if there is a mixed group insurance, this group insurance has, on average, more members. Both results are, however, not statistically significant. As illustrated by Figure A6 in Appendix A, group size in the *GPO* condition is larger because there more often exist two or three low genetic risk types who are willing to participate in a mixed group insurance in the same period, and their WTP is such that additional high genetic risk types are able to join the group insurance. In addition, group size in the *GPO* condition is larger because low genetic risk types are more often willing to cross-subsidize more than one high genetic risk type. Overall, these results suggest that, despite strong heterogeneity in social preferences, social preferences are sufficiently strong to allow for some pooling of ex-ante heterogeneous health risks at the societal level.

In order to better understand the group insurance dynamics in a society, we investigated the WTP dynamics of all subjects jointly in a society. In Figure 7, we graphically summarize the dynamics for subjects in society 14.³⁰ For each subject, we show the

³⁰Figure A7 in Appendix A provides another example for a society in the *FP* condition. In this society, there is initially a mixed group insurance, but upon observation of cross-subsidization in period 1 the pivotal low genetic risk type (subject 3) decreases her WTP such that there is no mixed group insurance in any period thereafter.

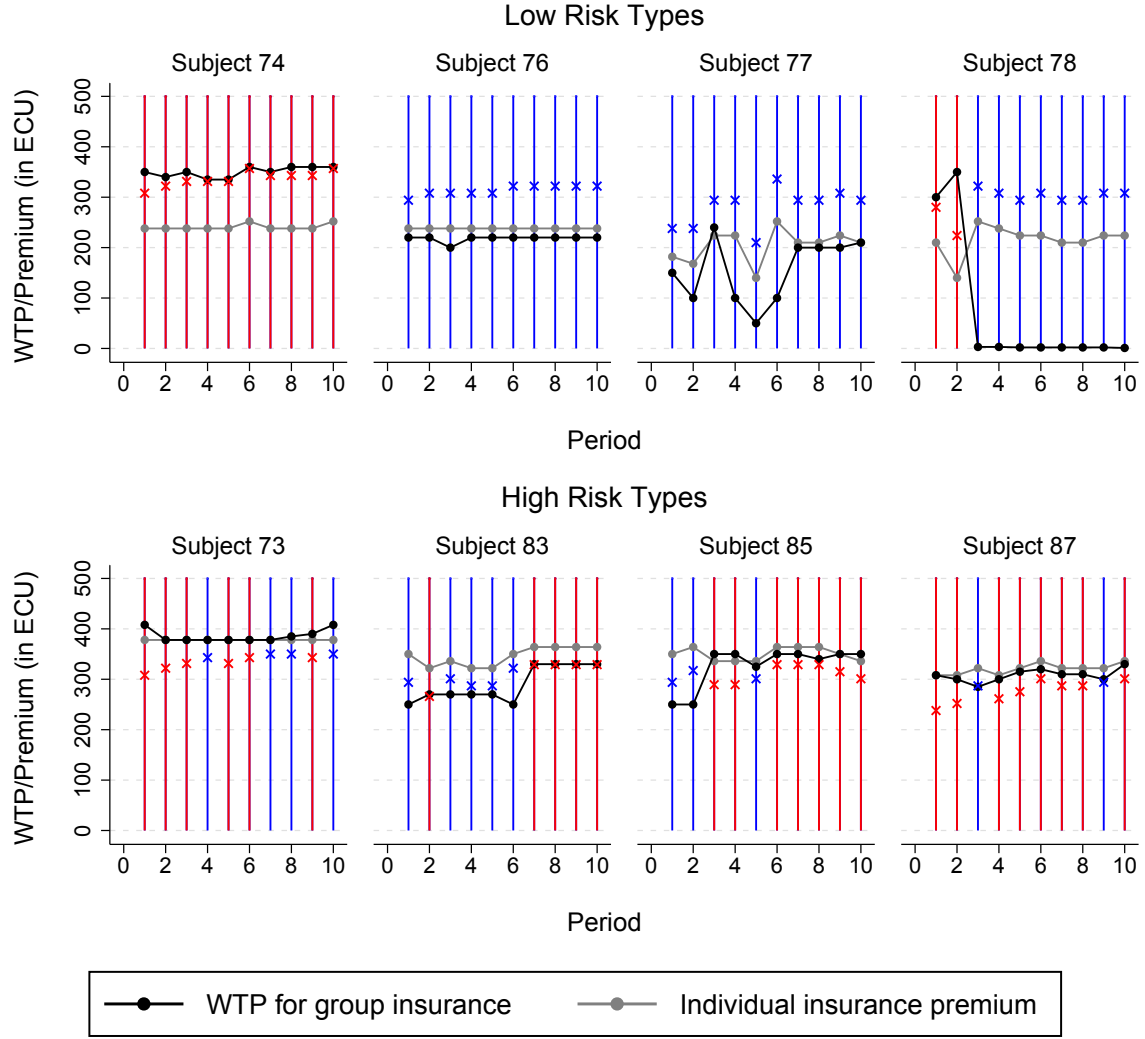


FIGURE 7. WTP DYNAMICS OF SOCIETY 14 (*GPO* CONDITION)

Notes: Red (blue) vertical lines indicate periods with a mixed group insurance in which the subject (does not) participate(s). Red crosses indicate a subject's group insurance premium. Blue crosses indicate a subject's hypothetical group insurance premium, i.e. the group insurance premium that would have had resulted if the subject had participated in the group insurance.

evolution of her WTP for group insurance and her individual insurance premium, where changes of the latter result from changes of her preventive effort level. Periods with mixed group insurance are indicated by vertical red (if subject participates) and blue (if subject does not participate) lines. In society 14, two subjects with low genetic risk of illness indicate a WTP for group insurance that exceeds their individual insurance premium (subjects 74 and 78). Initially, both subjects contribute to the mixed group insurance, each of them cross-subsidizing one subject with high genetic risk. The increase of subject 78's WTP for group insurance in period 2 allows one additional subject with high genetic risk to join the group insurance. This higher share of high genetic risk types

leads to an increase of the group insurance premium in period 2.³¹ Having learned that there is a higher number of high genetic risk types in the group insurance and no third subject with low genetic risk who is willing to participate in a mixed group insurance, subject 78 reduces her WTP to zero from period 3 onwards. Thus, subject 78 appears to be willing to contribute to a group insurance only if the share of high genetic risk types is sufficiently low. Mixed group insurance in this society is then supported only by one subject, subject 74, who exhibits strong social preferences, as already discussed in the previous section. Subject 74 decreases her WTP neither upon the participation of one additional high genetic risk type in the group insurance nor upon drop out of subject 78. She eventually increases her WTP in period 6 and keeps it roughly constant after being insured jointly with three high genetic risk subjects.

Overall, we find that sustained mixed group insurance is only possible with the presence of subjects with strong social preferences, and that the dynamics in societies with low genetic risk subjects with moderate WTP for group insurance disfavor the emergence of a mixed group insurance.

4.4 Discussion

The results of this paper are in line with those of Gajdos et al. (2017), who find that 8-10% of the subjects with low genetic risk voluntarily participate in a group insurance which pools genetic and behavioral risks. Different from this paper, in their study contributions to group insurance are proportional to income, which varies across subjects. Therefore, in their study low genetic risk subjects with low income have an additional incentive to participate in group insurance, which may explain the slightly higher participation shares in their study. This study also relates to the studies of Cappelen et al. (2013) and Mollerstrom et al. (2015), both of which study preferences for redistribution in the context of risky situations. In these studies, the shares of subjects who are willing to redistribute and the actual levels of redistribution are higher than in our study. This may be explained by three crucial differences: First, in their studies, with an explicit ex-post redistribution stage, redistribution is much more salient than in our study. In our study, redistribution is implicit in the health insurance scheme, as in many other policy domains. Second, they consider a situation of ex-ante equality in opportunities with redistribution for ex-post income inequalities, i.e. after risk realization, while we consider redistribution

³¹Note that subject 78's group insurance premium decreases in period 2. This decrease results from a higher effort level of subject 78 in period 2, however. The group insurance premium before effort-related premium discount increases with the addition of one extra high genetic risk type to the group insurance.

that accounts for ex-ante heterogeneity in risk exposure. Third, Mollerstrom et al. (2015) consider choices of spectators rather than stakeholders. Because a spectator's income in the experiment is not affected by her redistributive choice, spectators tend to redistribute more than stakeholders do.

To gain insights into the robustness of the results to variations of the incentive scheme and experiment parameters, we conducted a series of additional experimental sessions with a modified design.³² In particular, this modified design addresses concerns regarding potential noise introduced by the voucher as well as the question whether parameter changes might increase the level of pooling. In the additional experiment, which counts 8 societies per experimental condition, the voucher is taken out and effort parameters are correspondingly adjusted. Furthermore, the number of low genetic risk types per society of 8 subjects is increased from 4 to 6, implying a share of high genetic risk types of only 25%, as well as the difference in genetic risk between the two types is reduced from 0.2 to 0.15.³³ The main finding is that the shares of low genetic risk types in group insurance (mixed and non-mixed) in the additional experiment are, at 11.2% in *FP* and 13.3% in *GPO*, very close to the shares in the experiment presented (13% in *FP* and 16.7% in *GPO*). The lower share of high genetic risk types per society allows a higher fraction of high genetic risk types to be insured under group in the additional experiment. However, the membership in mixed group insurance and rates of pooling of genetic risk types in the new experiment are almost identical to the ones in the main experiment. Thus, the additional experiment confirms the insights of the main experiment about the presence of social preferences (among low risks) that however do not translate into a substantial share of these in mixed group insurance and thus a limited scope for voluntary pooling.

4.5 Results of the Survey

In order to compare and contrast the results of the incentivized experiment with stated preferences for health insurance systems, we asked subjects which health insurance system they would vote for in a post-experimental survey. In this survey, we also asked subjects whether they were using a health app, and whether they would be willing to share information about their health with their health insurance provider.

³²The full results are available from the authors upon request. In this discussion, the insights from the additional experiment regarding robustness of the current results are highlighted.

³³To further simplify the participants' decision problem, subjects are not asked to state their WTP but simply choose between group or individual insurance. All subjects indicating group insurance are automatically included in group insurance. This simplifies the decision at the expense of losing important information on WTP. Furthermore, the effort decision is taken after the insurance decision.

TABLE 5. RESULTS OF THE POST-EXPERIMENTAL SURVEY, SHARES IN %

Variable	FP condition	GPO condition
Use of health app	31.3	22.9
Willingness to share health information		
Yes	29.2	20.8
Yes, if premium discount	35.4	64.6
No	35.4	14.6
Vote on health insurance system		
Individual insurance only	12.5	8.3
Individual + group insurance (GPO)	60.4	62.5
Individual + group insurance (FP)	18.8	1.6
Group insurance (FP) only	8.3	12.5
Observations	48	48

Table 5 summarizes the results of the post-experimental survey. More than one quarter of all participants are currently using a health app. Moreover, Table 5 demonstrates that across experimental conditions 75.0% of the subjects are willing to share health information with their health insurance provider, although the majority of subjects would only do so if they get a premium discount. Differences across experimental conditions are striking and influenced by a subject’s condition in the experiment. Subjects in the *GPO* condition are, for example, 20 percentage points more likely to state that they are willing to share health information with their health insurance provider than subjects in the *FP* condition (p-value = 0.0184, two-sample test of proportions). Moreover, the share of subjects who would do so if they get a premium discount is at 75.6% ($= \frac{64.4\%}{64.4\%+20.8\%} \times 100\%$) also roughly 20 percentage points higher in the *GPO* condition (p-value = 0.0641, two-sample test of proportions), when compared to the *FP* condition.

Preferences elicited in the post-experimental survey on health insurance systems show that only 12.5% (8.3%) of the subjects in the *GPO* (*FP*) condition would vote for a health insurance system with individual insurance only. The majority of subjects (almost two third) would vote for a dual system in which there is available both individual insurance as well as a group insurance that pools genetic health risk but individually prices behavioral health risk.³⁴ Interestingly, incentivized decisions in the experiment are, however, such that in the societies often only a system with individual insurance only emerges, or a dual system in which however group insurance does not pool different genetic risk types.

Focusing on subjects who were assigned a low genetic risk of illness in the experiment,

³⁴In this survey, the option group insurance only was of the *FP* form. In a follow-up experiment, the option of group insurance only of the *GPO* form was included as a possible health insurance system. The results show that then about 50% would vote for a health insurance system with group insurance of the *GPO* form only and about 20% for *GPO* group insurance alongside individual insurance, with no strong differences across experimental conditions.

TABLE 6. STATED VOTING PREFERENCES VS. INCENTIVIZED DECISIONS

Vote on health insurance system	WTP > indiv. premium	
	Yes	No
Individual insurance only	10	40
Individual + group insurance (GPO)	53	237
Individual + group insurance (FP)	23	67
Group insurance (FP) only	12	38

Notes: Subjects with low assigned genetic risk of illness. 480 observations (48 subjects \times 10 periods).

another interesting result emerges if comparing incentivized decisions in the experiment with non-incentivized voting decisions from the survey. Table 6 shows that 89.6% ($= \frac{480-10-40}{480} \times 100\%$) of the subjects who were assigned a low genetic risk in the experiment would vote for a health insurance system with group insurance, but that the majority of these subjects ($92.4\% = \frac{237+67+38}{480-10-40} \times 100\%$) is not willing to sacrifice their income in the experiment to support a group insurance that pools health risks.

5 Conclusion

Scientific and technological advances in detecting, estimating, and monitoring health risks lead to an increased precision of information on individual health risk profiles, including on genetic risk. Technically, this development allows for a better tailoring of (health) insurance prices to individual health risk profiles, again including genetic risk components. Against this background, the starting point of our study was the question whether people would—out of equality and fairness concerns—however be willing to cross-subsidize genetic risk in health insurance. A closely related question is whether this willingness to pool in health insurance depends on whether behavioral risk is also pooled or individually priced. Economic theory abstracting from social preferences predicts that a group insurance scheme with community rating should not emerge when insurance with fully risk-adjusted premia is available. The logic behind this reasoning is that absent social preferences low (genetic) risk types are never willing to cross-subsidize high (genetic) risk types. Yet, if people exhibit social preferences in the form of disliking wealth differences that have an origin in uncontrollable heterogeneity in risk exposure, such as genetic risk, these predictions may no longer hold. Depending on the distribution of social preferences of low genetic risk types, a group insurance or mutual that pools and community rates certain components of health risk may well emerge, even when fully individually

risk-adjusted health insurance is available.

In this paper, we test for these social preferences in a health insurance lab experiment. In the experiment, a non-modifiable risk which is either high or low and explicitly framed as genetic risk is assigned. Total health risk furthermore additively includes an ex ante homogeneous behavioral risk which can be reduced by exerting costly effort. In the experiment, subjects decide on effort as well as whether they want to be included in a group insurance scheme by stating their willingness to pay for group insurance. As main experimental variation, we vary the degree of risk pooling, i.e. community rating, in the group insurance scheme. In the *FP* condition, the group insurance scheme pools both genetic and behavioral risks whereas in the *GPO* condition, group insurance pools genetic risk but individually prices behavioral risk.

We find that overall the share of a positive net WTP for group insurance, indicating social preferences for pooling, is at 20%. Furthermore, we find that in the experimental condition that separates out behavioral risk, low genetic risk subjects were roughly ten percentage points more likely to indicate a WTP that exceeded their individual insurance premium than in the full pooling condition. This difference across conditions was particularly large in the first five periods. A detailed analysis reveals a substantial heterogeneity of social preferences of subjects with low assigned genetic risk and shows that the manifestation of social preferences at the societal level, i.e. the existence of a group insurance that pools genetic risk, strongly depends on the low genetic risk subjects' distribution of social preferences in a society. A comparison of societies across experimental condition indicates a tendency of more genetic risk pooling in the *GPO* condition, however, results are not statistically significant.

Results from a post-experimental survey show a discrepancy between non-incentivized stated preferences for health insurance systems and incentivized revealed preferences in the experiment. Subjects with low assigned genetic risk of illness often stated that they would vote for a health insurance system with a group insurance that pools genetic risk, but in the experiment less than 8% of these subjects were willing to forgo some of their income in order to participate in a group insurance that pools genetic risk. Interestingly, survey results indicate much more support for group insurance of the *GPO* form than of the *FP* form.

The experimental set-up used to study the scope for voluntary pooling was stylized, in particular in the modelling of health risk as additively separable in genetic and behavioral risk. Several interesting extensions could be considered in future work. First, different marginal costs or benefits of effort for the different genetic risk types could be considered,

which would decrease or amplify inequality concerns with the separation or inclusion of behavioral risk in the group insurance scheme. Furthermore, in our voluntary pooling scheme, the design was close to an opt-in system. It would be interesting to see if more pooling can be achieved if participants have to explicitly opt out of the group insurance scheme.

In the experiment, we take the interim perspective in terms of health information: People know their genetic types and make insurance purchasing decisions accordingly. An important future complement will be to take the ex ante perspective, i.e. to study social preferences and fairness views about the health insurance scheme when people do not yet know their genetic risk type. While strong caution is required when drawing implications from individual laboratory experiments, combining the current results with this ex ante perspective can help inform the debate about the role of social preferences in health insurance design and regulation in light of increasingly precise information on individual health risk profiles.

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A Additional Figures and Tables

Periode 1 von 2

Verbleibende Zeit [sec] 0

Bitte entscheiden Sie sich jetzt!

Entscheidung 1

Ihre Anfangsausstattung : 1000 ECU
Ihr genetisches Risiko zu erkranken : 20 %

1. Welches Level an Gesundheitsprävention zur Reduktion des Verhaltensrisikos möchten Sie wählen?

Ihre Entscheidung:

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Durch Ihre Investition in Gesundheitsprävention erhalten Sie den Voucher für das Functional Movement Screen mit der Wahrscheinlichkeit, die in der Tabelle (Instruktionen) für die entsprechende Investition angegeben ist.

Der Besuch des Functional Movement Screenings hilft Ihnen, Ihre Bewegungsabläufe zu verbessern und Verletzungsrisiken vorzubeugen.

OK

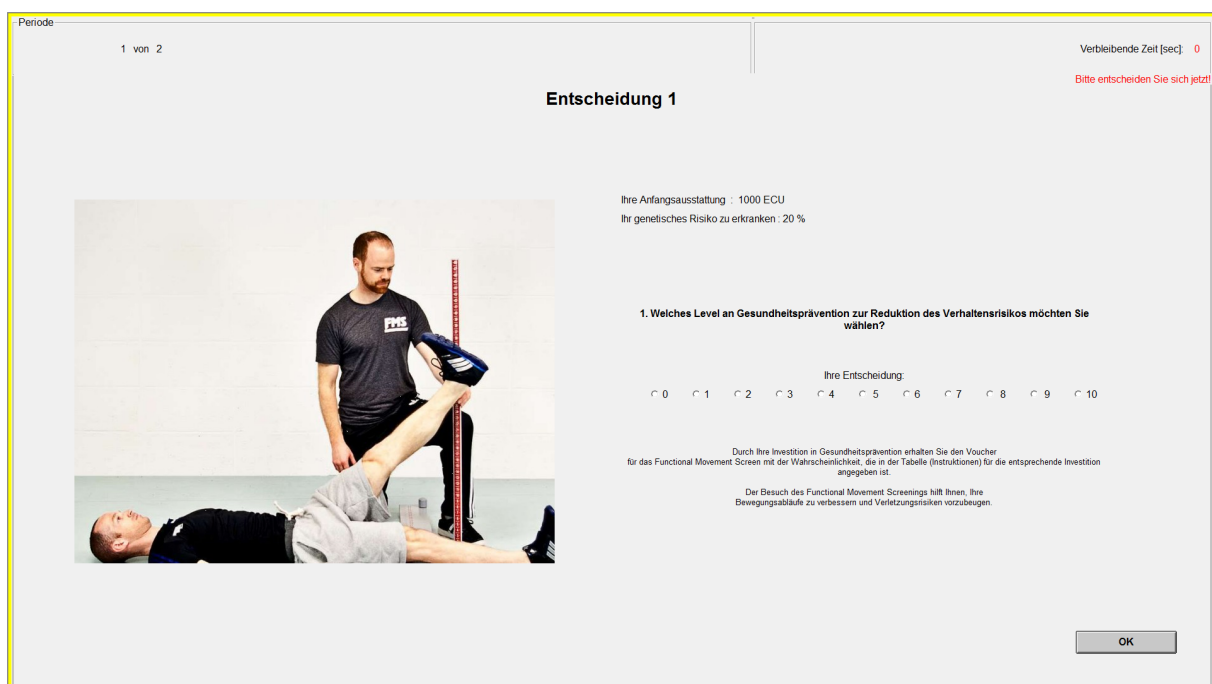


FIGURE A1. PREVENTIVE EFFORT DECISION

Notes: On the left hand side of the screen, subjects observe a picture of the Functional Movement Screen. On the right hand side of the screen, subjects observe their initial endowment and their genetic risk of illness. Moreover, subjects are reminded of the probability of winning a voucher for the Functional Movement Screen (see text below radio buttons), which depends on their preventive effort decision.

Periode

1 von 1

Entscheidungen 2 und 3

Ihr genetisches Risiko zu erkranken

20 %

Ihr ursprüngliches Verhaltensrisiko zu erkranken

+ 20 %

Ihre Reduktion des Verhaltensrisikos durch Investition in Gesundheitsprävention

- 10 %

Ihr aktuelles Gesamtrisiko zu erkranken

30 %

Ihre Anfangsausstattung

1000 ECU

Ihre Kosten für Gesundheitsprävention

- 66 ECU

Ihr aktuelles Vermögen

934 ECU

Ihre Behandlungskosten im Krankheitsfall

700 ECU

Ihre Versicherungsprämie für die individuelle Versicherung beträgt 210 ECU.

2. Wie viel sind Sie maximal bereit zu zahlen, um gruppenversichert zu sein?

Ihre Entscheidung:

3. Falls Ihr Krankheitsrisiko nicht über die Gruppenversicherung abgedeckt wird, möchten Sie sich individuell versichern oder unversichert bleiben?

☐ Individuell versichern
☐ Nicht versichern

OK

FIGURE A2. HEALTH INSURANCE DECISIONS

Notes: On the left hand side of the screen, subjects observe a summary of the consequences of their preventive effort decision, i.e. subjects observe their overall risk of illness post-prevention and their remaining budget. Moreover, they observe the treatment cost that they would be facing in the case of illness. On the right hand side of the screen, subjects observe their individual insurance premium. Below the insurance premium, they observe the WTP decision for group insurance and the decision between individual and no insurance.

Learning

FIGURE A3. SUMMARY SCREEN AT THE END OF A PERIOD

Notes: On the left hand side of the screen, subjects observe a summary of the consequences of their decisions, i.e. subjects observe their overall risk of illness post-prevention, their cost of prevention and their WTP for group insurance. On the right hand side of the screen, subjects observe important end-of-period outcomes. Information on the group insurance comprises the number of group insurance members, the number of group insurance members with high genetic risk, and the group insurance premium. In the GPO condition, the group insurance premium is split up into two parts, a genetic part, which is identical for all group insurance members, and an individual part, which corresponds to the individual premium discount. Private information is given on the insurance status, the paid insurance premium, the illness status, and the final profit.

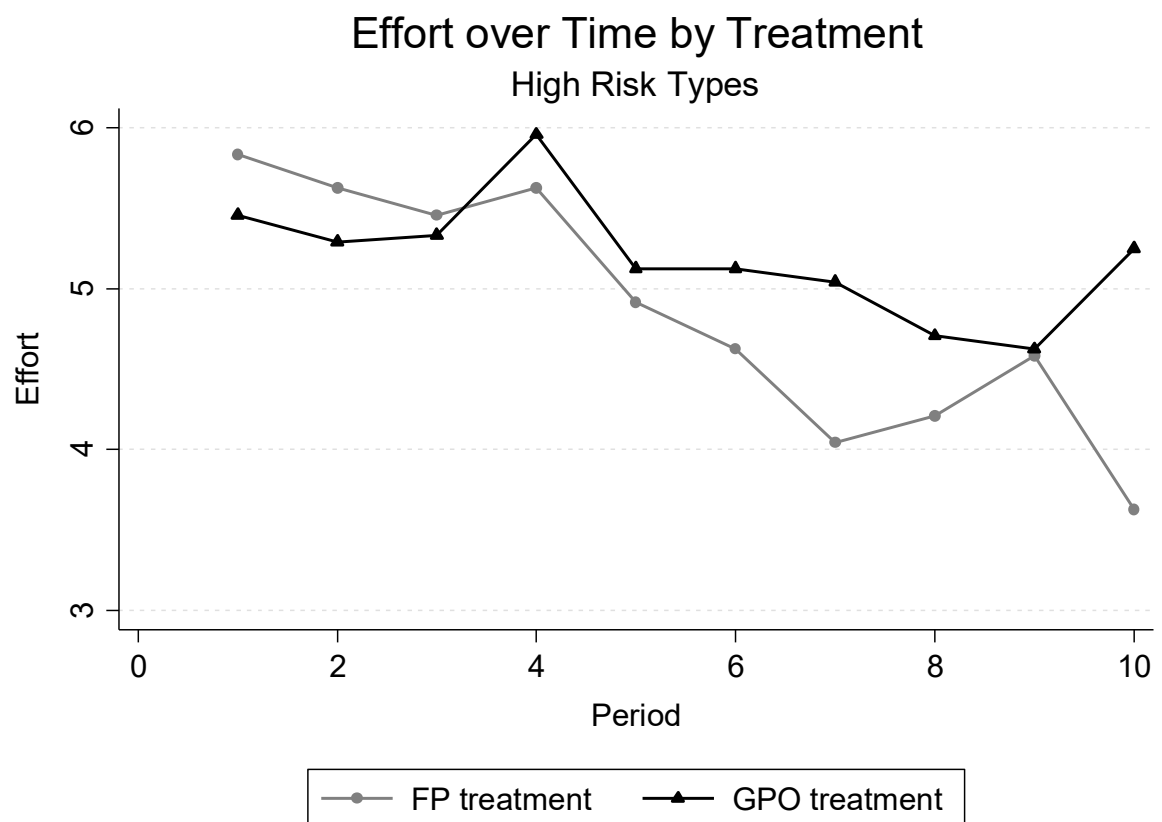
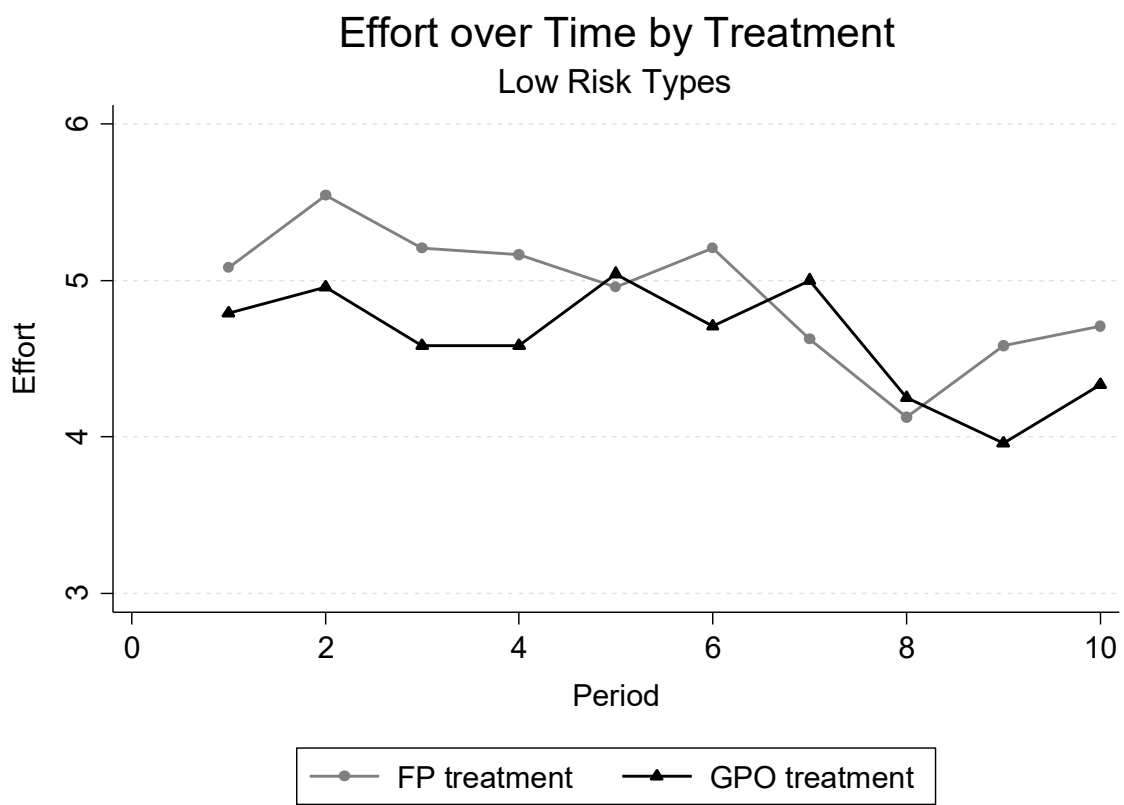


FIGURE A4. EFFORT OVER TIME AND BY TREATMENT.

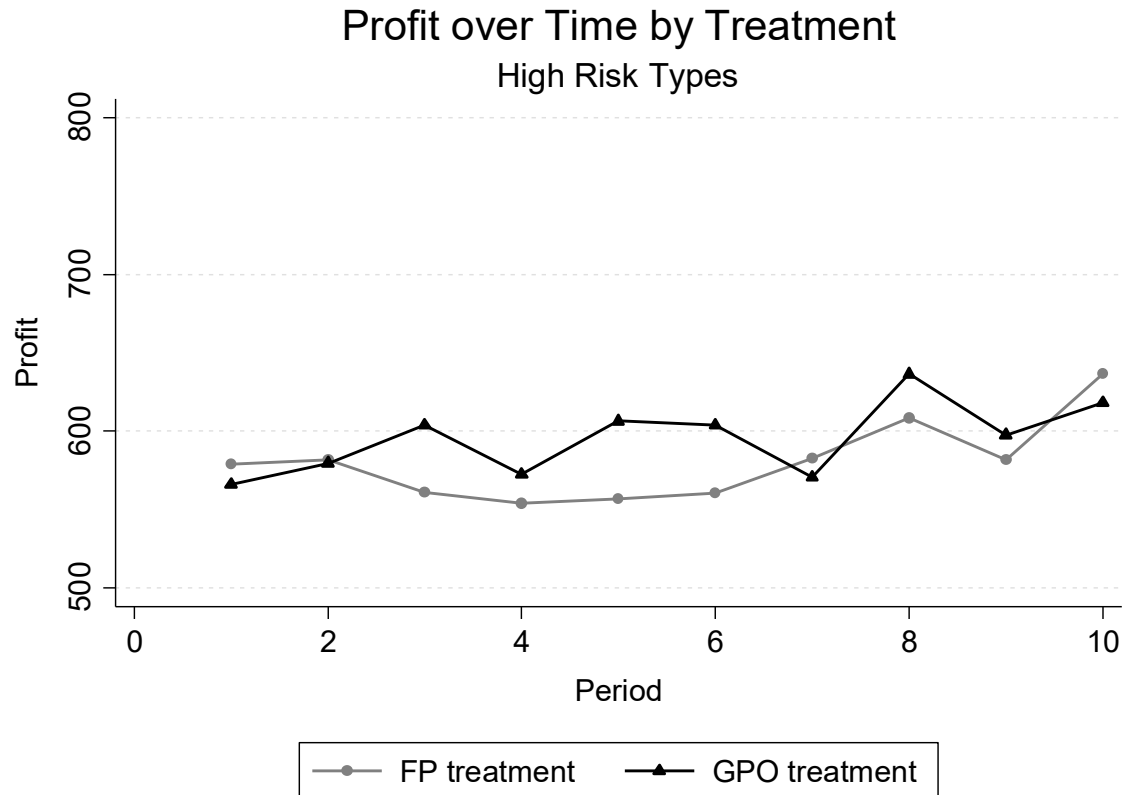
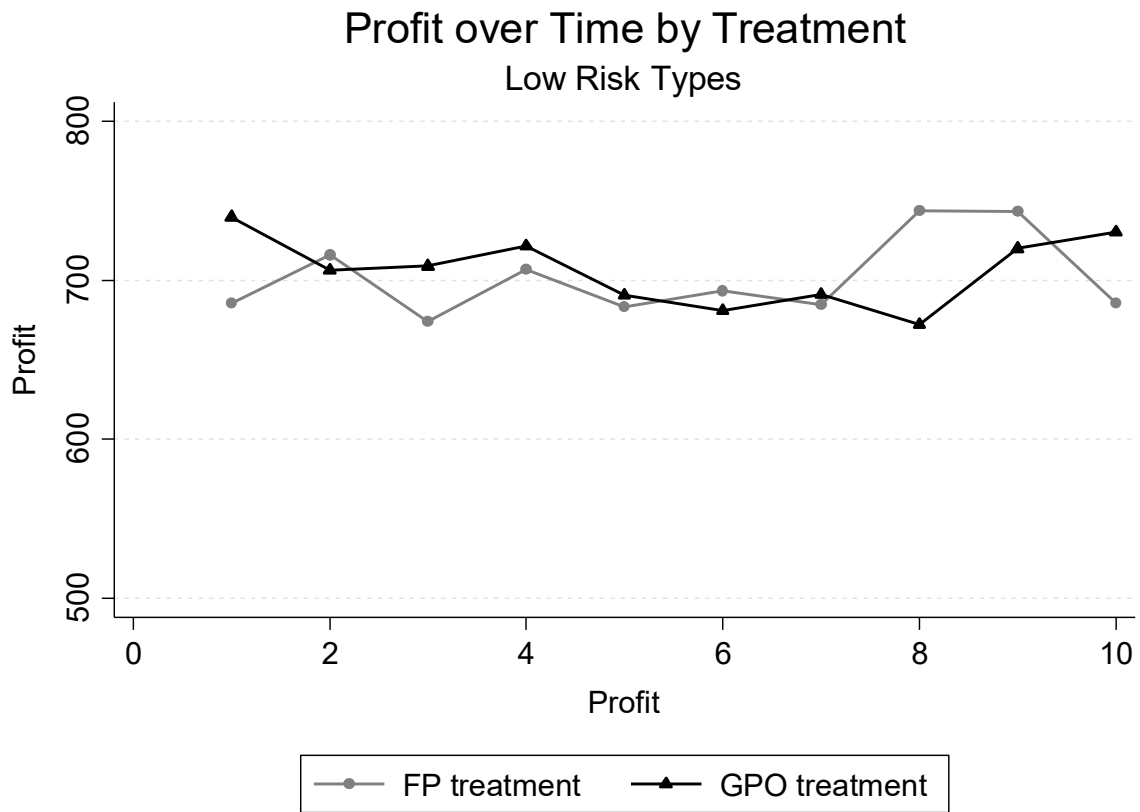


FIGURE A5. PROFIT OVER TIME AND BY TREATMENT.

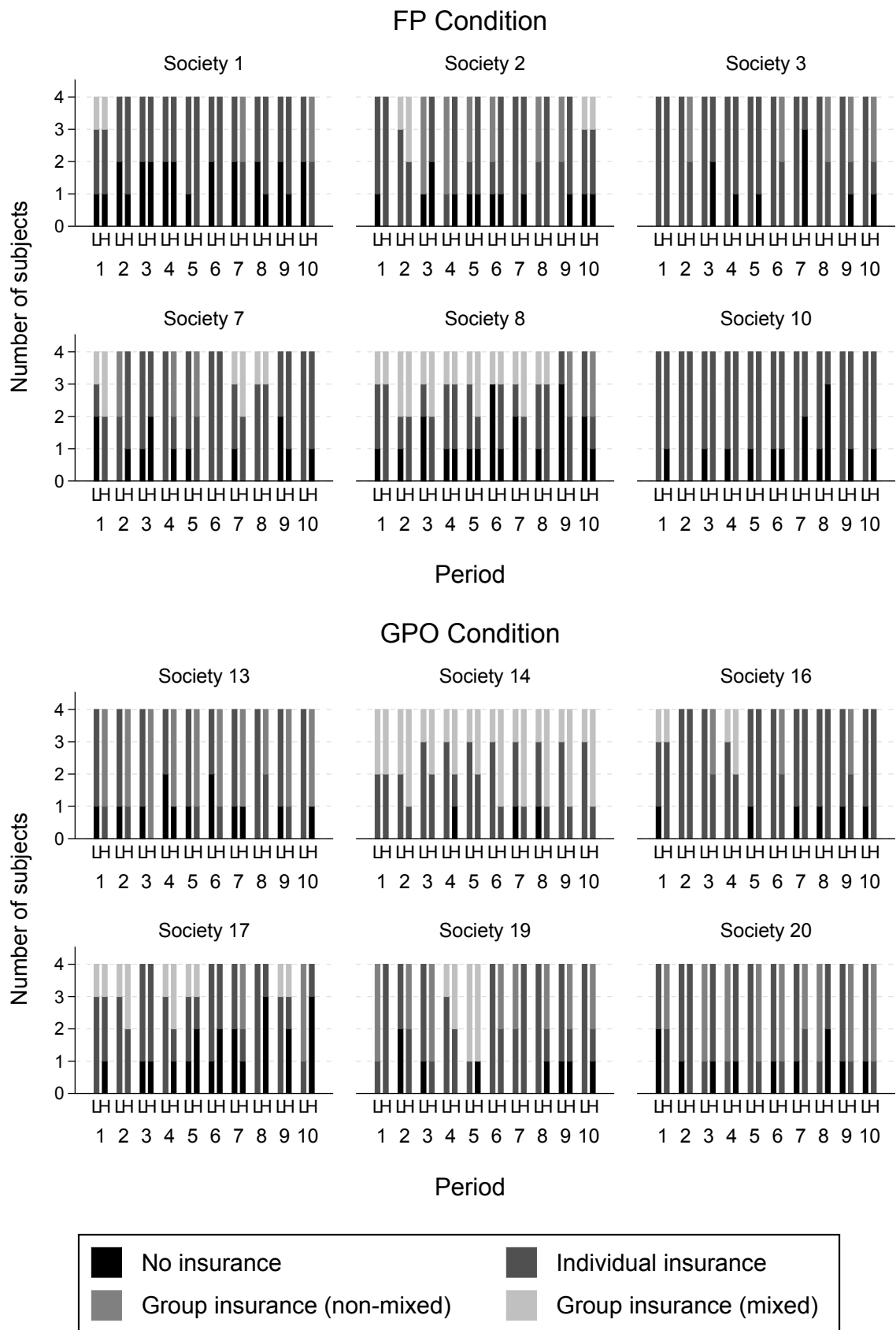


FIGURE A6. INSURANCE STATUS OVER TIME BY GENETIC RISK TYPE AND SOCIETY

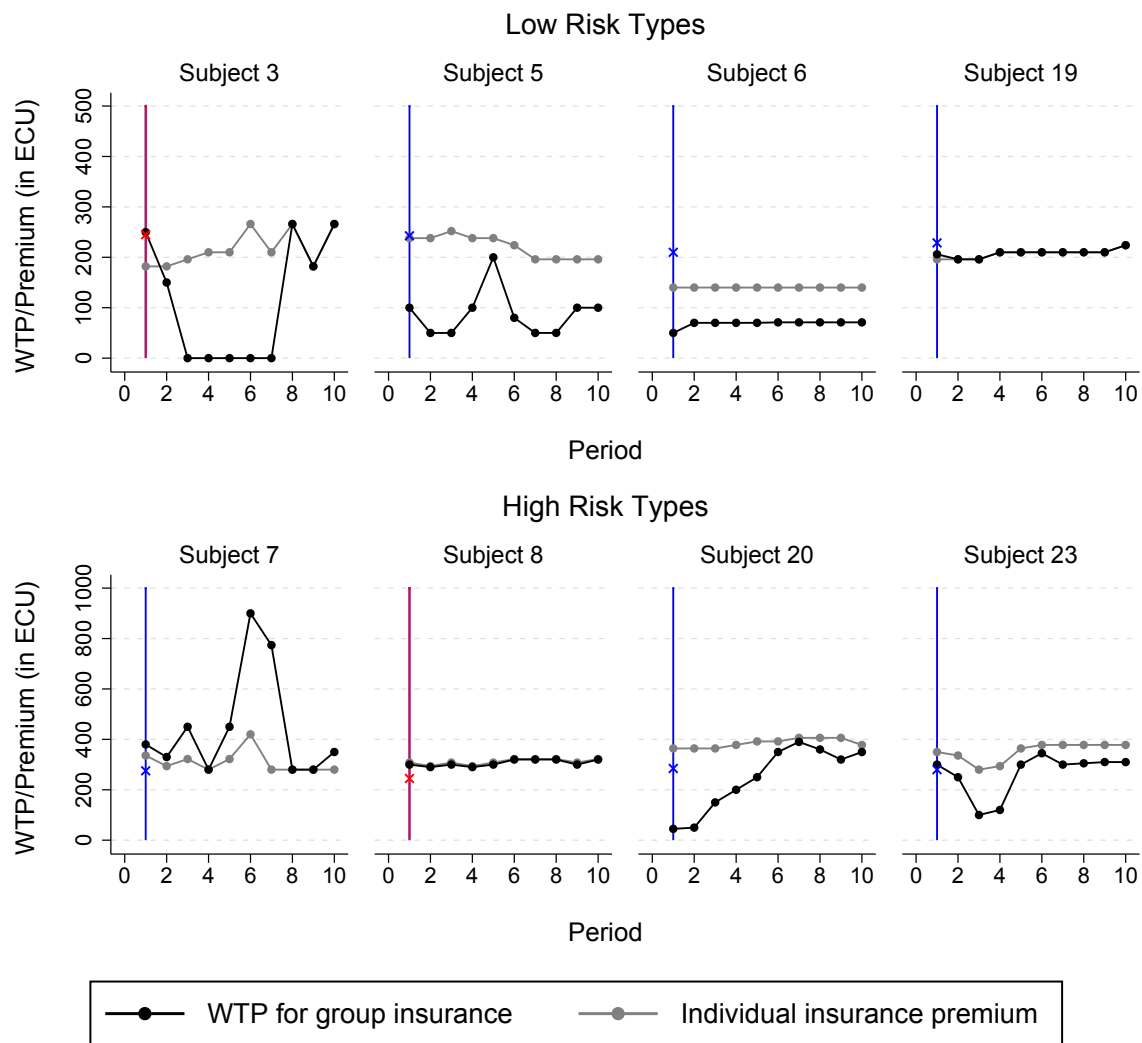


FIGURE A7. WTP DYNAMICS OF SOCIETY 1 (FP CONDITION)

Notes: Red (blue) vertical lines indicate periods with a mixed group insurance in which the subject (does not) participate(s). Red crosses indicate a subject's group insurance premium. Blue crosses indicate a subject's hypothetical group insurance premium, i.e. the group insurance premium that would have had resulted if the subject had participated in the group insurance.

B Theoretical Predictions: Additional Derivations

B.1 Utility functions

- Individual insurance:

$$\begin{aligned}
U_i^I(e_i) &= y - c(e_i) - P_i^I(e_i) \\
&\quad - \alpha_i \max\left(\Pi_{-i}^{gen,I} - \Pi_i^{gen,I}, 0\right) \\
&\quad - \beta_i \max\left(\Pi_i^{gen,I} - \Pi_{-i}^{gen,I}, 0\right) \\
&= y - c(e_i) - (\pi_i + z - a \cdot e_i) \cdot M \\
&\quad - \alpha_i \max\left((\pi_i - \pi_{-i}) \cdot M, 0\right) \\
&\quad - \beta_i \max\left((\pi_{-i} - \pi_i) \cdot M, 0\right) \quad \text{for } i = H, L
\end{aligned}$$

and as $\pi_H > \pi_L$:

$$\begin{aligned}
U_H^I(e_H) &= y - c(e_H) - (\pi_H + z - a \cdot e_H) \cdot M - \alpha_H \cdot (\pi_H - \pi_L) \cdot M \\
U_L^I(e_L) &= y - c(e_L) - (\pi_L + z - a \cdot e_L) \cdot M - \beta_L \cdot (\pi_H - \pi_L) \cdot M
\end{aligned}$$

- Group insurance (GPO condition):

$$\begin{aligned}
U_i^{G,GPO}(e_i) &= y - c(e_i) - P_i^{G,GPO}(e_i) \\
&\quad - \alpha_i \max\left(\Pi_{-i}^{gen,G} - \Pi_i^{gen,G}, 0\right) \\
&\quad - \beta_i \max\left(\Pi_i^{gen,G} - \Pi_{-i}^{gen,G}, 0\right) \quad | \quad \Pi_i^{gen,G} = \Pi_{-i}^{gen,G} \\
&= y - c(e_i) - (\bar{\pi} + z - a \cdot e_i) \cdot M \quad \text{for } i = H, L,
\end{aligned}$$

$$\text{where } \bar{\pi} = \frac{1}{2} \cdot (\pi_H + \pi_L)$$

- Group insurance (FP condition):

$$\begin{aligned}
U_i^{G,FP}(e_i, e_{-i}) &= y - c(e_i) - P_i^{G,FP}(e_i, e_{-i}) \\
&\quad - \alpha_i \max\left(\Pi_{-i}^{gen,G} - \Pi_i^{gen,G}, 0\right) \\
&\quad - \beta_i \max\left(\Pi_i^{gen,G} - \Pi_{-i}^{gen,G}, 0\right) \quad | \quad \Pi_i^{gen,G} = \Pi_{-i}^{gen,G} \\
&= y - c(e_i) - (\bar{\pi} + z - a \cdot \bar{e}) \cdot M \quad \text{for } i = H, L,
\end{aligned}$$

$$\text{where } \bar{\pi} = \frac{1}{2} \cdot (\pi_H + \pi_L) \quad \text{and} \quad \bar{e} = \frac{1}{2} \cdot (e_H + e_L)$$

B.2 Optimal Effort Choices

- Individual insurance:

– Maximization problem:

$$\max_{e_i} U_i^I(e_i) \quad \text{for } i = H, L$$

- First order condition:

$$\begin{aligned}\frac{\partial U_i^I(e_i)}{\partial e_i} &= -c'(e_i) + a \cdot M \\ c'(e_i^*) &= a \cdot M \quad \Rightarrow \quad e_H^* = e_L^* = e^*\end{aligned}$$

An interior solution requires: $c'(0) < a \cdot M < c'(1)$.

- Second order condition:

$$\frac{\partial^2 U_i^I(e_i)}{\partial e_i^2} = -c''(e_i) < 0 \quad (\text{due to convexity})$$

- Group insurance (GPO condition):

- Maximization problem:

$$\max_{e_i} U_i^{G,GPO}(e_i) \quad \text{for } i = H, L$$

- First order condition:

$$\begin{aligned}\frac{\partial U_i^{G,GPO}(e_i)}{\partial e_i} &= -c'(e_i) + a \cdot M \\ c'(e_i^*) &= a \cdot M \quad \Rightarrow \quad e_H^* = e_L^* = e^*\end{aligned}$$

Again, an interior solution requires: $c'(0) < a \cdot M < c'(1)$.

- Hence, in the GPO condition, optimal effort under group insurance is identical to optimal effort under individual insurance.

- Group insurance (FP condition):

- Maximization problem:

$$\max_{e_i} U_i^{G,FP}(e_i, e_{-i}) \quad \text{for } i = H, L$$

- First order condition:

$$\begin{aligned}\frac{\partial U_i^{G,FP}(e_i, e_{-i})}{\partial e_i} &= -c'(e_i) + \frac{1}{2} \cdot a \cdot M \\ c'(e_i^o) &= \frac{1}{2} \cdot a \cdot M \quad \Rightarrow \quad e_H^o = e_L^o = e^o < e^*\end{aligned}$$

An interior solution requires: $c'(0) < \frac{1}{2} \cdot a \cdot M < c'(1)$.

- Second order condition:

$$\frac{\partial^2 U_i^{G,FP}(e_i, e_{-i})}{\partial e_i^2} = -c''(e_i) < 0 \quad (\text{due to convexity})$$

- In the FP condition, optimal effort under group insurance is smaller than optimal effort under individual insurance. Marginal benefits of effort are reduced by the factor $\frac{1}{2}$ because benefits of effort are split equally among both types.

B.3 Optimal Insurance Choices

Benchmark case: No social preferences ($\alpha_i = \beta_i = 0$)

- GPO condition:

- H -type individual prefers group insurance:

$$\begin{aligned} U_H^{G,GPO}(e^*) &> U_H^I(e^*) \\ y - c(e^*) - (\bar{\pi} - a \cdot e^*) \cdot M &> y - c(e^*) - (\pi_H - a \cdot e^*) \cdot M \\ \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M &< \pi_H \cdot M \\ \frac{1}{2} \cdot (\pi_L - \pi_H) \cdot M &< 0, \end{aligned}$$

which always holds true for all $M > 0$, since $(\pi_L - \pi_H) < 0$.

- L -type individual prefers individual insurance:

$$\begin{aligned} U_L^I(e^*) &> U_L^{G,GPO}(e^*) \\ y - c(e^*) - (\pi_L - a \cdot e^*) \cdot M &> y - c(e^*) - (\bar{\pi} - a \cdot e^*) \cdot M \\ \pi_L \cdot M &< \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M \\ 0 &< \frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M, \end{aligned}$$

which always holds true for all $M > 0$, since $(\pi_H - \pi_L) > 0$.

- Since the participation constraint for the L -type individual is violated, group insurance does not exist.

- FP condition:

- H -type individual will prefer group insurance if

$$\begin{aligned} U_H^I(e^*) &\leq U_H^{G,FP}(e^o, e^o) \\ \underbrace{\frac{1}{2} \cdot (\pi_L - \pi_H) \cdot M}_{<0} + \underbrace{(e^* - e^o) \cdot a \cdot M}_{>0} &\leq \underbrace{c(e^*) - c(e^o)}_{>0} \end{aligned}$$

- L -type individual will prefer individual insurance if

$$\begin{aligned} U_L^I(e^*) &> U_L^{G,FP}(e^o, e^o) \\ \underbrace{\frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M}_{>0} + \underbrace{(e^* - e^o) \cdot a \cdot M}_{>0} &> \underbrace{c(e^*) - c(e^o)}_{>0} \\ a \cdot M &> \frac{c(e^*) - c(e^o)}{e^* - e^o} \end{aligned}$$

Using the mean value theorem ($c(\cdot)$ cont.), we have

$$a \cdot M > \frac{c(e^*) - c(e^o)}{e^* - e^o} = c'(\xi), \quad \xi \in (e^o, e^*).$$

This condition always holds for interior solutions because

$$\begin{aligned} e^o < e^* \text{ and } \frac{1}{2} \cdot a \cdot M = c'(e^o) < c'(e^*) = a \cdot M \\ \Rightarrow \frac{1}{2} \cdot a \cdot M < c'(\xi) < a \cdot M, \quad \xi \in (e^o, e^*), \end{aligned}$$

if $c'(\cdot)$ is continuous and $c''(\cdot) > 0$. It may be violated for corner solutions because then $c'(e^*) > a \cdot M$.

- Since the participation constraint for the L -type individual is violated, group insurance does not exist.

Case: Social Preferences ($\alpha_i \geq \beta_i > 0$, $\beta_i < 1$)

- GPO condition:

- H -type individual prefers group insurance:

$$\begin{aligned} U_H^{G,GPO}(e^*) &> U_H^I(e^*) \\ y - c(e^*) - (\bar{\pi} + z - a \cdot e^*) \cdot M &> y - c(e^*) - (\pi_H + z - a \cdot e^*) \cdot M \\ &\quad - \alpha_H \cdot (\pi_H - \pi_L) \cdot M \\ \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M &< \pi_H \cdot M + \alpha_H \cdot (\pi_H - \pi_L) \cdot M \\ -\frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M &< \alpha_H \cdot (\pi_H - \pi_L) \cdot M \\ -\frac{1}{2} &< \alpha_H, \end{aligned}$$

which always holds true, since $\alpha_H > 0$.

- L -type individual will prefer individual insurance if

$$\begin{aligned} U_L^I(e^*) &> U_L^{G,GPO}(e^*) \\ y - c(e^*) - (\pi_L + z - a \cdot e^*) \cdot M \\ &\quad - \beta_L \cdot (\pi_H - \pi_L) \cdot M > y - c(e^*) - (\bar{\pi} + z - a \cdot e^*) \cdot M \\ \pi_L \cdot M + \beta_L \cdot (\pi_H - \pi_L) \cdot M &< \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M \\ \beta_L \cdot (\pi_H - \pi_L) \cdot M &< \frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M \\ \beta_L &< \frac{1}{2} \end{aligned}$$

- Hence, there are two cases:

- * $\beta_L < \frac{1}{2}$: Group insurance does not exist because the participation constraint for the L -type individual is violated.
- * $\beta_L \geq \frac{1}{2}$: Group insurance exists because the L -type individual is sufficiently inequity averse with respect to genetically caused income differences.

- FP condition:

- H -type individual will prefer group insurance if

$$U_H^{G,FP}(e^o, e^o) \geq U_H^I(e^*)$$

$$y - c(e^o) - (\bar{\pi} + z - a \cdot e^o) \cdot M \geq y - c(e^*) - (\pi_H + z - a \cdot e^*) \cdot M - \alpha_H \cdot (\pi_H - \pi_L) \cdot M$$

$$[a \cdot e^o \cdot M - c(e^o)] - \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M \geq [a \cdot e^* \cdot M - c(e^*)] - \pi_H \cdot M - \alpha_H \cdot (\pi_H - \pi_L) \cdot M$$

$$\begin{aligned} \frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M + \alpha_H \cdot (\pi_H - \pi_L) \cdot M &\geq [a \cdot e^* \cdot M - c(e^*)] \\ &\quad - [a \cdot e^o \cdot M - c(e^o)] \\ \alpha_H &\geq -\frac{1}{2} + \kappa(e^*, e^o), \end{aligned}$$

$$\text{where } \kappa(e^*, e^o) = \frac{[a \cdot e^* \cdot M - c(e^*)] - [a \cdot e^o \cdot M - c(e^o)]}{(\pi_H - \pi_L) \cdot M}.$$

- L -type individual will prefer individual insurance if

$$U_L^{G,FP}(e^o, e^o) \geq U_L^I(e^*)$$

$$y - c(e^o) - (\bar{\pi} + z - a \cdot e^o) \cdot M \geq y - c(e^*) - (\pi_L + z - a \cdot e^*) \cdot M - \beta_L \cdot (\pi_H - \pi_L) \cdot M$$

$$[a \cdot e^o \cdot M - c(e^o)] - \frac{1}{2} \cdot (\pi_H + \pi_L) \cdot M \geq [a \cdot e^* \cdot M - c(e^*)] - \pi_L \cdot M - \beta_L \cdot (\pi_H - \pi_L) \cdot M$$

$$\begin{aligned} -\frac{1}{2} \cdot (\pi_H - \pi_L) \cdot M + \beta_L \cdot (\pi_H - \pi_L) \cdot M &\geq [a \cdot e^* \cdot M - c(e^*)] \\ &\quad - [a \cdot e^o \cdot M - c(e^o)] \\ \beta_L &\geq \frac{1}{2} + \kappa(e^*, e^o). \end{aligned}$$

- We have that $\kappa(e^*, e^o) > 0$ because $f(e_i) = a \cdot e_i \cdot M - c(e_i)$ is maximized at e^* and $(\pi_H - \pi_L) \cdot M > 0$. That is, $\kappa(e^*, e^o)$ represents a penalty term that quantifies the efficiency loss resulting from free-riding in the FP condition.
- As $\beta_L < 1$ by assumption, the L -type individual is only willing to participate in group insurance, if $\kappa(e^*, e^o) < \frac{1}{2}$. Note that in this case the participation constraint for the H -type individual is always fulfilled.
- Two cases:
 - * $\beta_L < \frac{1}{2} + \kappa(e^*, e^o)$: Group insurance does not exist because the participation constraint for group insurance is violated for L -type individual.
 - * $\beta_L \geq \frac{1}{2} + \kappa(e^*, e^o)$: Group insurance exists because the L -type individual is sufficiently inequity averse with respect to genetically caused income differences.

C Instructions

On the following pages, you find the instructions for the experiment:

D.1 Instructions FP Condition (German Version)

D.2 Instructions FP Condition (English Translation)

D.3 Instructions GPO Condition (German Version)

D.4 Instructions GPO Condition (English Translation)

ANLEITUNG ZUM EXPERIMENT

Herzlichen Dank für Ihre Teilnahme am Experiment. Bitte lesen Sie die folgenden Informationen aufmerksam durch. Falls Sie Fragen zu den Instruktionen haben, heben Sie bitte die Hand. Wir werden dann zu Ihrer Kabine kommen und Ihnen die Fragen beantworten. Bitte sprechen Sie bis zum Ende des Experiments nicht mehr mit anderen Teilnehmern.

Für Ihr rechtzeitiges Erscheinen erhalten Sie 10 Franken. Während des Experiments können Sie weiteres Geld verdienen. Die Höhe Ihres Verdienstes hängt von Ihren Entscheidungen und den Entscheidungen anderer Teilnehmer ab. Sie haben ausserdem die Möglichkeit, einen Gutschein für einen Gesundheitspräventionskurs beim Hochschulsportverein (ASVZ) zu gewinnen. Alle Entscheidungen werden anonym getroffen, d. h. keiner der anderen Teilnehmer erfährt Ihre Identität. Auch die Auszahlung am Ende des Experiments erfolgt anonym, d. h. kein anderer Teilnehmer erhält über Ihre Auszahlung Bescheid. Der Verdienst während des Experiments wird in ECU (=Experimental Currency Unit) angegeben:

$$20 \text{ ECU} = 1 \text{ Franken.}$$

Das Experiment besteht aus **zwei Teilen**:

- Im **ersten** Teil des Experiments treffen Sie über mehrere Perioden hinweg dieselbe Abfolge an Entscheidungen. Zum Ende des Experiments wird **eine dieser Perioden zufällig** ausgewählt und bestimmt Ihren Verdienst aus diesem Teil des Experiments.
- Im **zweiten** Teil des Experiments sehen Sie sich nacheinander verschiedenen Situationen gegenüber, in denen Sie eine oder aber auch mehrere Entscheidungen treffen. Zum Ende des Experiments wird **eine dieser Situationen zufällig** ausgewählt und bestimmt Ihren Verdienst aus diesem Teil des Experiments.

Im Anschluss an das Experiment bitten wir Sie noch einige Fragen zu beantworten. Auf den folgenden Seiten erklären wir den genauen Ablauf des Experiments.

Teil 1

Allgemeine Informationen:

- Teil 1 des Experiments besteht aus 10 Perioden. Innerhalb jeder dieser 10 Perioden treffen Sie dieselbe Abfolge an Entscheidungen.
- In dem Experiment erhalten Sie in jeder Periode eine **Anfangsausstattung** von 1000 ECU und sehen sich dem Risiko ausgesetzt, zu erkranken. Wenn Sie erkranken, führt dies zu **Behandlungskosten** von 700 ECU.
- Ihr Gesamtrisiko zu erkranken setzt sich aus zwei Komponenten zusammen: Einer genetischen Komponente und einer Verhaltenskomponente. *Im Folgenden werden wir einfach von **genetischem Risiko** und **Verhaltensrisiko** sprechen.* Ihr genetisches Risiko, d. h. Ihre angeborene Wahrscheinlichkeit zu erkranken, ist entweder niedrig oder hoch. Ihr genetisches Risiko wird Ihnen zufällig zugewiesen und ändert sich während des Experiments nicht. Ihr genetisches Risiko können Sie im Experiment nicht beeinflussen. Ihr ursprüngliches Verhaltensrisiko, d. h. Ihre Wahrscheinlichkeit aufgrund Ihres Verhaltens zu erkranken, beträgt 20%. Ihr Verhaltensrisiko können Sie im Experiment durch Gesundheitsprävention beeinflussen. Ihr Gesamtrisiko zu erkranken ergibt sich aus der Summe von genetischem Risiko und Verhaltensrisiko. Die beiden Komponenten und das resultierende Gesamtrisiko zu erkranken werden Ihnen zu Beginn des Experiments auf Ihrem Bildschirm angezeigt. Diese Informationen sind für andere Experimententeilnehmer nicht sichtbar.

Niedriges Risiko	
Risikokomponente	Wahrscheinlichkeit zu erkranken
Genetisches Risiko	20%
Verhaltensrisiko	20%
Gesamtrisiko	40%

Hohes Risiko	
Risikokomponente	Wahrscheinlichkeit zu erkranken
Genetisches Risiko	40%
Verhaltensrisiko	20%
Gesamtrisiko	60%

- Zu Beginn von Teil 1 werden Sie ausserdem zufällig einer Gesellschaft zugeordnet. Jede Gesellschaft setzt sich aus 8 Teilnehmern zusammen, von denen 4 ein niedriges und 4 ein hohes genetisches Risiko zu erkranken haben. Die Zusammensetzung Ihrer Gesellschaft ändert sich während des Experiments nicht.
- In jeder Periode können Sie grundsätzlich zwei Arten von Entscheidungen treffen: Zum einen eine Gesundheitspräventionsentscheidung, die der Reduktion Ihres Verhaltensrisikos dienen kann, und zum anderen eine Krankenversicherungsentscheidung.

Ablauf einer Periode:

1. Jeder Teilnehmer erhält eine Anfangsausstattung in Höhe von 1000 ECU und sieht sein genetisches Risiko zu erkranken. Jeder Teilnehmer wählt zwischen 11 Leveln, wie viel Gesundheitsprävention er zur Reduktion seines Verhaltensrisikos betreiben möchte. Je höher das Level an Gesundheitsprävention, desto geringer das Verhaltensrisiko zu erkranken und desto höher die Wahrscheinlichkeit, einen Gutschein für ein Präventionsangebot des ASVZs zu erhalten. Bei diesem Präventionsangebot handelt es sich um einen „Functional Movement Screen“ (FMS). Ziel dieses Screens ist es Bewegungsabläufe zu verbessern, um so einer Abnutzung und Schädigung des Bewegungsapparates vorzubeugen. Weitere Informationen zu diesem Screen finden Sie im Abschnitt „Gutscheine für den Functional Movement Screen“.

Die mit den 11 Leveln verbundenen Reduktionen im Verhaltensrisiko, die Wahrscheinlichkeiten den Gutschein für den FMS zu erhalten und die Kosten für Gesundheitsprävention sehen sie in folgender Tabelle:

Level an Gesundheitsprävention	Reduktion des Verhaltensrisikos (in Prozentpunkten)	Wahrscheinlichkeit, den Gutschein für den FMS zu erhalten (in Prozent)	Kosten für Gesundheitsprävention (in ECU)
0	0	0	0
1	2	1	8
2	4	2.5	18
3	6	4.5	30
4	8	7	46
5	10	10	66
6	12	13.5	90
7	14	17.5	118
8	16	22	150
9	18	27	186
10	20	33	226

Das heisst, wenn Sie z. B. ein hohes genetisches Risiko zu erkranken (40%) haben und das Präventionslevel 6 zur Reduktion Ihres Verhaltensrisikos wählen, beträgt Ihr Gesamtrisiko zu erkranken nach Gesundheitsprävention $40\% + 20\% - 12\% = 48\%$. Durch die Gesundheitsprävention erhalten Sie den Gutschein für den FMS beim ASVZ mit einer Wahrscheinlichkeit von 13.5%. Die Kosten für Ihre Gesundheitsprävention belaufen sich auf 90 ECU.

2. Jeder Teilnehmer trifft seine Krankenversicherungsentscheidung. Grundsätzlich gibt es zwei verschiedene Möglichkeiten der Krankenversicherung: entweder eine Gruppenversicherung oder eine individuelle Versicherung. Bei beiden Versicherungen werden im Krankheitsfall die gesamten Behandlungskosten von der Versicherung übernommen. Wenn Sie die Gruppenversicherung haben, dann sind Sie gemeinsam mit anderen Teilnehmern aus Ihrer Gesellschaft versichert. Die Krankenversicherungsprämie wird dann durch Sie **und** die anderen Teilnehmer in der Gruppenversicherung beeinflusst (s. Abschnitt „Prämienberechnung“). Wenn Sie die individuelle Versicherung haben, sind Sie unabhängig von den anderen Gesellschaftsmitgliedern versichert, d. h. in diesem Fall wird die Krankenversicherungsprämie nur durch Sie beeinflusst. Sie können auch unversichert bleiben. Wenn Sie nicht versichert sind, werden Ihnen im Krankheitsfall Ihre Behandlungskosten von der Anfangsausstattung abgezogen.

Die Krankenversicherungsentscheidung in einer Periode involviert zwei Entscheidungen, die Sie gleichzeitig treffen:

- (i) Jeder Teilnehmer entscheidet, welche Versicherungsprämie er maximal zu zahlen bereit ist, um in der **Gruppenkrankenversicherung** zu sein. Die Gruppenversicherungsprämie ist für alle Gruppenversicherten gleich hoch. Die Zahlungsbereitschaft bestimmt, ob der Teilnehmer über die Gruppenversicherung versichert ist oder nicht. Um am Ende der Periode gruppenversichert zu sein, muss die Zahlungsbereitschaft mindestens der Versicherungsprämie entsprechen, die sich ergibt, wenn der Teilnehmer gruppenversichert wäre. Daher kann es sein, dass ein Teilnehmer nicht gruppenversichert ist, obwohl seine Zahlungsbereitschaft die Gruppenversicherungsprämie übersteigt. Dies wäre z. B. der Fall, wenn die Gruppenversicherungsprämie nach Berücksichtigung des Teilnehmers so stark ansteigen würde, dass diese über der Zahlungsbereitschaft des Teilnehmers liegen würde. Jeder Teilnehmer kann als Zahlungsbereitschaft maximal seine Anfangsausstattung abzüglich seiner Präventionsinvestition (gemäß seines gewählten Levels für Gesundheitsprävention) wählen.
 - (ii) Jeder Teilnehmer entscheidet, ob er sein Krankheitsrisiko über die **individuelle Krankenversicherung** abdecken möchte oder **unversichert** bleiben möchte, wenn er aufgrund seiner maximalen Zahlungsbereitschaft für die Gruppenkrankenversicherung nicht gruppenversichert sein sollte.
3. Die Prämie der Gruppenversicherung wird berechnet. Eine Gruppenversicherung wird angeboten, wenn diese im Erwartungswert keinen Verlust macht, d. h. die Summe der Prämien nicht kleiner ist als die erwarteten Behandlungskosten aller Mitglieder einer Gruppenversicherung. Je nach Zahlungsbereitschaften innerhalb einer Gesellschaft kann die Anzahl der Teilnehmer, die gemeinsam in der Gruppenversicherung versichert sind, variieren. So kann es sein, dass z. B. 3 Teilnehmer einer Gesellschaft in der Gruppenversicherung versichert sind und die anderen Teilnehmer der Gesellschaft individuell oder

nicht versichert sind. Wenn keine Gruppenversicherung angeboten werden kann, da im Erwartungswert Verluste entstehen, ist jeder Teilnehmer gemäss seiner Entscheidung entweder individuell versichert oder nicht versichert.

4. Für jeden Teilnehmer entscheidet sich zufällig, ob er in der Periode erkrankt oder nicht. Dabei richtet sich seine Wahrscheinlichkeit zu erkranken nach seinem aktuellen Gesamtrisiko zu erkranken, d. h. seinem Gesamtrisiko nach Reduktion des Verhaltensrisikos.
5. Am Ende der Periode erhält jeder Teilnehmer Informationen zur Gruppenversicherung: Anzahl der Mitglieder insgesamt, Anzahl der Mitglieder mit hohem genetischen Risiko zu erkranken und Versicherungsprämie. Darüber hinaus sieht jeder Teilnehmer seinen Versicherungsstatus (gruppenversichert, individuell versichert, nicht versichert), seine Versicherungsprämie, seinen Krankheitsstatus (erkrankt, nicht erkrankt) und seinen Gewinn.

Ihr Gewinn in einer Periode:

Zu unterscheiden sind vier Fälle:

- Sie sind **gruppenversichert** (Zahlungsbereitschaft \geq Gruppenversicherungsprämie):

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} - \text{Ihre Gruppenversicherungsprämie},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und Ihre Gruppenversicherungsprämie, währenddessen die Gruppenversicherung im Krankheitsfall Ihre gesamten Behandlungskosten übernimmt.

- Sie sind **individuell versichert** (Zahlungsbereitschaft $<$ Gruppenversicherungsprämie, wenn Sie gruppenversichert wären):

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} - \text{Ihre individuelle Versicherungsprämie},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und Ihre individuelle Versicherungsprämie, währenddessen die individuelle Versicherung im Krankheitsfall Ihre gesamten Behandlungskosten übernimmt.

- Sie sind **nicht versichert** (Zahlungsbereitschaft < Gruppenversicherungsprämie, wenn Sie gruppenversichert wären):

- ... und **erkrankt**:

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} \\ - \text{Ihre Behandlungskosten}$$

- ... und **nicht erkrankt**:

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und im Krankheitsfall Ihre Behandlungskosten. Eine Versicherungsprämie entfällt.

Prämienberechnung:

- **Individuelle Versicherung:**

$$\text{Ihre Prämie} = \text{Behandlungskosten} \times \text{Ihr Gesamtrisiko nach Gesundheitsprävention zu erkranken (in Prozent)} / 100 ,$$

d. h. die individuelle Versicherungsprämie entspricht Ihren erwarteten Behandlungskosten nach Gesundheitsprävention (erwartete Behandlungskosten = Behandlungskosten x aktuelle Wahrscheinlichkeit zu erkranken (in Prozent)/100).

- **Gruppenversicherung:**

$$\text{Ihre Prämie} = \text{Behandlungskosten} \times \text{durchschnittliches Gesamtrisiko der Mitglieder der Gruppenversicherung nach Gesundheitsprävention zu erkranken (in Prozent)} / 100,$$

d. h. die Gruppenversicherungsprämie entspricht den erwarteten Behandlungskosten des durchschnittlichen Gruppenversicherten nach Gesundheitsprävention. Im Gegensatz zur individuellen Versicherungsprämie hängt die Gruppenversicherungsprämie nicht nur von Ihrem genetischen Krankheitsrisiko und Ihrer Gesundheitsprävention ab, sondern auch von den genetischen Krankheitsrisiken und der Gesundheitsprävention der anderen Gruppenversicherten.

Je nach Zahlungsbereitschaften innerhalb einer Gesellschaft kann es mehrere mögliche Gruppenversicherungen in einer Gesellschaft geben, die sich in Bezug auf den Versichertenpool und die Prämie unterscheiden. In diesem Fall wird zunächst die Gruppenversicherung mit der grösstmöglichen Anzahl an Gruppenversicherten gewählt. Sollten dann immer noch mehrere Gruppenversicherungen mit gleicher Versichertenzahl exi-

stieren, so wird innerhalb dieser Gruppenversicherungen die Gruppenversicherung mit der grösstmöglichen Anzahl an Gruppenversicherten mit hohem genetischem Risiko zu erkranken gewählt. Sollten dann immer noch mehrere Gruppenversicherungen mit gleicher Versichertenzahl und gleicher Anzahl an Gruppenversicherten mit hohem genetischem Risiko zu erkranken existieren, so wird eine dieser Gruppenversicherungen zufällig ausgewählt.

Gutscheine für den Functional Movement Screen:

Der „Functional Movement Screen“ ist ein standardisiertes Testverfahren aus Amerika, welches zur Erfassung ineffizienter und schädlicher Bewegungsmuster eingesetzt wird. Hauptziel dieses Screens ist es Bewegungsschwächen zu erkennen und Bewegungsabläufe zu verbessern, um so einer Abnutzung und Schädigung des Bewegungsapparates vorzubeugen. Langfristig sind sowohl die Abnutzung als auch die Schädigung des Bewegungsapparates mit starken Schmerzen verbunden und können zu hohen Behandlungskosten führen (z. B. durch die Behandlung bei einem Orthopäden oder Physiotherapeuten).

Der „Functional Movement Screen“ des ASVZs wird durch ausgebildete Physiotherapeuten angeboten. Er umfasst sieben einfache Bewegungstests zur Quantifizierung von Beweglichkeit, Stabilität und Bewegungsmustern. Die Kosten für diesen Screen belaufen sich auf 60 Franken. Der Zeitaufwand für diesen Screen beträgt 30 Minuten. Termine für diesen Screen sind individuell vereinbar. Weitere Informationen zu diesem Präventionsangebot des ASVZs finden Sie auf der Seite des ASVZs oder erhalten Sie unter der Nummer +41 44 251 60 51.

Wenn Sie den Gutschein erhalten (gemäss der Wahrscheinlichkeit des von Ihnen gewählten Levels der Gesundheitsprävention), deckt der Gutschein die gesamten Kosten dieses Screens.

Teil 2

Informationen zu den verschiedenen Situationen, in denen Sie Entscheidungen treffen, erhalten Sie nach Teil 1 des Experiments auf Ihrem Bildschirm.

INSTRUCTIONS FOR THE EXPERIMENT

Thank you for your participation in this experiment. Please read the following information carefully. If you have any questions concerning the instructions, please raise your hand. Then, we will come to your cabin to answer your questions. Please do not talk to other participants anymore until the end of the experiment.

For showing up on time you will receive 10 Swiss Francs. Throughout the experiment you can earn more money. The height of your remuneration depends on your decisions and the decisions of other participants. In addition, you have the opportunity to win a voucher for a health prevention course which is offered by the student sport association of the university (ASVZ). All decisions are made anonymously, i. e. none of the other participants learns about your identity. Also the final payoff at the end of the experiment is made anonymously, i. e. none of the other participants is informed about your final payoff. Throughout the experiment the profits are indicated in ECU (= Experimental Currency Unit):

$$20 \text{ ECU} = 1 \text{ Swiss Franc.}$$

The experiment consists of **two parts**:

- In the **first** part of the experiment you will make the same sequence of decisions over multiple periods. At the end of the experiment **one of these periods is randomly** selected and determines your payoff in this part of the experiment.
- In the **second** part of the experiment you will face several distinct situations, in which you have to make one or several decisions. At the end of the experiment **one of these situations is randomly** selected and determines your payoff in this part of the experiment.

After the experiment we will still ask you to answer some questions. On the following pages we will explain the exact procedure of this experiment.

Part 1

General Information:

- Part 1 of the experiment comprises 10 periods. In each of these 10 periods you make the same sequence of decisions.
- In the experiment, in each period you receive an **initial endowment** of 1000 ECU and you face the risk of illness. If you turn ill, this leads to **treatment costs** of 700 ECU.
- Your total risk of illness is composed of two components: a genetic component and a behavioral component. *In the following we will simply refer to these components as **genetic risk** and **behavioral risk**.* Your genetic risk, i.e. your innate probability to turn ill, is either low or high. Your genetic risk of illness will be randomly assigned to you and does not change throughout the experiment. Your genetic risk of illness can not be influenced by you in the experiment. Your initial behavioral risk, i.e. your probability to turn ill because of your behavior, amounts to 20%. Your behavioral risk of illness can be influenced by you in the experiment through the means of health prevention. Your total risk of illness is the sum of the genetic risk of illness and the behavioral risk of illness. Both components and the resulting total risk of illness are shown to you on your computer screen at the beginning of the experiment. This information is private and not observed by other participants in this experiment.

Low risk	
Risk component	Probability to turn ill
Genetic risk	20%
Behavioral risk	20%
Total risk	40%

High risk	
Risk component	Probability to turn ill
Genetic risk	40%
Behavioral risk	20%
Total risk	60%

- At the beginning of part 1 you are also randomly assigned to a society. Each society consists of 8 participants, 4 of which have a high genetic risk of illness and 4 of which have a low genetic risk of illness. The composition of your society does not change throughout the experiment.
- In each period you can principally make two types of decisions: On the one hand, a health prevention decision which may serve to reduce your behavioral risk of illness, and on the other hand, a health insurance decision.

Sequence of Events in a Period:

1. Each participant receives an initial endowment of 1000 ECU and observes her genetic risk of illness. Each participant chooses among 11 levels how much health prevention she wants to do in order to reduce her behavioral risk of illness. The higher the level of health prevention, the lower the behavioral risk of illness and the higher the probability to obtain a voucher for a health preventive offer of the ASVZ. This offer comprises a ‘Functional Movement Screen’ (FMS). The goal of this screen is to improve the course of motion in order to prevent degeneration and damage of the musculoskeletal system. You will find more information about this screen in the section ‘Vouchers for the Functional Movement Screen’.

In the following table, you see the reduction of behavioral risk, the probability to obtain a voucher for the FMS, and the costs of prevention for each of the 11 corresponding health prevention levels:

Level of health prevention	Reduction of behavioral risk (in percentage points)	Probability to obtain the voucher for the FMS (in percent)	Costs of health prevention (in ECU)
0	0	0	0
1	2	1	8
2	4	2.5	18
3	6	4.5	30
4	8	7	46
5	10	10	66
6	12	13.5	90
7	14	17.5	118
8	16	22	150
9	18	27	186
10	20	33	226

That is, if you, for example, have a high genetic risk of illness (40%) and choose the prevention level 6 to reduce your behavioral risk of illness, then your total risk of illness after health prevention amounts to $40\% + 20\% - 12\% = 48\%$. Due to the health prevention you obtain the voucher for the FMS at the ASVZ with a probability of 13.5%. The costs of your health prevention amount to 90 ECU.

2. Each participant makes her health insurance decision. In principle, there exists two possibilities for a health insurance: either a group insurance or an individual insurance.

Both types of insurance will pay the full treatment costs in the case of illness. If you have the group insurance, then you will be jointly insured with other participants of your society. The insurance premium will then be influenced by you **and** other participants in the group insurance (cf. section ‘Premium Calculation’). If you have the individual insurance, you will be insured independently of the other members of your society, i. e. in this case the insurance premium will only be influenced by you. You can also remain uninsured. If you are not insured, the whole treatment costs will be subtracted from your initial endowment in the case of illness.

The health insurance decision in a given period involves two choices which are made simultaneously:

- (i) Each participant decides on the insurance premium that she would be willing to pay at most in order to become a member of the **group insurance**. The group insurance premium is for all members of the group insurance identical. The willingness to pay determines whether the participant is insured by the group insurance or not. To be group insured at the end of the period, the willingness to pay has to equal at least the insurance premium that would result, if the participant was included in the group insurance. Therefore, it may be that a participant is not group insured, even if her willingness to pay exceeds the group insurance premium. This would be, for example, the case, if upon consideration of the participant the group insurance premium increased to the extent that it lay above the participant’s willingness to pay. Each participant can only indicate a willingness to pay which equals at most her initial endowment minus her investments in health prevention (according to her chosen level of health prevention).
 - (ii) For the case that a participant would not be group insured because of her maximum willingness to pay for group insurance, she decides whether she wants to insure her risk of illness by an **individual insurance** or whether she wants to remain **uninsured**.
3. The premium of the group insurance is calculated. A group insurance is provided, if this insurance will not make any losses in expectation, i. e. if the sum of the group insurance premiums will not be smaller than the expected treatment costs of all group insurance members. Depending on the willingnesses to pay in a society, the number of participants who are jointly insured by the group insurance may vary. It may be, for example, that three participants of a society are group insured, while the other participants of this society are individually insured or not insured. If no group insurance is provided, as the group insurance would make losses in expectation, each participant is either individually insured or not insured according to her decision.
 4. For each participant it is randomly determined whether she turns ill in the period or not. The probability to turn ill corresponds to her actual total risk of illness, i. e. her

total risk of illness after reduction of the behavioral risk of illness.

5. At the end of the period, each participant obtains some information about the group insurance: number of total members, number of members with high genetic risk of illness, and insurance premium. Moreover, each participant observes her insurance status (group insured, individually insured, not insured), her insurance premium, her sickness status (sick, not sick), and her profit.

Your Profit in a Period:

There are four cases which need to be distinguished:

- You are **group insured** (willingness to pay \geq group insurance premium):

your profit = your initial endowment - your costs of health prevention - your group insurance premium,

i.e. you pay your costs of health prevention and your group insurance premium, while the group insurance will cover your total treatment costs in the case of illness.

- You are **individually insured** (willingness to pay $<$ group insurance premium, if you would be included in the group insurance):

your profit = your initial endowment - your costs of health prevention - your individual insurance premium,

i.e. you pay the costs for health prevention and your individual insurance premium, while the individual insurance will cover your total treatment costs in the case of illness.

- You are **not insured** (willingness to pay $<$ group insurance premium, if you would be included in the group insurance):

– ... and **sick**:

your profit = your initial endowment - your costs of health prevention - your treatment costs

– ... and **not sick**:

your profit = your initial endowment - your costs of health prevention,

i.e. you pay your costs for health prevention and, in the case of illness, your treatment costs. An insurance premium does not need to be paid.

Premium Calculation:

- **Individual insurance:**

your premium = treatment costs \times your total risk of illness after health prevention
(in percent)/100 ,

i. e. the individual insurance premium corresponds to your expected treatment costs after health prevention (expected treatment costs = treatment costs \times actual probability to turn ill (in percent)/100).

- **Group insurance:**

your premium = treatment costs \times average total risk of illness of all group insurance members after health prevention (in percent)/100,

i. e. the group insurance premium corresponds to the expected treatment costs of the average group insurance member after health prevention. In contrast to the individual insurance premium, the group insurance premium depends not only on your genetic risk of illness and your health prevention, but also on the genetic risks of illness and the health prevention of the other group insurance members.

Depending on the willingness to pay in a society, there may exist several possible group insurances in a society, which differ with respect to the pool of insured and the premium. In this case, the group insurance with the highest number of group insurance members is selected first. If there still exist several group insurances with the same number of group insurance members, next the group insurance with the highest number of group insurance members with high genetic risk is selected among the remaining ones. If there still exist several group insurances with the same number of group insurance members and the same number of group insurance members with high genetic risk of illness, one of the remaining group insurances is selected at random.

Vouchers for the Functional Movement Screen:

The ‘Functional Movement Screen’ is a standardized test procedure, which was developed in America and is used to detect inefficient and harmful movement patterns. The primary goal of this screen is to detect weaknesses in movement orders and to improve the course of motion in order to prevent degeneration and damage of the musculoskeletal system. In the long run, degeneration as well as damage of the musculoskeletal system causes strong pain and may lead to high treatment costs (e. g. due to the treatment by a orthopedic specialist or a physiotherapist).

The ‘Functional Movement Screen’ at the ASVZ is offered by professionally trained physiotherapists. It comprises seven simple movement tests to quantify mobility, stability and movement patterns. The cost of this screening amount to 60 Swiss Francs. The time required for this screening is 30 minutes. Appointments for this screening can be made individually. More information about this health prevention offer of the ASVZ can be found on the webpage of the ASVZ or is obtained by calling the number +41 44 251 60 51.

If you receive the voucher (according to the probability which is attached to your chosen level of health prevention), this voucher will cover the total cost of this screening.

Part 2

After completion of part 1 of the experiment, you will receive further information about the distinct decision situations that you will be facing on your computer screen.

ANLEITUNG ZUM EXPERIMENT

Herzlichen Dank für Ihre Teilnahme am Experiment. Bitte lesen Sie die folgenden Informationen aufmerksam durch. Falls Sie Fragen zu den Instruktionen haben, heben Sie bitte die Hand. Wir werden dann zu Ihrer Kabine kommen und Ihnen die Fragen beantworten. Bitte sprechen Sie bis zum Ende des Experiments nicht mehr mit anderen Teilnehmern.

Für Ihr rechtzeitiges Erscheinen erhalten Sie 10 Franken. Während des Experiments können Sie weiteres Geld verdienen. Die Höhe Ihres Verdienstes hängt von Ihren Entscheidungen und den Entscheidungen anderer Teilnehmer ab. Sie haben ausserdem die Möglichkeit, einen Gutschein für einen Gesundheitspräventionskurs beim Hochschulsportverein (ASVZ) zu gewinnen. Alle Entscheidungen werden anonym getroffen, d. h. keiner der anderen Teilnehmer erfährt Ihre Identität. Auch die Auszahlung am Ende des Experiments erfolgt anonym, d. h. kein anderer Teilnehmer erhält über Ihre Auszahlung Bescheid. Der Verdienst während des Experiments wird in ECU (=Experimental Currency Unit) angegeben:

$$20 \text{ ECU} = 1 \text{ Franken.}$$

Das Experiment besteht aus **zwei Teilen**:

- Im **ersten** Teil des Experiments treffen Sie über mehrere Perioden hinweg dieselbe Abfolge an Entscheidungen. Zum Ende des Experiments wird **eine dieser Perioden zufällig** ausgewählt und bestimmt Ihren Verdienst aus diesem Teil des Experiments.
- Im **zweiten** Teil des Experiments sehen Sie sich nacheinander verschiedenen Situationen gegenüber, in denen Sie eine oder aber auch mehrere Entscheidungen treffen. Zum Ende des Experiments wird **eine dieser Situationen zufällig** ausgewählt und bestimmt Ihren Verdienst aus diesem Teil des Experiments.

Im Anschluss an das Experiment bitten wir Sie noch einige Fragen zu beantworten. Auf den folgenden Seiten erklären wir den genauen Ablauf des Experiments.

Teil 1

Allgemeine Informationen:

- Teil 1 des Experiments besteht aus 10 Perioden. Innerhalb jeder dieser 10 Perioden treffen Sie dieselbe Abfolge an Entscheidungen.
- In dem Experiment erhalten Sie in jeder Periode eine **Anfangsausstattung** von 1000 ECU und sehen sich dem Risiko ausgesetzt, zu erkranken. Wenn Sie erkranken, führt dies zu **Behandlungskosten** von 700 ECU.
- Ihr Gesamtrisiko zu erkranken setzt sich aus zwei Komponenten zusammen: Einer genetischen Komponente und einer Verhaltenskomponente. *Im Folgenden werden wir einfach von **genetischem Risiko** und **Verhaltensrisiko** sprechen.* Ihr genetisches Risiko, d. h. Ihre angeborene Wahrscheinlichkeit zu erkranken, ist entweder niedrig oder hoch. Ihr genetisches Risiko wird Ihnen zufällig zugewiesen und ändert sich während des Experiments nicht. Ihr genetisches Risiko können Sie im Experiment nicht beeinflussen. Ihr ursprüngliches Verhaltensrisiko, d. h. Ihre Wahrscheinlichkeit aufgrund Ihres Verhaltens zu erkranken, beträgt 20%. Ihr Verhaltensrisiko können Sie im Experiment durch Gesundheitsprävention beeinflussen. Ihr Gesamtrisiko zu erkranken ergibt sich aus der Summe von genetischem Risiko und Verhaltensrisiko. Die beiden Komponenten und das resultierende Gesamtrisiko zu erkranken werden Ihnen zu Beginn des Experiments auf Ihrem Bildschirm angezeigt. Diese Informationen sind für andere Experimententeilnehmer nicht sichtbar.

Niedriges Risiko	
Risikokomponente	Wahrscheinlichkeit zu erkranken
Genetisches Risiko	20%
Verhaltensrisiko	20%
Gesamtrisiko	40%

Hohes Risiko	
Risikokomponente	Wahrscheinlichkeit zu erkranken
Genetisches Risiko	40%
Verhaltensrisiko	20%
Gesamtrisiko	60%

- Zu Beginn von Teil 1 werden Sie ausserdem zufällig einer Gesellschaft zugeordnet. Jede Gesellschaft setzt sich aus 8 Teilnehmern zusammen, von denen 4 ein niedriges und 4 ein hohes genetisches Risiko zu erkranken haben. Die Zusammensetzung Ihrer Gesellschaft ändert sich während des Experiments nicht.
- In jeder Periode können Sie grundsätzlich zwei Arten von Entscheidungen treffen: Zum einen eine Gesundheitspräventionsentscheidung, die der Reduktion Ihres Verhaltensrisikos dienen kann, und zum anderen eine Krankenversicherungsentscheidung.

Ablauf einer Periode:

1. Jeder Teilnehmer erhält eine Anfangsausstattung in Höhe von 1000 ECU und sieht sein genetisches Risiko zu erkranken. Jeder Teilnehmer wählt zwischen 11 Leveln, wie viel Gesundheitsprävention er zur Reduktion seines Verhaltensrisikos betreiben möchte. Je höher das Level an Gesundheitsprävention, desto geringer das Verhaltensrisiko zu erkranken und desto höher die Wahrscheinlichkeit, einen Gutschein für ein Präventionsangebot des ASVZs zu erhalten. Bei diesem Präventionsangebot handelt es sich um einen „Functional Movement Screen“ (FMS). Ziel dieses Screens ist es Bewegungsabläufe zu verbessern, um so einer Abnutzung und Schädigung des Bewegungsapparates vorzubeugen. Weitere Informationen zu diesem Screen finden Sie im Abschnitt „Gutscheine für den Functional Movement Screen“.

Die mit den 11 Leveln verbundenen Reduktionen im Verhaltensrisiko, die Wahrscheinlichkeiten den Gutschein für den FMS zu erhalten und die Kosten für Gesundheitsprävention sehen sie in folgender Tabelle:

Level an Gesundheitsprävention	Reduktion des Verhaltensrisikos (in Prozentpunkten)	Wahrscheinlichkeit, den Gutschein für den FMS zu erhalten (in Prozent)	Kosten für Gesundheitsprävention (in ECU)
0	0	0	0
1	2	1	8
2	4	2.5	18
3	6	4.5	30
4	8	7	46
5	10	10	66
6	12	13.5	90
7	14	17.5	118
8	16	22	150
9	18	27	186
10	20	33	226

Das heisst, wenn Sie z. B. ein hohes genetisches Risiko zu erkranken (40%) haben und das Präventionslevel 6 zur Reduktion Ihres Verhaltensrisikos wählen, beträgt Ihr Gesamtrisiko zu erkranken nach Gesundheitsprävention $40\% + 20\% - 12\% = 48\%$. Durch die Gesundheitsprävention erhalten Sie den Gutschein für den FMS beim ASVZ mit einer Wahrscheinlichkeit von 13.5%. Die Kosten für Ihre Gesundheitsprävention belaufen sich auf 90 ECU.

2. Jeder Teilnehmer trifft seine Krankenversicherungsentscheidung. Grundsätzlich gibt es zwei verschiedene Möglichkeiten der Krankenversicherung: entweder eine Gruppenversicherung oder eine individuelle Versicherung. Bei beiden Versicherungen werden im Krankheitsfall die gesamten Behandlungskosten von der Versicherung übernommen. Wenn Sie die Gruppenversicherung haben, dann sind Sie gemeinsam mit anderen Teilnehmern aus Ihrer Gesellschaft versichert. Die Krankenversicherungsprämie wird dann durch Sie **und** die anderen Teilnehmer in der Gruppenversicherung beeinflusst (s. Abschnitt „Prämienberechnung“). Wenn Sie die individuelle Versicherung haben, sind Sie unabhängig von den anderen Gesellschaftsmitgliedern versichert, d. h. in diesem Fall wird die Krankenversicherungsprämie nur durch Sie beeinflusst. Sie können auch unversichert bleiben. Wenn Sie nicht versichert sind, werden Ihnen im Krankheitsfall Ihre Behandlungskosten von der Anfangsausstattung abgezogen.

Die Krankenversicherungsentscheidung in einer Periode involviert zwei Entscheidungen, die Sie gleichzeitig treffen:

- (i) Jeder Teilnehmer entscheidet, welche Versicherungsprämie er maximal zu zahlen bereit ist, um in der **Gruppenkrankenversicherung** zu sein. Die Gruppenversicherungsprämie setzt sich aus zwei Teilen zusammen: einem Teil, der für alle Gruppenversicherten gleich ist, und einem individuellen Teil, der die Prämienreduktion durch Gesundheitsprävention berücksichtigt:
 - Den erwarteten Behandlungskosten des durchschnittlichen Gruppenversicherten vor Gesundheitsprävention
 - **abzüglich** Ihrer Prämienreduktion durch Gesundheitsprävention.

Die Zahlungsbereitschaft bestimmt, ob der Teilnehmer über die Gruppenversicherung versichert ist oder nicht. Um am Ende der Periode gruppenversichert zu sein, muss die Zahlungsbereitschaft mindestens der Versicherungsprämie entsprechen, die sich insgesamt ergibt, wenn der Teilnehmer gruppenversichert wäre. Daher kann es sein, dass ein Teilnehmer nicht gruppenversichert ist, obwohl seine Zahlungsbereitschaft die gesamte Versicherungsprämie in der Gruppenversicherung übersteigt. Dies wäre z. B. der Fall, wenn die gesamte Gruppenversicherungsprämie nach Berücksichtigung des Teilnehmers so stark ansteigen würde, dass diese über der Zahlungsbereitschaft des Teilnehmers liegen würde. Jeder Teilnehmer kann als Zahlungsbereitschaft maximal seine Anfangsausstattung abzüglich seiner Präventionsinvestition (gemäß seines gewählten Levels für Gesundheitsprävention) wählen.

- (ii) Jeder Teilnehmer entscheidet, ob er sein Krankheitsrisiko über die **individuelle Krankenversicherung** abdecken möchte oder **unversichert** bleiben möchte, wenn er aufgrund seiner maximalen Zahlungsbereitschaft für die Gruppenkrankenversicherung nicht gruppenversichert sein sollte.

3. Die Prämien der Gruppenversicherung werden berechnet. Eine Gruppenversicherung wird angeboten, wenn diese im Erwartungswert keinen Verlust macht, d. h. die Summe der Prämien nicht kleiner ist als die erwarteten Behandlungskosten aller Mitglieder einer Gruppenversicherung. Je nach Zahlungsbereitschaften innerhalb einer Gesellschaft kann die Anzahl der Teilnehmer, die gemeinsam in der Gruppenversicherung versichert sind, variieren. So kann es sein, dass z. B. 3 Teilnehmer einer Gesellschaft in der Gruppenversicherung versichert sind und die anderen Teilnehmer der Gesellschaft individuell oder nicht versichert sind. Wenn keine Gruppenversicherung angeboten werden kann, da im Erwartungswert Verluste entstehen, ist jeder Teilnehmer gemäss seiner Entscheidung entweder individuell versichert oder nicht versichert.
4. Für jeden Teilnehmer entscheidet sich zufällig, ob er in der Periode erkrankt oder nicht. Dabei richtet sich seine Wahrscheinlichkeit zu erkranken nach seinem aktuellen Gesamtrisiko zu erkranken, d. h. seinem Gesamtrisiko nach Reduktion des Verhaltensrisikos.
5. Am Ende der Periode erhält jeder Teilnehmer Informationen zur Gruppenversicherung: Anzahl der Mitglieder insgesamt, Anzahl der Mitglieder mit hohem genetischen Risiko zu erkranken, Versicherungsprämie (vor Berücksichtigung der Prämienreduktion durch Gesundheitsprävention) und seine Prämienreduktion durch Gesundheitsprävention. Darüber hinaus sieht jeder Teilnehmer seinen Versicherungsstatus (gruppenversichert, individuell versichert, nicht versichert), seine Versicherungsprämie (nach Berücksichtigung der Prämienreduktion durch Gesundheitsprävention), seinen Krankheitsstatus (erkrankt, nicht erkrankt) und seinen Gewinn.

Ihr Gewinn in einer Periode:

Zu unterscheiden sind vier Fälle:

- Sie sind **gruppenversichert** (Zahlungsbereitschaft \geq Ihre Gruppenversicherungsprämie insgesamt):

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} - \text{Ihre Gruppenversicherungsprämie},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und Ihre Gruppenversicherungsprämie, währenddessen die Gruppenversicherung im Krankheitsfall Ihre gesamten Behandlungskosten übernimmt.

- Sie sind **individuell versichert** (Zahlungsbereitschaft < Ihre Gruppenversicherungsprämie insgesamt, wenn Sie gruppenversichert wären):

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} - \text{Ihre individuelle Versicherungsprämie},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und Ihre individuelle Versicherungsprämie, währenddessen die individuelle Versicherung im Krankheitsfall Ihre gesamten Behandlungskosten übernimmt.

- Sie sind **nicht versichert** (Zahlungsbereitschaft < Ihre Gruppenversicherungsprämie insgesamt, wenn Sie gruppenversichert wären):

– ... und **erkrankt**:

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention} - \text{Ihre Behandlungskosten}$$

– ... und **nicht erkrankt**:

$$\text{Ihr Gewinn} = \text{Ihre Anfangsausstattung} - \text{Ihre Kosten für Gesundheitsprävention},$$

d. h. Sie zahlen Ihre Kosten für Gesundheitsprävention und im Krankheitsfall Ihre Behandlungskosten. Eine Versicherungsprämie entfällt.

Prämienberechnung:

- **Individuelle Versicherung:**

$$\text{Ihre Prämie} = \text{Behandlungskosten} \times \text{Ihr Gesamtrisiko nach Gesundheitsprävention zu erkranken (in Prozent)/100},$$

d. h. die individuelle Versicherungsprämie entspricht Ihren erwarteten Behandlungskosten nach Gesundheitsprävention (erwartete Behandlungskosten = Behandlungskosten x aktuelle Wahrscheinlichkeit zu erkranken (in Prozent)/100).

- **Gruppenversicherung:**

$$\begin{aligned} \text{Ihre Prämie insgesamt nach Berücksichtigung der Prämienreduktion durch} \\ \text{Gesundheitsprävention} = \text{Behandlungskosten} \times \text{durchschnittliches Gesamtrisiko der} \\ \text{Mitglieder der Gruppenversicherung vor Gesundheitsprävention zu erkranken (in} \\ \text{Prozent)/100} - \text{Ihre Prämienreduktion durch Gesundheitsprävention} \end{aligned}$$

$$\text{Ihre Prämienreduktion durch Gesundheitsprävention} = \frac{\text{Behandlungskosten} \times \text{Ihre Reduktion des Verhaltensrisikos durch Gesundheitsprävention (in Prozentpunkten)}}{100},$$

d. h. die Gruppenversicherungsprämie entspricht den erwarteten Behandlungskosten des durchschnittlichen Gruppenversicherten vor Gesundheitsprävention abzüglich den erwarteten Kosteneinsparungen durch Ihre Gesundheitsprävention. Im Gegensatz zur individuellen Versicherungsprämie hängt die Gruppenversicherungsprämie nicht nur von Ihrem genetischen Krankheitsrisiko und Ihrer Gesundheitsprävention ab, sondern auch von den genetischen Krankheitsrisiken der anderen Gruppenversicherten.

Je nach Zahlungsbereitschaften innerhalb einer Gesellschaft kann es mehrere mögliche Gruppenversicherungen in einer Gesellschaft geben, die sich in Bezug auf den Versichertenpool und die Prämie unterscheiden. In diesem Fall wird zunächst die Gruppenversicherung mit der grösstmöglichen Anzahl an Gruppenversicherten gewählt. Sollten dann immer noch mehrere Gruppenversicherungen mit gleicher Versichertenzahl existieren, so wird innerhalb dieser Gruppenversicherungen die Gruppenversicherung mit der grösstmöglichen Anzahl an Gruppenversicherten mit hohem genetischem Risiko zu erkranken gewählt. Sollten dann immer noch mehrere Gruppenversicherungen mit gleicher Versichertenzahl und gleicher Anzahl an Gruppenversicherten mit hohem genetischem Risiko zu erkranken existieren, so wird eine dieser Gruppenversicherungen zufällig ausgewählt.

Gutscheine für den Functional Movement Screen:

Der „Functional Movement Screen“ ist ein standardisiertes Testverfahren aus Amerika, welches zur Erfassung ineffizienter und schädlicher Bewegungsmuster eingesetzt wird. Hauptziel dieses Screens ist es Bewegungsschwächen zu erkennen und Bewegungsabläufe zu verbessern, um so einer Abnutzung und Schädigung des Bewegungsapparates vorzubeugen. Langfristig sind sowohl die Abnutzung als auch die Schädigung des Bewegungsapparates mit starken Schmerzen verbunden und können zu hohen Behandlungskosten führen (z. B. durch die Behandlung bei einem Orthopäden oder Physiotherapeuten).

Der „Functional Movement Screen“ des ASVZs wird durch ausgebildete Physiotherapeuten angeboten. Er umfasst sieben einfache Bewegungstests zur Quantifizierung von Beweglichkeit, Stabilität und Bewegungsmustern. Die Kosten für diesen Screen belaufen sich auf 60 Franken. Der Zeitaufwand für diesen Screen beträgt 30 Minuten. Termine für diesen Screen sind individuell vereinbar. Weitere Informationen zu diesem Präventionsangebot des ASVZs finden Sie auf der Seite des ASVZs oder erhalten Sie unter der Nummer +41 44 251 60 51.

Wenn Sie den Gutschein erhalten (gemäss der Wahrscheinlichkeit des von Ihnen gewählten Levels der Gesundheitsprävention), deckt der Gutschein die gesamten Kosten dieses Screens.

Teil 2

Informationen zu den verschiedenen Situationen, in denen Sie Entscheidungen treffen, erhalten Sie nach Teil 1 des Experiments auf Ihrem Bildschirm.

INSTRUCTIONS FOR THE EXPERIMENT

Thank you for your participation in this experiment. Please read the following information carefully. If you have any questions concerning the instructions, please raise your hand. Then, we will come to your cabin to answer your questions. Please do not talk to other participants anymore until the end of the experiment.

For showing up on time you will receive 10 Swiss Francs. Throughout the experiment you can earn more money. The height of your remuneration depends on your decisions and the decisions of other participants. In addition, you have the opportunity to win a voucher for a health prevention course which is offered by the student sport association of the university (ASVZ). All decisions are made anonymously, i. e. none of the other participants learns about your identity. Also the final payoff at the end of the experiment is made anonymously, i. e. none of the other participants is informed about your final payoff. Throughout the experiment the profits are indicated in ECU (= Experimental Currency Unit):

$$20 \text{ ECU} = 1 \text{ Swiss Franc.}$$

The experiment consists of **two parts**:

- In the **first** part of the experiment you will make the same sequence of decisions over multiple periods. At the end of the experiment **one of these periods is randomly** selected and determines your payoff in this part of the experiment.
- In the **second** part of the experiment you will face several distinct situations, in which you have to make one or several decisions. At the end of the experiment **one of these situations is randomly** selected and determines your payoff in this part of the experiment.

After the experiment we will still ask you to answer some questions. On the following pages we will explain the exact procedure of this experiment.

Part 1

General Information:

- Part 1 of the experiment comprises 10 periods. In each of these 10 periods you make the same sequence of decisions.
- In the experiment, in each period you receive an **initial endowment** of 1000 ECU and you face the risk of illness. If you turn ill, this leads to **treatment costs** of 700 ECU.
- Your total risk of illness is composed of two components: a genetic component and a behavioral component. *In the following we will simply refer to these components as **genetic risk** and **behavioral risk**.* Your genetic risk, i.e. your innate probability to turn ill, is either low or high. Your genetic risk of illness will be randomly assigned to you and does not change throughout the experiment. Your genetic risk of illness can not be influenced by you in the experiment. Your initial behavioral risk, i.e. your probability to turn ill because of your behavior, amounts to 20%. Your behavioral risk of illness can be influenced by you in the experiment through the means of health prevention. Your total risk of illness is the sum of the genetic risk of illness and the behavioral risk of illness. Both components and the resulting total risk of illness are shown to you on your computer screen at the beginning of the experiment. This information is private and not observed by other participants in this experiment.

Low risk	
Risk component	Probability to turn ill
Genetic risk	20%
Behavioral risk	20%
Total risk	40%

High risk	
Risk component	Probability to turn ill
Genetic risk	40%
Behavioral risk	20%
Total risk	60%

- At the beginning of part 1 you are also randomly assigned to a society. Each society consists of 8 participants, 4 of which have a high genetic risk of illness and 4 of which have a low genetic risk of illness. The composition of your society does not change throughout the experiment.
- In each period you can principally make two types of decisions: On the one hand, a health prevention decision which may serve to reduce your behavioral risk of illness, and on the other hand, a health insurance decision.

Sequence of Events in a Period:

1. Each participant receives an initial endowment of 1000 ECU and observes her genetic risk of illness. Each participant chooses among 11 levels how much health prevention she wants to do in order to reduce her behavioral risk of illness. The higher the level of health prevention, the lower the behavioral risk of illness and the higher the probability to obtain a voucher for a health preventive offer of the ASVZ. This offer comprises a ‘Functional Movement Screen’ (FMS). The goal of this screen is to improve the course of motion in order to prevent degeneration and damage of the musculoskeletal system. You will find more information about this screen in the section ‘Vouchers for the Functional Movement Screen’.

In the following table, you see the reduction of behavioral risk, the probability to obtain a voucher for the FMS, and the costs of prevention for each of the 11 corresponding health prevention levels:

Level of health prevention	Reduction of behavioral risk (in percentage points)	Probability to obtain the voucher for the FMS (in percent)	Costs of health prevention (in ECU)
0	0	0	0
1	2	1	8
2	4	2.5	18
3	6	4.5	30
4	8	7	46
5	10	10	66
6	12	13.5	90
7	14	17.5	118
8	16	22	150
9	18	27	186
10	20	33	226

That is, if you, for example, have a high genetic risk of illness (40%) and choose the prevention level 6 to reduce your behavioral risk of illness, then your total risk of illness after health prevention amounts to $40\% + 20\% - 12\% = 48\%$. Due to the health prevention you obtain the voucher for the FMS at the ASVZ with a probability of 13.5%. The costs of your health prevention amount to 90 ECU.

2. Each participant makes her health insurance decision. In principle, there exists two possibilities for a health insurance: either a group insurance or an individual insurance.

Both types of insurance will pay the full treatment costs in the case of illness. If you have the group insurance, then you will be jointly insured with other participants of your society. The insurance premium will then be influenced by you **and** other participants in the group insurance (cf. section ‘Premium Calculation’). If you have the individual insurance, you will be insured independently of the other members of your society, i. e. in this case the insurance premium will only be influenced by you. You can also remain uninsured. If you are not insured, the whole treatment costs will be subtracted from your initial endowment in the case of illness.

The health insurance decision in a given period involves two choices which are made simultaneously:

- (i) Each participant decides on the insurance premium that she would be willing to pay at most in order to become a member of the **group insurance**. The group insurance premium consists of two parts: one part which is identical for all members of the group insurance, and one individual-specific part which accounts for the premium reduction due to health prevention:
 - the expected treatment costs of the average group insurance member before health prevention
 - **minus** your premium reduction due to health prevention.

The willingness to pay determines whether the participant is insured by the group insurance or not. To be group insured at the end of the period, the willingness to pay has to equal at least the total insurance premium that would result, if the participant was included in the group insurance. Therefore, it may be that a participant is not group insured, even if her willingness to pay exceeds the total insurance premium for the group insurance. This would be, for example, the case, if upon consideration of the participant the total group insurance premium increased to the extent that it lay above the participant’s willingness to pay. Each participant can only indicate a willingness to pay which equals at most her initial endowment minus her investments in health prevention (according to her chosen level of health prevention).

- (ii) For the case that a participant would not be group insured because of her maximum willingness to pay for group insurance, she decides whether she wants to insure her risk of illness by an **individual insurance** or whether she wants to remain **uninsured**.
3. The premiums of the group insurance are calculated. A group insurance is provided, if this insurance will not make any losses in expectation, i. e. if the sum of the group insurance premiums will not be smaller than the expected treatment costs of all group insurance members. Depending on the willingnesses to pay in a society, the number of participants who are jointly insured by the group insurance may vary. It may be,

for example, that three participants of a society are group insured, while the other participants of this society are individually insured or not insured. If no group insurance is provided, as the group insurance would make losses in expectation, each participant is either individually insured or not insured according to her decision.

4. For each participant it is randomly determined whether she turns ill in the period or not. The probability to turn ill corresponds to her actual total risk of illness, i. e. her total risk of illness after reduction of the behavioral risk of illness.
5. At the end of the period, each participant obtains some information about the group insurance: number of total members, number of members with high genetic risk of illness, insurance premium (before consideration of the premium reduction due to health prevention) and her premium reduction due to health prevention. Moreover, each participant observes her insurance status (group insured, individually insured, not insured), her insurance premium (after consideration of the premium reduction due to health prevention), her sickness status (sick, not sick), and her profit.

Your Profit in a Period:

There are four cases which need to be distinguished:

- You are **group insured** (willingness to pay \geq your total group insurance premium):

your profit = your initial endowment - your costs of health prevention - your group insurance premium,

i. e. you pay your costs of health prevention and your group insurance premium, while the group insurance will cover your total treatment costs in the case of illness.

- You are **individually insured** (willingness to pay $<$ your total group insurance premium, if you would be included in the group insurance):

your profit = your initial endowment - your costs of health prevention - your individual insurance premium,

i. e. you pay the costs for health prevention and your individual insurance premium, while the individual insurance will cover your total treatment costs in the case of illness.

- You are **not insured** (willingness to pay < your total group insurance premium, if you would be included in the group insurance):

- ... and **sick**:

your profit = your initial endowment - your costs of health prevention - your treatment costs

- ... and **not sick**:

your profit = your initial endowment - your costs of health prevention,

i.e. you pay your costs for health prevention and, in the case of illness, your treatment costs. An insurance premium does not need to be paid.

Premium Calculation:

- **Individual insurance:**

your premium = treatment costs × your total risk of illness after health prevention (in percent)/100 ,

i.e. the individual insurance premium corresponds to your expected treatment costs after health prevention (expected treatment costs = treatment costs × actual probability to turn ill (in percent)/100).

- **Group insurance:**

your total premium after consideration of the premium reduction due to health prevention = treatment costs × average total risk of illness of all group insurance members before health prevention (in percent)/100 - your premium reduction due to health prevention

your premium reduction due to health prevention = treatment costs × your reduction of the behavioral risk of illness by health prevention (in percentage points)/100,

i.e. the group insurance premium corresponds to the expected treatment costs of the average group insurance member before health prevention minus the expected cost savings due to your health prevention. In contrast to the individual insurance premium, the group insurance premium depends not only on your genetic risk of illness and your health prevention, but also on the genetic risks of illness of the other group insurance members.

Depending on the willingness to pay in a society, there may exist several possible group insurances in a society, which differ with respect to the pool of insured and the premium. In this case, the group insurance with the highest number of group insurance members is selected first. If there still exist several group insurances with the same number of group insurance members, next the group insurance with the highest number of group insurance members with high genetic risk is selected among the remaining ones. If there still exist several group insurances with the same number of group insurance members and the same number of group insurance members with high genetic risk of illness, one of the remaining group insurances is selected at random.

Vouchers for the Functional Movement Screen:

The ‘Functional Movement Screen’ is a standardized test procedure, which was developed in America and is used to detect inefficient and harmful movement patterns. The primary goal of this screen is to detect weaknesses in movement orders and to improve the course of motion in order to prevent degeneration and damage of the musculoskeletal system. In the long run, degeneration as well as damage of the musculoskeletal system causes strong pain and may lead to high treatment costs (e.g. due to the treatment by a orthopedic specialist or a physiotherapist).

The ‘Functional Movement Screen’ at the ASVZ is offered by professionally trained physiotherapists. It comprises seven simple movement tests to quantify mobility, stability and movement patterns. The cost of this screening amount to 60 Swiss Francs. The time required for this screening is 30 minutes. Appointments for this screening can be made individually. More information about this health prevention offer of the ASVZ can be found on the webpage of the ASVZ or is obtained by calling the number +41 44 251 60 51.

If you receive the voucher (according to the probability which is attached to your chosen level of health prevention), this voucher will cover the total cost of this screening.

Part 2

After completion of part 1 of the experiment, you will receive further information about the distinct decision situations that you will be facing on your computer screen.

D Post-Experimental Questionnaire

D.1 Questionnaire (German Version)

1. Welches Geschlecht haben Sie?
 - Männlich
 - Weiblich
2. Wie alt sind Sie?
3. Sind Sie Student?
 - Ja
 - Nein
4. In welchem Studiengang sind Sie eingeschrieben?
 - Geisteswissenschaften
 - Ingenieurwissenschaften
 - Mathematik
 - Medizin
 - Naturwissenschaften
 - Rechtswissenschaften
 - Theologie
 - Wirtschaftswissenschaften
 - Anderer Studiengang
 - Kein Studiengang
5. Wie schätzen Sie sich selbst ein: Sind Sie eine Person, die prinzipiell bereit ist Risiken einzugehen oder die versucht Risiken zu vermeiden? *Bitte geben Sie auf einer Skala von 0 bis 10 an, wie risikobereit Sie sind. 0 bedeutet, dass Sie keinesfalls Risiken eingehen möchten. 10 bedeutet, dass Sie sehr stark bereit sind Risiken einzugehen.*
6. Wie beurteilen Sie Ihre Bereitschaft mit anderen zu teilen ohne dafür eine Gegenleistung zu erhalten, wenn es sich um eine Wohltätigkeitsorganisation handelt? *Bitte geben Sie auf einer Skala von 0 bis 10 an, wie bereit Sie sind zu teilen. 0 bedeutet, dass Sie keinesfalls bereit sind zu teilen. 10 bedeutet, dass Sie sehr stark bereit sind zu teilen.*
7. Wie schätzen Sie sich selbst ein: Sind Sie eine Person, die grundsätzlich bereit ist unfaires Verhalten zu bestrafen, selbst wenn die Bestrafung mit Kosten für Sie verbunden ist. *Bitte geben Sie auf einer Skala von 0 bis 10 an, wie bereit Sie sind, jemanden trotz Ihrer Kosten zu bestrafen. 0 bedeutet, dass Sie keinesfalls bereit sind trotz Kosten zu bestrafen. 10 bedeutet, dass Sie sehr stark bereit sind trotz Kosten zu bestrafen.*

8. Stellen Sie sich folgende Situation vor: Sie befinden sich in einer unbekannten Stadt und bemerken, dass Sie die Orientierung verloren haben. Sie fragen einen unbekannten Passanten nach dem Weg. Dieser Passant bietet Ihnen an, Sie mit dem Auto zu Ihrem Ziel zu fahren. Die Fahrtzeit beträgt ca. 20 Minuten und kostet den Passanten 20 Franken. Der Passant möchte kein Geld als Gegenleistung erhalten. Sie haben sechs Flaschen Wein bei sich. Die günstigste Flasche kostete 5 Franken, die teuerste 30. Sie entscheiden sich eine der Flaschen an den Passanten als Dankeschön zu geben. Entscheiden Sie sich für die Flasche, die 5, 10, 15, 20, 25, oder 30 CHF gekostet hat?
9. Für welches Gesundheitssystem würden Sie stimmen?
- Ein Gesundheitssystem, bei dem die Krankenversicherungsprämie des Einzelnen auf dessen individuellem Krankheitsrisiko basiert.
 - Ein Gesundheitssystem, bei dem man wählen kann zwischen einer Gruppenversicherung mit gleicher Krankenversicherungsprämie für alle Gruppenversicherten und einer Versicherung basierend auf dem individuellen Krankheitsrisiko.
 - Ein Gesundheitssystem, bei dem man wählen kann zwischen einer Gruppenversicherung mit einer Krankenversicherungsprämie, die für die Gruppenversicherten genetische Risiken nicht unterscheidet aber Gesundheitsprävention individuell berücksichtigt, und einer Versicherung basierend auf dem individuellen Krankheitsrisiko.
 - Ein Gesundheitssystem mit gleicher Krankenversicherungsprämie für alle.
10. Benutzen Sie eine Gesundheitsapp?
- Ja
 - Nein
11. Wären Sie bereit Informationen über Ihr Gesundheitsverhalten mit Ihrer Krankenversicherung zu teilen?
- Ja
 - Ja, aber nur bei Reduktion der Krankenversicherungsprämie
 - Nein
12. Wie würden Sie Ihren gegenwärtigen Gesundheitszustand beschreiben?
- Sehr gut
 - Gut
 - Zufriedenstellend
 - Weniger gut
 - Schlecht
13. Wie wichtig ist Ihnen der ASVZ Gutschein?
- Sehr wichtig

- Wichtig
 - Weniger wichtig
 - Unwichtig
14. Was haben Sie bei Ihrer Entscheidung über die Zahlungsbereitschaft für die Gruppenversicherung berücksichtigt? (Mehrfachnennungen möglich)
- Eigenes genetisches Risiko
 - Ihre Investition in Gesundheitsprävention
 - Investition in Gesundheitsprävention durch andere
 - Prämienreduktion
15. Wie sind Sie versichert?
- Über Familie versichert
 - Einzel versichert
16. Wie hoch ist Ihre Franchise?
- 300 CHF
 - 500 CHF
 - 1000 CHF
 - 1500 CHF
 - 2000 CHF
 - 2500 CHF
17. Haben Sie Zusatzversicherungen?
- Ja
 - Nein

D.2 Questionnaire (English Translation)

1. What is your gender?
 - Male
 - Female
2. How old are you?
3. Are you a student?
 - Yes
 - No
4. What is your major?
 - Humanities
 - Engineering
 - Mathematics
 - Medicine
 - Natural Science
 - Law
 - Theology
 - Economics
 - Other major
 - No program of study
5. How do you see yourself: Are you a person who is generally willing to take risks, or do you try to avoid taking risks? *Please use a scale from 0 to 10, where a 0 means you are ‘completely unwilling to take risks’ and a 10 means you are ‘willing to take risks’. You can also use the values in-between to indicate where you fall on the scale.*
6. How do you assess your willingness to share with others without expecting anything in return when it comes to charity? *Please use a scale from 0 to 10, where 0 means you are ‘completely unwilling to share’ and a 10 means you are ‘very willing to share’. You can also use the values inbetween to indicate where you fall on the scale.*
7. How do you see yourself: Are you a person who is generally willing to punish unfair behavior even if this is costly? *Please use a scale from 0 to 10, where 0 means you are ‘not willing at all to incur costs to punish unfair behavior’ and a 10 means you are ‘very willing to incur costs to punish unfair behavior’. You can also use the values in-between to indicate where you fall on the scale.*

8. Imagine the following situation: You are shopping in an unfamiliar city and realize you lost your way. You ask a stranger for directions. The stranger offers to take you with their car to your destination. The ride takes about 20 minutes and costs the stranger about 20 Euro in total. The stranger does not want money for it. You carry six bottles of wine with you. The cheapest bottle costs 5 Euro, the most expensive one 30 Euro. You decide to give one of the bottles to the stranger as a thank-you gift. Which bottle do you give? Do you choose the bottle which cost 5, 10, 15, 20, 25, or 30 CHF?
9. Which health care system would you vote for?
- A health care system, in which the health insurance premium for each individual is based on her own risk of illness.
 - A health care system, in which people can choose between a group insurance with identical insurance premium for all group insurance members and an insurance whose premium is based on the individual risk of illness.
 - A health care system, in which people can choose between a group insurance that does not distinguish between genetic risk of illness, but individually considers preventive effort, and an insurance whose premium is based on the individual risk of illness.
 - A health care system with identical health insurance premium for everybody.
10. Do you use a health app?
- Yes
 - No
11. Are you willing to share information about your health with your health insurance provider?
- Yes
 - Yes, but only if I get a premium reduction
 - No
12. How would you assess your current health status?
- Very good
 - Good
 - Satisfactory
 - Less good
 - Bad
13. How important is the ASVZ voucher for you?
- Very important
 - Important
 - Less important

- Unimportant
14. What did you take into account when making your decision on the willingness to pay for the group insurance? (multiple answers possible)
- Own genetic risk
 - Your investment in health prevention
 - Investment in health prevention by others
 - Premium reduction
15. How are you insured?
- Family insurance
 - Individual insurance
16. How high is your franchise?
- 300 CHF
 - 500 CHF
 - 1000 CHF
 - 1500 CHF
 - 2000 CHF
 - 2500 CHF
17. Do you have any supplementary insurance?
- Yes
 - No