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## Financial literacy, experimental preference measures and field behavior: A randomized educational intervention

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**Financial literacy, experimental  
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educational intervention**

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# **Financial literacy, experimental preference measures and field behavior – A randomized educational intervention**

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March 2023

# Financial literacy, experimental preference measures and field behavior – A randomized educational intervention\*

Matthias Sutter, Michael Weyland, Anna Untertrifaller,  
Manuel Froitzheim, and Sebastian O. Schneider<sup>#</sup>

## Abstract

We present the results of a randomized intervention to study how teaching financial literacy to 16-year old high-school students affects their behavior in risk and time preference tasks. Compared to two different control treatments, we find that teaching financial literacy makes subjects behave more patiently, more time-consistent, and more risk-averse. These effects persist for up to almost 5 years after our intervention. Behavior in the risk and time preference tasks is related to financial behavior outside the lab, in particular spending patterns. This shows that teaching financial literacy affects economic decision-making which in turn is important for field behavior.

**JEL Codes:** C93, D14, I21

**Keywords:** Financial literacy, randomized intervention, risk preferences, time preferences, financial behavior, field experiment

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# 1. Introduction

Financial literacy is generally understood as an individual's capability to handle financial aspects of everyday life and to make meaningful and informed decisions regarding investments, savings, and consumption (OECD, 2017). However, the level of financial literacy is fairly limited across the globe. Many people around the world have difficulties in understanding seemingly simple concepts like compound interest, risk diversification, or the relation of inflation and purchasing power. Lusardi and Mitchell (2014) report that at most around 50% of respondents in countries like the US, Japan, Germany, New Zealand, or Russia are able to answer three standard questions about financial literacy correctly.<sup>1</sup> This is particularly worrying, given that numerous studies have found a correlation between an individual's financial literacy on the one hand side and financial behavior on the other hand side (e.g., Hastings et al., 2013; Fernandes et al., 2014; Kaiser and Menkhoff, 2017; Ambühl et al., 2022). For example, it has been shown that less financially literate subjects are more likely to save too little for retirement (Boisclair et al., 2017), are more likely to earn lower returns from their savings accounts (Deuflhard et al., 2019), and are less likely to engage in recommended credit, savings, and investment practices (Hilgert et al., 2003). Moreover, lower financial literacy correlates with suboptimal mortgage choices (Agarwal et al., 2010), higher credit-card debt (Lusardi and Tufano, 2015), and lower overall wealth (Lusardi et al., 2017).

While a correlation between financial literacy and financial behavior has been established for a wide range of domains, it is less clear whether and how financial literacy affects financial behavior in a causal way. In this paper, we provide evidence that teaching financial literacy in a randomized education intervention has causal effects on the behavior of students in incentivized experiments on risk and time preferences. Since the behavior in such experiments is related in meaningful ways to field behavior, our results suggest that the relation between financial literacy and financial behavior is driven – at least partly – by the effects of financial literacy on behavior measured in the economic risk and time preference tasks.

In this paper, we present a field experiment (Harrison and List, 2004) that examines how teaching financial literacy affects students' risk behavior and intertemporal choices. Our intervention lasted for four weeks and comprised eight hours of teaching more than 600

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<sup>1</sup> The three questions read as follows: (1) Suppose you had \$100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow? [more than \$102; exactly \$102; less than \$102.] (2) Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy: [more than, exactly the same as, or less than today] with the money in this account? (3) Do you think that the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund." [true; false.]

students, aged around 16 years, in German high schools. By running three waves of data collection after the intervention (plus a baseline measurement before the intervention), we can study effects in the short term (one week after the intervention's finish), the mid term (of about half a year later), and the long term (of between 3 and up to almost five years after the intervention). In all waves, we experimentally elicit risk and time preference measures, but also knowledge about financial literacy, in an incentivized way. The long-term nature of our project allows us to address whether effects of financial education might fade away with time or need some time to build up. Moreover, it allows us to study links to financial behavior in the field once our sample has reached adulthood (in our last data collection) and when they make most financial decisions on their own.

Another distinctive feature of our field experiment is the fact that our study-design has three arms (in a within-school design), which includes two different control treatments. One of the latter allows us to contrast an educational intervention on monetary policy with teaching financial literacy. Both interventions focus on the use of money and financial decisions, but from very different perspectives. We consider the monetary policy intervention an insightful (and novel) benchmark for the effects of education in financial literacy. Monetary policy issues are frequently taught in German high schools. Therefore, one might ask whether exposing students to concepts like inflation rates or monetary stability in courses on monetary policy can function as a substitute for financial literacy (that is not part of high school curricula in Germany). We are able to give a negative answer to this question.

We find that both of our school interventions, the one on financial literacy and the one on monetary policy, increase knowledge in the respective areas. This is reassuring, as it shows that the material (that we had developed ourselves) helped students to gain knowledge and apply it successfully to problem sets. The effect sizes in the learning progress are relatively large. Most importantly, however, we find a noticeable effect of the financial literacy intervention on behavior in our experiments on risk and time preferences, while there are practically no such behavioral changes in the genuine control condition and in the monetary policy intervention group. Remarkably, the effects of the financial literacy intervention persist across all three waves, thus covering a post-intervention period of up to almost 5 years.

The financial literacy intervention makes subjects behave more patiently and more often time-consistent in our incentivized tasks, as the share of present-biased behavior decreases. Concerning risk attitudes, the financial literacy intervention induces slightly more risk-averse behavior in our tasks in the aggregate. Survey evidence then reveals that behavior in the risk

and time preference experiments is related to financial behavior in the field, covering spending decisions, or the degree of financial independence as young adults.

Our paper contributes in particular to the literature on randomized intervention studies with respect to financial literacy, but due to its focus on behavior in risk and time preference experiments it is also related to the literature on the formation of economic preferences and their malleability. Concerning the first strand of literature, we focus in particular on previous work with adolescents. Due to demographic changes and the rapid development of innumerable financial products, adolescents will have to make relatively more complex financial decisions in their lives than earlier generations, including decisions regarding retirement savings or risky investment opportunities. Thus, strengthening the financial literacy of teenagers is of great practical importance (OECD, 2017), in particular since the level of financial literacy is typically lower for adolescents than for adults (Lusardi and Mitchell, 2014; OECD, 2015). While financial education programs need not improve the financial literacy of adolescents or affect their behavior (see reviews by Hastings et al., 2013, or Lusardi and Mitchell, 2014), Brown et al. (2014) have shown that the effects of high-school financial education on knowledge are most pronounced when courses are taught by trained teachers. Following this insight, Bruhn et al. (2016) evaluate a comprehensive financial education program with about 25,000 Brazilian high-school students. The program lasted for about one year, and it showed a large increase in the students' financial literacy, but the short-run effects on financial behavior (measured immediately after the intervention) were mixed: for instance, the students' savings improved, but at the same time they increased the use of expensive credit to make consumer purchases. Overall, Bruhn et al. (2016) focus on the link between financial education and financial behavior, but they do not consider the potential impact of their program on economic preference measures and they only consider short term effects directly after the intervention. Frisanco (2023) reports an intervention on financial literacy, run in 300 Peruvian schools with more than 20,000 students. The program covered 20 hours of teaching and it generated strong gains in financial literacy. It also improved financial autonomy and, judging from credit bureau records three years after the intervention, it reduced the outstanding debt of indebted students by about 20%, thus improving financial behavior. Frisanco's (2023) study corroborates the important link between financial literacy and financial behavior, yet it does not address in the published version the role of economic preferences<sup>2</sup> and how they might be affected through a

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<sup>2</sup> In the working paper version (see <https://s2.aebanca.es/wp-content/uploads/2020/10/trabajo-de-vernica-frisanco.pdf>), Frisanco presents some evidence on risk aversion, summarizing the findings as follows (on p. 13):

financial literacy intervention and whether potential effects are long-lasting or transitory. The latter aspects will be the core of our study due to its focus on studying behavioral changes in risk and time preference experiments and by its long-term horizon of following subjects for up to almost five years after the intervention. Lührmann et al. (2018) were the first to explicitly focus on the possible effects of financial literacy training on behavior in time preference experiments. They ran a study with about 900 students, aged 14 years on average, about half of whom were exposed to a 4.5-hour training session on financial literacy. Lührmann et al. (2018) found that the degree of patience in their experiments did not change significantly, but that students behaved more frequently in a time-consistent (non-present-biased) manner. They were eliciting time preference measures between four and twelve weeks after the intervention, which is a relatively short period compared to Frischno's (2023) time span of 3 years or ours with between 3 and almost 5 years after the interventions. Moreover, Lührmann et al. (2018) did not investigate whether the intervention affected financial knowledge or field behavior, and they also did not capture potential effects on risk attitudes. We propose that it is important to consider risk attitudes when investigating the potential effects of a financial literacy training for the following reason: Financial decisions are hardly ever only characterized by an intertemporal dimension, and thus do not only relate to intertemporal choices. Rather, they almost always entail a risky component, for example about the development of inflation and interest rates, or of the stock market. It is therefore important to consider both dimensions, risk attitudes and intertemporal choices, when studying whether and how financial literacy might affect financial decisions, not least because of the intertwined nature of risk-taking and time discounting (Andersen et al., 2008; Epper and Fehr-Duda, 2023). Bjorvatn et al. (2020) considered both risk and time preference measures in their field study in Tanzania. They exposed more than 2,000 students, aged 18 years on average, to an edutainment program on TV about entrepreneurship, also including elements of financial literacy. Although the show triggered some interest in entrepreneurship and business, it had an unintended side effect by discouraging students from investing in schooling, thus yielding a negative outcome on school performance and the likelihood to continue their education. Bjorvatn et al. (2020) also collected measures of risk and time preferences once after their intervention. However, they found no effect of the TV show on these experimentally elicited preference measures, without controlling for potential changes

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“Additional results for conscientiousness, impulsiveness, as well as on the probability of being risk averse, are presented in Table A.12 in Appendix A. The program does not lead to significant effects on any of these traits.”



in financial literacy, however. The null effects may also be due to the medium of information provision being the television, rather than a trained teacher with personal interaction.<sup>3</sup>

Our study differs from the previously described ones in the following combination of characteristics: We let trained teachers educate students in financial literacy in a standardized program that was developed by us (with one of the authors having taught in high-school for many years). We have a three-armed study design, with two control treatments, one of them teaching monetary policy that covers similar topics as financial literacy, yet from a very different perspective. We carefully measure in an incentivized way both the students' knowledge in financial literacy (and monetary policy) and their behavior in incentivized experiments to elicit risk and time preference measures. We have a baseline measurement before the intervention, and three post-intervention data collection waves, the last one between three and up to almost five years after the intervention. The multiple waves allow us to measure short-term, mid-term and long-term effects of our intervention. We can link changes in knowledge on an individual level to changes in economic decision-making in our experiments, on top of identifying the main effect of the intervention *per se* on behavior in risk and time preference tasks. Moreover, we relate the preference measures of our sample, as well as the participants' treatment group, to financial decision-making.

The second strand of literature our paper is related to concerns the formation of non-cognitive skills (Heckman, 2006; Cunha and Heckman, 2007; Heckman and Mosso, 2014), and here in particular the formation and malleability of economic preferences (Alan and Ertac, 2018, 2019; Alan et al., 2019; Cappelen et al., 2020; Kosse et al., 2020). Preference measures have been related to educational achievements (Castillo et al., 2011, 2018; Golsteyn et al., 2014), labor market outcomes (Heckman et al., 2006; Caliendo et al., 2010), financial success (Meier and Sprenger, 2010, 2012; Dohmen et al., 2011), or a subject's health status (Chabris et al., 2008; Moffitt et al., 2011; Sutter et al., 2013, Schneider and Sutter, 2022). Recently, several papers have addressed how economic preferences might be formed through educational interventions. While any intervention that is run over a longer time period consists of several components that make it difficult to disentangle the effects of each single component, the randomized assignment of interventions to different groups allows for a clean identification of an intervention's effects. Alan and Ertac (2018, 2019) and Alan et al. (2019) have shown that curricular interventions (which are completely unrelated to financial literacy) can affect time

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<sup>3</sup> Evidence by Berg and Zia (2017), however, suggests that edutainment on TV can also increase financial literacy without teacher interaction, though they do not consider any effects of their intervention on economic preferences.

preference measures, as well as measures of grit, and of the competitiveness of children. Cappelen et al. (2020) have presented evidence that pre-school interventions and curricular changes can make young children behave more fairness-minded and less selfishly. Kosse et al. (2020) have studied how a mentoring program for disadvantaged children changes their measured social preferences and triggers more prosocial behavior. The papers mentioned here included relatively young children, aged 3 to 10 years, an age range that is considered as easily accessible for behavioral changes (see Sutter et al., 2019). Our study with teenagers around the age of 16 (at the time of the intervention) examines whether behavior in risk and time preference experiments is also malleable during that age. Even more importantly, compared to earlier work that focuses on a single economic preference dimension, our study shows that a curricular intervention can affect two important components of economic decision-making at the same time: risk taking and intertemporal choice, both of which are undeniably important for many decisions in life, in particular financial ones. Our assessment of the intervention also covers an unusually long time period by looking at how teaching financial literacy affects behavior in incentivized preference tasks up to almost five years after the intervention.

The remainder of the paper is organized as follows. Section 2 introduces the design of our field intervention, including its implementation. Section 3 presents the results; first on financial literacy and monetary policy literacy, then on risk taking and intertemporal choices. In this section, we also relate knowledge and economic preference measures to field behavior of students. Section 4 concludes the paper.

## **2. Implementation and design of the field experiment**

Our study was approved by the IRB of the University of Innsbruck and it was pre-registered at the AEA RCT registry (<https://www.socialscienceregistry.org/trials/2953>). In the pre-registration, we expected that students who were taught in financial literacy would make less risky and more patient choices than students who got no such teaching. This expectation was based on the one-hand-side on the earlier results of Lührmann et al. (2018) on time preference measures and on the other-hand-side on empirical patterns that pre-adults often show a relatively large degree of risk-appetite (Sutter et al., 2019), for which reason we expected financial literacy to reduce their risk tolerance.

We recruited a total of eleven schools (and 31 classes therein) in the German states of North Rhine-Westphalia, Rhineland-Palatinate, and Thuringia. Recruitment was done during advanced training courses for teachers, which were given by three of the authors (but which

were unrelated to the intervention study). In nine out of eleven schools, we recruited three parallel classes in a particular grade and each class was randomly assigned to one of the three treatment arms (explained in Section 2.1 in detail). Two schools (in Ahaus and Heilbad Heiligenstadt) had only two parallel classes per grade, for which reason we could only implement two treatment arms there, i.e., the genuine control treatment and the financial literacy intervention. The classes that participated in a particular school were always in the same grade, but across schools it differed whether they were in the 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup>, or 12<sup>th</sup> grade.

The three treatment arms differed with respect to the material covered in the respective courses. Each of the three treatment arms comprised eight hours in total, two in each of four consecutive weeks. The material in the two intervention arms was developed by us, but always taught by the students' regular teachers. To standardize the lectures and exercises, we developed a web platform and trained teachers how to use it in the same way across the different schools. This training was conducted by two of the authors prior to any intervention, and was done on an individual level to train the teachers as well as possible and to have the lectures – and the style of lecturing and interaction with students – as identical as possible (which was strongly facilitated by the use of the web platform).

While the teaching in the three treatment arms was done by regular teachers, the questionnaires and experimental measurements were executed by us (and additional research assistants). In total, we had four touchpoints with students, of which the first three were done in school visits (during regular school hours): (i) one week before the intervention started; this will be labeled as *Pre*; (ii) one week after the end of the four-weeks intervention, denoted as *Post1*; and (iii) about half a year after the second visit (ranging from four to nine months later). We refer to the latter as *Post2* in the following. In each of these visits, we measured the students' literacy and their behavior in our risk and time preference experiments in an incentivized way (described in Section 2.2). Finally, (iv) between three years and up to almost five years after the invention (median of 3.9 years), we invited – with the help of schools – students to participate in an incentivized follow-up data collection. This last wave is called *Post3* henceforth, and it was conducted online, because by that time all students had left school (and were on average 20 years old). We used the same elicitation instruments as in our previous school visits. To preserve the panel structure, students had to self-generate a personalized code that was identical across all school visits and the online data collection.

## 2.1 The three treatment arms

We implemented our treatment arms in the courses that dealt with business, economics, or social sciences.<sup>4</sup> Within each school, all three arms were taught in parallel classes during the four weeks of the intervention.<sup>5</sup>

Our *Control* group was exposed to the regular teaching material in the respective course. The content in the *Control* group differed from school to school (and across grades), but never captured any material that was used in the other two treatment arms (but instead covered topics such as, e.g., demographic change or climate policy or the European Union’s political system).

The *monetary policy* intervention group – henceforth abbreviated as *MP* – served as a second control group. It covered topics such as the functioning of the Euro system, the regulatory framework of the economic and monetary union, the recent financial crisis and possible rescue measures, as well as concepts such as inflation, public debt and monetary stability. These topics are typically part of the ordinary curricula, but none of them had been covered before students were exposed to our intervention. The *MP* intervention was based on a textbook on monetary policy published by the German Central Bank (Deutsche Bundesbank, 2017).<sup>6</sup>

The *financial literacy* intervention group – henceforth abbreviated as *FL* – is our main treatment of interest. In this treatment arm, the eight hours of intervention focused on individual decision-making applied to financial matters. Students in the *FL* intervention learned to comprehend a salary statement, to develop an investment strategy, and to deal with inflation and its influence on purchasing power, to name a few examples. Moreover, they were informed about common mistakes people incur when making financial decisions. These behavioral biases included, among others, the sunk cost fallacy, or loss aversion.<sup>7</sup> Some of the concepts were also illustrated by getting students engaged in experiments that investigated these concepts in order

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<sup>4</sup> All over Germany, and also in our schools, there are different labels for such courses. In our cases, they were mainly labelled “Sozialwissenschaft”, “Sozialwissenschaften/Wirtschaft“, or “Wirtschafts- und Sozialkunde“. For further information about the German school system and its different tracks for 14-19 year olds (with all tracks being represented in our sample of schools) see <https://www.kmk.org/kmk/information-in-english.html>.

<sup>5</sup> Since students did not have access to the material covered in the parallel classes, spillovers are unlikely.

<sup>6</sup> The full content is available here: <https://www.bundesbank.de/de/publikationen/schule-und-bildung/geld-und-geldpolitik-606038>. Froitzheim and Schuhen (2015) have adapted this material (actually using the previous edition of the German Central bank’s book that is identical in content, however) for an online version. Since the monetary policy intervention only serves as a second control treatment (as does the genuine control treatment), it is not included in the material covered in the online appendix. Interested readers can find the material on the German website.

<sup>7</sup> We included insights from behavioral and experimental economics about fallacies in human decision-making in the financial literacy intervention on purpose, due to our conviction that understanding how people tend to behave and how they are prone to biases is useful for making informed and meaningful financial decisions.

to place an emphasis on experiential learning. We also exposed them to practice problems (unlike in the *MP* intervention) where students had to apply the concepts taught to typical finance-related situations in their lives. None of the material covered in the *FL* intervention was part of the curriculum, and as such was completely new to students (while teachers were trained by us to deepen their knowledge).<sup>8</sup> Two of the authors had developed this material (of which a full translation is available in Appendix B4), and they had trained the teachers in delivering the material with the help of an online platform ([www.econ-ebook.de](http://www.econ-ebook.de)). It is important to stress that the material did not include any instructions on how economists elicit risk and time preference measures or any normative statements about how “optimal” risk and time preferences should look like.

## 2.2 Measuring literacy and behavior in our risk and time preference experiments

In order to assess the students’ literacy about monetary policy and financial issues, we tested them prior to the intervention to get a baseline measure, and then in each of the three post-intervention waves (two of them in school, the final one online). This test (reprinted in Appendix B2) was structured in two parts and consisted of multiple-choice questions and a few computing tasks. One part contained questions on monetary policy, the other on financial literacy. In both parts, students could earn up to 24 points as their score if they answered all questions correctly. During our school visits (*Pre*, *Post1* and *Post2*), we randomly drew five students per class after each test and then paid them €1 for each point as an incentive to do their best. In the online data collection in *Post3*, a payment depending on performance in the test was made to each participant, and since their knowledge in financial literacy was our prime interest, we dropped the test on monetary policy questions in *Post3*.

In all data collection waves, we also measured the students’ behavior in our risk and time preference experiments (see Appendix B1 for the instructions). Here we followed the procedure of Sutter et al (2013). Students had to fill in three choice lists: one for the risk preference task, two for the time preference tasks. Each choice list contained 20 decisions. In the risk elicitation task, students could either choose a lottery that paid €0 or €10 with equal probability or a safe amount that started with €0.50 and increased in steps of €0.50 until it reached €10.<sup>9</sup>

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<sup>8</sup> The 31 teachers of the 31 classes that were included in our study had all graduated from a German university in the social sciences (plus one additional subject) to be qualified to teach this subject. Our teaching guaranteed that all of them in the *FL*-treatment had a sound knowledge of financial literacy.

<sup>9</sup> In the online data collection, all involved amounts were doubled such that the choices remain meaningful for the by that time about 20-year-olds.

The two choice lists to elicit time preference measures let students choose between getting €10.10 sooner or another amount later. The later amount increased in steps of €0.20 from €10.10 to €13.90. In one choice list, the sooner amount of €10.10 was available on the day of the experiment, and the later amount was due one week later. In the second choice list, all payment dates were shifted one week into the future (meaning that the earlier amount was available in one week, and the larger amount in two weeks). The combination of both choice lists allows us to study the intertemporal consistency of choices (Laibson, 1997).

After the students had made all decisions, each was paid according to one randomly selected decision. This rule was applied in all four measurement points, but the implementation differed slightly between the three school visits and the online data collection. If a student had chosen the lottery in the risk elicitation task, it was resolved as follows during the school visits: A student blindly drew one ball from a bag with 10 white and 10 orange balls. A white ball yielded a win of €10, while an orange ball yielded zero earnings. In the online visit, the lottery was resolved by a computer draw. Earnings from the time preference experiment were paid out depending upon the chosen payment date (i.e., either at the day of the experiment, or one or two weeks later). During the school visits, payments were handed out in sealed envelopes that only had the individual (anonymous) code of students on it, implying that neither other students nor teachers could identify a student's choices. Payments were executed during regular school hours in order to minimize transaction costs. In the online data collection, payments were delivered via PayPal or bank transfer on the day when they were due.<sup>10</sup>

In the following results section, we use *certainty equivalents* (CE) as our measure for risk aversion in the risk elicitation task. The CE will be defined as the midpoint between the largest safe amount over which the lottery is preferred and the smallest safe amount that is preferred over the lottery. Lower certainty equivalents will indicate relatively more risk aversion. In case of multiple switching between the lottery and a safe amount, we check whether a subject's pattern can be rationalized. This applies if the largest safe amount until which a subject always preferred the lottery is smaller than the smallest safe amount from which onwards a subject always preferred the safe amount. In this case, we again take the midpoint between these two values. If multiple switching cannot be rationalized (e.g., if a subject prefers

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<sup>10</sup> To maintain anonymity, all payment data was (and since then remained) stored separately from decision data, and used exclusively for payment. This was clearly announced to participants at the beginning of the online data collections. All payments were administered by admin staff not involved in the study.

small amounts over the lottery, but prefers the lottery over larger amounts), we exclude a subject from the respective analysis.<sup>11</sup>

In the time preference task, we will use a variable called *future premium* that indicates how much money a subject needs to get on top of €10.10 to wait for one more week to receive a larger payment. As an indifference point between taking the sooner and taking the later payment, we take the midpoint between the largest later amount over which a student prefers €10.10 and the lowest later amount that is always preferred over €10.10.<sup>12</sup> A lower future premium indicates a more patiently behaving student, while a larger future premium signals more impatience in this task. With respect to the time preference experiment, we can also classify a subject as present-biased or future-biased. If the future premium is *larger* in the choice list without an upfront delay – i.e., in the list where students choose between €10.10 today and another amount one week later – than in the choice list with an upfront delay of one week, then a student is classified as *present-biased*. In the reverse case, the student is classified as *future-biased*. If both premia are identical, we speak of a non-biased subject.

At the end of an experimental session in schools, we administered a short questionnaire, including three questions targeted at field behavior that relates to financial decision-making. Using a five-point scale (from “never” to “very often”), we asked about the frequency of the following activities over the past month: (i) betting with friends on something; (ii) participating in gambling; (iii) buying something on the internet. Additionally, we also asked with the same scale about smoking.

At the end of the online data collection, we ran an extensive survey on financial behavior. This survey was based on items taken from Dew and Xiao (2011), Ksendzova et al. (2017), Brown et al. (2018) and Barbic et al. (2019). The questions are reprinted in Appendix C, and we will provide more details about the categories of financial behavior when presenting the results in Section 3.4.

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<sup>11</sup> This means that we excluded subjects for the analysis from only that post-intervention wave in which their choices were not rationalizable. If someone was therefore excluded from the analysis of Post2, for example, the same person could be included in Post3, if choices in Post3 were rationalizable. Our results are robust to including subjects with non-rationalizable choices as we will explain in the results section.

<sup>12</sup> In case of multiple switching, we proceed analogously to our method for determining the certainty equivalents. Note that in the online data collection, the amount paid on the sooner date was €20.20, as explained above.

### 3. Results

#### 3.1 Sample descriptives

The data in schools were collected between May 2017 and June 2019 in a staggered way across schools – while within schools the interventions were always run at the same time. Each student earned on average 15 Euro per visit, meaning that those who were present during all three visits earned on average 45 Euro, which is a significant amount of money for 16-year-olds. The online collection was conducted between November 2021 and March 2022. Since students had left their high-schools by that time, it was difficult to contact them, as schools do not keep track of their graduates’ addresses, but we managed to reach out to a large fraction of them. Subjects participating in *Post3* received on average 85 Euro for the experiments, tests and surveys in the online data collection.

We had 645 participants in *Pre*, 633 in *Post1*, and 573 in *Post2*. The slightly lower number in *Post2* is because of one class not participating in the *Post2*-visit (as a result of conflicts with other school events) and because some students had moved to different schools (as in a few cases we conducted the *Post2* visit after the summer break, i.e., in a new academic year). For *Post3*, we succeeded to obtain follow-up data for 247 participants whom we then could match with all of their previous choices.

Of the 645 participants in *Pre*, 257 were in the *Control* treatment, 186 in the *MP* treatment, and 202 in the *FL* treatment.<sup>13</sup> See Table 1 for characteristics of the different treatment groups in terms of baseline data. Treatment indicators do not predict any of these pre-treatment characteristics (we can never reject the hypothesis that the treatment coefficients are all zero), implying pre-treatment balance with respect to the variables listed in Table 1.

In order to study the within-subject causal effects of our interventions, we are going to consider students from the post-intervention visits only if they were present in our first (pre-intervention) visit. For this set of students, we can identify short-term, mid-term or even long-term effects of participating in the four-week intervention. More precisely, we had 580 students who participated both in *Pre* and *Post1*, and 515 students who participated both in *Pre* and *Post2*. Of those former students participating in the online data collection *Post3*, 228 had also participated in *Pre*.

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<sup>13</sup> Recall that in two schools we did not have an MP treatment arm because we could only work with two parallel classes. Given our primary interest in financial literacy and given that we wanted to have a genuine control condition in each school, we have only nine classes with the monetary policy intervention, which explains the lowest number of students for the MP treatment arm.



In the analysis, we include only subjects whose experimental choices can be rationalized as consistent. Out of the 645 subjects in *Pre*, at most 7% made inconsistent choices in the elicitation process of a given preference measure and were thus excluded from the corresponding analyses. In *Post1* and *Post2*, the fraction of subjects with non-rationalizable choices was as low as 3%; for the online data collection in *Post3*, the maximum was 5%.

On average, at our *Pre*-measurement, subjects were 16 years old, and 52% were female; across treatments and waves, we observe some differences in the share of females and age, although statistical tests would not reject equivalence of group means with respect to these two variables (see Table 1). To account for potential age and gender effects (Croson and Gneezy, 2009; Sutter et al., 2019) in risk and time preferences, and for the obvious implication any pre-treatment difference still might have, we control for age and gender in our analysis.

In line with our pre-registration, we test one-sided hypotheses regarding the (positive) effects of our financial literacy intervention on financial literacy, risk averse and patient choices (note that our measures of risk aversion and patience are premia, and are thus, strictly speaking, measures of risk seeking and impatient behavior, i.e., they are reverse coded). P-values result, unless otherwise noted, from wild cluster bootstrapping (Cameron et al., 2008; Roodman et al., 2019) with Gamma weights and 2000 repetitions to account for the clustered nature of errors, and the fact that asymptotic arguments are likely inappropriate with our 31 clusters.

[ Table 1 about here ]

Before proceeding to the results, we'd like to briefly address the potential issue of attrition. In Tables A1 to A4 in the online appendix, we present results regarding attrition across the four different waves of our experiment. Table A1 is dedicated to selective attrition: From column 1, we see that attrition between *Pre* and *Post1* amounts to about 10% in the control group, and it is not different in the *MP* or the *FL* treatment. Similarly, in column 2 we report that attrition between *Pre* and *Post2* amounts to about 17% in the control group, again with equal shares in the *FL* and the *MP* group. Finally, in column 3, we see that attrition in the *MP* group happens to be lower than in the control group. However, attrition in the *FL* group is not different to that of the control group; similarly, the attrition rates between the *FL* group and the *MP* group do not differ significantly. Thus, except for the *MP* group in *Post3*, we see no indication of selective attrition. In particular, attrition rates between *FL* and the control group are not different, and attrition rates between the two intervention groups are not different across all waves. Yet, attrition – even if non-selective with respect to treatment status – could still alter

the balance of the analyzed samples with respect to pre-treatment characteristics in the post-intervention waves *Post1*, *Post2* and *Post3*. Therefore, in Tables A2 to A4 we show balance of baseline characteristics of the samples analyzed in the post-intervention waves *Post1*, *Post2* and *Post3*. As the last column of each table indicates, mean values do not systematically differ across treatment groups. In sum, we have no reasons to believe that attrition was a problem in our study (and even less so, as we control for baseline outcomes to address potential imbalances when assessing the intervention’s success in Sections 3.2 and 3.3).

### 3.2 Test scores on financial literacy and monetary policy

Figures 1 and 2 present the test scores for financial literacy and monetary policy literacy. We show the average scores in our three school visits (*Pre*, *Post1*, *Post2*). As the tests were not designed for online assessment and most answers are available online via search engines within seconds, scores from an online assessment of these tests cannot be meaningfully compared to previous tests within schools, for which reason we do not include the test scores from our *Post3*-measurement in Figures 1 and 2.

Recall that in each topic subjects could achieve a maximum score of 24 points. In the financial literacy test, students across all treatments scored on average 9 points before the intervention, and 7 points on average in the monetary policy test. Figure 1 shows the test scores for financial literacy, conditional on the treatment arm (*Control*, *MP* or *FL*) and on the time of the test (*Pre*, *Post1*, or *Post2*). As Table 1 shows, in the *Pre*-condition, there is no relevant difference across treatments in the test score for financial literacy. This indicates that randomization was successful in creating treatment groups with equal mean test values. In the *Post1*-condition and the *Post2*-condition, the scores are significantly higher in *FL* than in the control treatment or the control and *MP* treatment pooled together, on average by about 2 points in *Post1* ( $p < 0.01$  in both cases, one-sided hypotheses, wild cluster bootstrap, regression-adjusted for imbalances in gender, age, and pre-treatment scores) and 1.5 points in *Post2* ( $p < 0.1$  in both cases; analysis as for *Post1*).<sup>14</sup>

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<sup>14</sup> We also note the following side-result. Questions 14-16 in the financial literacy test deal explicitly with inflation related to saving and investment. The sum of correct answers to these questions is larger in the *FL* treatment than the *MP* treatment, even though both study arms cover inflation. The difference fails significance in *Post1*, but is significant both in *Post2* and *Post3* ( $p < 0.1$  in each wave; two-sided hypotheses;  $p$ -values obtained via wild cluster bootstrapping; regression-adjusted for age and gender). This difference suggests that the applied character of the financial literacy intervention leads to a better understanding of the effects of inflation than the more macro-oriented approach of dealing with inflation in the monetary policy intervention. This is reflected in findings that more practically oriented approaches promote better understanding of financial concepts (Amagir et al., 2018).

To quantify the effect sizes of the *FL* intervention on individual-level test scores, we use Cohen's  $d$  here, which relates the change in the score to its standard deviation. Hattie (2008) classifies  $d$ -values that satisfy  $0.4 \leq d \leq 0.6$  as medium effects sizes, and this range applies to our findings for the increase in the financial literacy scores, as we find  $d = 0.55$  in the short term (from *Pre* to *Post1*) and  $d = 0.42$  in the mid term (from *Pre* to *Post2*).<sup>15</sup>

[ Figure 1 about here ]

Figure 2 illustrates how the test scores in the monetary policy test depend on the treatment and the time of the test. After the intervention, the absolute scores (as well as the increase in scores in comparison to *Pre*) are significantly larger in the *MP* treatment than in the control treatment or the control and *FL* treatment pooled together.<sup>16</sup> This means that teaching students eight hours in monetary policy has the expected positive effects on test scores. According to Cohen's  $d$ , this effect is to be considered as large, given  $d = 1.29$  for the short term and  $d = 0.74$  for the longer term.<sup>17</sup> We also see that the *FL* treatment shows a small increase in the test score on monetary policy, but the increase is much smaller than in the *MP* treatment (and not significantly different from the control group).

[ Figure 2 about here ]

### 3.3 Intervention effects on behavior in the risk and time preferences experiments

#### 3.3.1 Overview and group comparisons

*Risk preference task.* As depicted in Table 1, before our interventions, students had an average certainty equivalent (CE) of 4.82 for the lottery (that had a 50:50 chance of winning €10 or zero). This indicates slight risk aversion on average, but the CE is very close to risk neutrality. Across the three different treatment arms, the CE is €4.53 in *Control*, €4.98 in *MP*, and €5.06 in *FL*. Thus, there are no relevant differences between the *MP* and *FL* condition regarding pre-intervention CEs, with participants in both groups behaving on average risk neutral. Yet, participants in the *control* treatment happen to behave risk averse, and would accept an about

<sup>15</sup> Adjusting for the clustered nature of our study even yields larger effect sizes: Deriving  $d$  from the cluster-adjusted t-statistic yields  $d = 0.88$  in the short term, and  $d = 0.68$  in the mid term (Rosnow et al., 2000, Eq. 14).

<sup>16</sup> In *MP*, scores are higher by about 3.7 points in *Post1* ( $p < 0.01$  in both comparisons, two-sided hypotheses, wild cluster bootstrap, regression-adjusted for imbalances in gender, age, and pre-treatment scores) and by about 1.6 points in *Post2* ( $p < 0.05$  in both comparisons, analyses as for *Post1*).

<sup>17</sup> Cluster-adjusted effect sizes are  $d = 1.22$  in the short term, and  $d = 1.34$  in the long term.

€0.5 lower CE for the lottery than their counterparts in the *MP* and *FL* condition would do. When investigating CEs, we will thus need to adjust for these differences using regression when comparing the different treatment groups, even though these differences are within the limits of chance (see Table 1; in order to keep the analysis consistent and comparable, we do so also when investigating financial literacy scores and time preference measures).

Before the intervention, we observed, across all treatments, a significantly negative (rank) correlation between the financial literacy test score and a subject's CE (correlation coefficient =  $-.07$ ;  $p < .08$ , obtained via wild cluster bootstrapping, two-sided hypothesis). This indicates that subjects with higher financial literacy scores behave, on average, slightly more risk-averse (or less risk-seeking). Figure 3 shows that our *FL* intervention reinforces this relationship. The figure looks at the change in CEs in the short, the mid and the long term. In treatments *Control* and *MP*, we note that CEs are practically the same across *Pre*, *Post1*, *Post2* and are still fairly similar in *Post3*.<sup>18</sup> In the *FL* treatment, however, we note that CEs go down right after the intervention to €4.38 in *Post1*, and then stay at about that level up to almost five years after the intervention (€4.44 in *Post2*; €4.32 in *Post3*). For all post-intervention periods, the CEs in *FL* are significantly smaller than in *MP* (recall that in the *Pre*-condition, mean values of the *FL* and *MP* groups were the most comparable;  $p < 0.05$  for the comparisons in *Post1* and *Post2*,  $p < 0.1$  for the comparison in *Post3*; analyses as above for the financial literacy scores). Compared to the “pooled” control group consisting of *MP* and the *control* group, the CEs in *Post1* and *Post3* are significantly smaller in the *FL* treatment ( $p < 0.05$ ); for *Post2*, we cannot reject equality ( $p = 0.10$ ). Note that all these comparisons actually consider differences-in-differences or within-person shifts caused by our intervention, as we control for baseline values (measured in *Pre*).

[ Figure 3 about here ]

Overall, the descriptive presentation and the previous group comparisons indicate that the financial literacy intervention has a significant impact on risk aversion in our experimental tasks, in the direction indicated in our pre-registration. In the following, we take a closer look at the changes in CEs to understand better where the changes on the aggregate level come from. First, we consider the fraction of subjects that are classified as risk-averse (with a  $CE < 4.75$ ),

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<sup>18</sup> Recall that amounts were doubled in *Post3*. To have all CEs on the same scale, we normalize the CEs in *Post3* such that the amounts of the high-outcome and the low-outcome in the lotteries coincide, that is, we divide CEs by 2.

risk-neutral (with  $4.75 \leq CE \leq 5.25$ ), or risk-seeking (with  $5.25 < CE$ ). Figure 4 presents these fractions separately for the three treatments and the four measurement points. Looking specifically at the *FL* treatment, we note that the fraction of risk-seeking subjects (17%) has decreased after the intervention (and, although it has increased again over the years, it still remains the smallest across the three groups), while the fraction of risk-averse subjects has constantly increased.

[ Figure 4 about here ]

Another way of looking at the effects of the intervention on behavior in the risk preference task is to consider the changes in the certainty equivalents between the *Pre*-date and the three other dates, subject to the different treatments. Figure 5 shows the cumulative density function of these differences. Compared to *Control* and *MP* (where the changes are largely centered around zero), we see a shift towards negative values in *FL*. For example, while in the control treatment, 50% of the sample have reduced their CE at most by 0 from *Pre* to *Post3*, i.e., they require the same amount or more after the intervention, in the *FL* treatment, 50% have reduced their CE at least by 50 cent.

[ Figure 5 about here ]

*Time preference tasks.* Now we turn to intertemporal choices in the time preference experiment. We start by looking at what we have defined as the *future premium*. Recall that this premium indicates the additional amount (on top of the earlier payment of €10.10) that subjects were asking for to wait for one week to receive a larger payment.<sup>19</sup> We call the future premium in the choice between a payment today and in one week the *premium01*, and the premium in the choice between a payment in one week vs. a payment in two weeks the *premium12*.

We note a significantly negative correlation between the subjects' financial literacy scores and their future premium in *Pre*, i.e., before our intervention. The (rank) correlation is -0.12 (and -0.14, respectively) between the financial literacy score and *premium01* (*premium12*). The correlation coefficients are both significant at the 5% level (two-sided hypotheses, obtaining p-values via wild cluster bootstrapping). This means that subjects with higher financial literacy behave more patiently before any intervention starts. It is also

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<sup>19</sup> Recall that the earlier payment in *Post3* was €20.20.

noteworthy that the differences across treatments in *premium01* and *premium12* in *Pre* are within the limits of chance, even though they differ on average by 10 cents, respectively 20 cents (also see Table 1). Figure 6 then shows how patience develops across our four measurement points, conditional on the treatment.

The upper panel of Figure 6 looks at *premium01*. Overall, *premium01* is €1.20 on average in *Pre*, which implies that subjects demand on average at least €11.30 in one week to give up €10.10 right now. Here we note that in *Control* and *MP* the *premium01* is roughly stable or increases slightly across time. The development in *FL* is different: first, there is a decrease in the future premium to about €0.98 in *Post1*, and the decrease is significant compared to the change in the *control* group ( $p < 0.10$ , analysis as for financial literacy scores and CE). Then the premium decreases further to €0.86 in *Post2*, which is again a significant decrease compared to the change in the control group ( $p < 0.01$ ). Finally, the future premium drops to €0.84 in *Post3*, although not significantly different from the control group.

The general pattern for *premium12* in the lower panel of Figure 6 looks similar to the one described for *premium01*. Again, the future premium is lower in the *Post*-conditions than in *Pre* in the *FL* treatment, while in *Control* and *MP* we see ups and downs. The difference-in-differences is significant for the short-term effects (of *Pre* vs. *Post1*) when comparing *FL* to the *control* group and to the *control* and *MP* groups pooled together ( $p < 0.10$  and  $p < 0.05$ , respectively, analyses as for financial literacy scores, CE and *premium01*). The effects are also significant in the mid and the long run between *FL* and *control* as well as between *FL* and the *control* and *MP* groups pooled together (for *Pre* vs. *Post2*:  $p < 0.01$  in both cases and for *Pre* vs. *Post3*:  $p < 0.05$  in both cases). Overall, both panels of Figure 6 suggest that the financial literacy intervention makes students behave more patiently.

This effect of the financial literacy treatment is in line with our pre-registration, in which we expected financial literacy to improve patience in our experiment, as such a relationship would be consistent with the positive correlations found in earlier studies between financial literacy and savings for retirement, less credit card debt, or higher overall wealth (Boisclair et al., 2017; Lusardi et al., 2017).

[Figure 6 about here]

We can also take a joint look at a subject's choices in both intertemporal choice lists – the one with an upfront delay and the one without it – in order to classify subjects into present-biased, future-biased, and those without any bias of this kind. A subject is classified as present-

biased if her *premium01* is larger than her *premium12*. If the reverse is true, the subject is classified as future-biased. If both premia are identical, there is no bias. Figure 7 presents the distributions of types. While in the *Pre* date the distributions look very similar across treatments (and are not significantly different according to a clustered Chi-squared test building on Donner and Klar, 2000), in *Post2* we notice that the fraction of non-biased subjects (of 72%) is significantly larger in *FL* than in the *control* group or the *control* and *MP* groups pooled together ( $p < 0.05$  in both mean comparisons, two-sided hypotheses, controlling for age, gender, and premia in *Pre*) and stays on that level through *Post3*. This increase in the fraction of non-biased subjects is due to a steady reduction in the share of present-biased subjects in *FL* over time (to 9%), which is the lowest number across all treatments.<sup>20</sup>

[ Figure 7 about here ]

Before moving to our regression analysis, we would like to show how risk aversion and patience measures are related and address the similarity of subjects' decisions across the different waves of data collection. A Spearman rank correlation shows that the students' certainty equivalents and future premia are significantly positively correlated in *Pre*, *Post1*, and *Post2*. Before our interventions (i.e., in *Pre*), the correlation between CE and *premium01*, respectively *premium12*, was 0.10 ( $p = 0.076$ , obtained via wild cluster bootstrapping, two-sided hypothesis), respectively 0.13 ( $p < 0.05$ , analysis as for *premium01*). In *Post1*, the correlations are 0.22 ( $p < 0.01$ , analysis as for *Pre*) and 0.15 ( $p < 0.01$ , analysis as for *Pre*), and in *Post2* they are 0.13 ( $p = 0.084$ , analysis as for *Pre*) and 0.12 ( $p = 0.05$ , analysis as for *Pre*). All of this means that subjects who behave relatively more risk-seeking (i.e., have a higher CE) typically also behave more impatiently (i.e., have a higher future premium). The same general relationship also prevails in *Post3*, yet the correlations are not significant in that final wave.

We can also look at the similarity of choices across the different waves of data collection, and we can do so for both certainty equivalents and the two measures of our future premium together. As a measure of the consistency of a subject's choices across all waves, we use the concept of cosine similarity. It is used to compare the similarity of vectors. It ranges from -1 to 1, with 1 indicating perfectly equal vectors. Multiplying the (positive) cosine similarity for the risk choices and the two time preference lists for a given comparison between two waves yields aggregate measures, which are scalars between 0 to 1, with 1 indicating

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<sup>20</sup> This finding resembles Lührmann et al.'s (2018) major result that financial literacy makes students behave more frequently in a time-consistent manner.

perfect (aggregate) similarity across all choice lists. We find a noteworthy treatment effect such that our *FL*-intervention increases the consistency in choices across waves. Comparing aggregated cosine similarities as just described between *Post1* and *Post2*, *Post2* and *Post3* and *Post1* and *Post3* indicates higher similarity among the *FL* group (with the comparisons for the similarity between *Post2* and *Post3*, and *Post1* and *Post3* being significant,  $p < 0.03$  and  $p < 0.01$ , respectively, two-sided hypotheses, adjusting for age and gender, and  $p$ -values obtained via wild cluster bootstrapping).<sup>21</sup>

### 3.3.2 Regression analysis

We now analyze the short-term, the mid-term, and the long-term effects of our interventions in a regression framework. We take the changes in certainty equivalents and future premia as our dependent variables. The short-term change is defined as the difference between the measure taken one week after the intervention (*Post1*) and the measure one week before it (*Pre*). The mid-term change considers the difference between the *Post2* measurement about half a year after the intervention and the *Pre* measurement. Finally, the long-term change is the difference between the measure in *Post3* and the *Pre*-measurement.

[ Table 2 about here ]

We use OLS regressions and cluster standard errors at the class level ( $N=31$ ).<sup>22</sup> Due to the relatively small number of clusters, we avoid relying on asymptotic arguments (throughout the paper) and thus use the wild cluster bootstrap for inference.<sup>23</sup> In all regressions shown in Tables 2 to 4, we control for age and gender and take into account preference measures and test scores before the intervention started (i.e., at the *Pre*-level). These variables are denoted as *CE\_Pre*, *premium01\_Pre* and *premium12\_Pre*, respectively. The initial test scores are labelled *FL-Score\_Pre* and *MP-Score\_Pre*. For causal interpretation, we include indicator variables for the interventions themselves (*FL* and *MP*). Columns (1), (3), and (5) of Tables 2 to 4 focus on these indicator variables in order to measure the causal intention-to-treat effect. In columns (2),

<sup>21</sup> The reverse side of this finding is the following. It seems natural to assume that across time (with even up to almost 5 years passing by) the similarity of a subject's choices across waves might become weaker (such that the similarity between *Post1* and *Post3* (or *Post2* and *Post3*) is smaller than that between *Post1* and *Post2*). This is, in fact, what we observe. Yet, these declines in similarity are significantly smaller in the *FL*-group than in the other groups ( $p < 0.05$  in both cases; analysis as for the cosine similarity).

<sup>22</sup> Our main results remain robust to clustering on the school level ( $N=11$ ).

<sup>23</sup> Randomization inference – a non-parametric approach to test the sharp null hypothesis (see, e.g., Abadie et al., 2020) – yields the same main results.



(4), and (6) of these tables we add the change in the test scores as explanatory variables in order to examine whether the potential changes in economic behavior are not only due to the intervention per se, but also driven by the extent to which participants improve their knowledge. Therefore, we consider in these regressions the short-term change ( $\Delta FL\text{-}Score\_Post1\text{-}Pre$  or  $\Delta MP\text{-}Score\_Post1\text{-}Pre$ ) or the mid-term change ( $\Delta FL\text{-}Score\_Post2\text{-}Pre$  or  $\Delta MP\text{-}Score\_Post2\text{-}Pre$ ). When investigating long-term changes in *Post3*, we use the average of the two *Post*-scores from waves 1 and 2, respectively ( $\Delta Average\_FL\text{-}Score\_Post\text{-}Pre$  or  $\Delta Average\_MP\text{-}Score\_Post\text{-}Pre$ ). Strictly speaking, the coefficients of these change variables have no causal interpretation, but they complement the evidence on the “internal margin” of our intervention.

Table 2 reports the effects on certainty equivalents. In columns (1), (3), and (5) we see the causal treatment effects. Both in the short run (*Post1*) and the long run (*Post3*) we notice a significantly negative effect of *FL* on the certainty equivalents, meaning that treated subjects behave more risk averse, in comparison to the *Control* treatment that serves as benchmark here. The coefficient for the mid term (*Post2*) is also negative (and of comparable magnitude), but not significant.<sup>24</sup> The monetary policy intervention (*MP indicator*) and the change in the test scores on monetary policy have no significant impact on certainty equivalents in comparison to the *Control* treatment.

As a side result, Table 2 shows gender difference in the short and mid term. On average, women behave more risk-averse than men in our sample, with CEs of €4.96 for men and €4.73 for women before the intervention (even though the difference is not significant). Yet, the change of the certainty equivalent over time is significantly more negative for women than for men in the short and mid term, as the variable *Female* shows in columns (1) to (4) of Table 2. This means that women become relatively more risk-averse over time, compared to men, but this flattens out in the long run.

[ Table 3 about here ]

Tables 3 and 4 examine intertemporal choices in our time preference experiment. The dependent variable is the change in the future premium (recall that a smaller premium indicates

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<sup>24</sup> In the mid term, we note in column (4) an influence of an improvement in financial literacy ( $\Delta FL\text{-}Score\_Post2\text{-}Pre$ ). Those subjects who improve their score more behave less risk-averse, meaning that larger improvements in financial literacy countervail the shift towards more risk aversion of the intervention per se. Given that we don’t find such a pattern in the short and long run (columns (2) and (6)) and given that we find an improvement in financial literacy to systematically correlate with more patient behavior in Tables 3 and 4, we don’t want to emphasize this result in column (4) too much.

more patience). Like in Table 2 on certainty equivalents, columns (1), (3), and (5) identify the causal treatment effects, while columns (2), (4), and (6) of Tables 3 and 4 add insights on the degree to which an improvement in financial literacy affects an individual's intertemporal choices as well.

Looking first at the causal treatment effects, we note from both Table 3 and Table 4 that our *FL* treatment reduces the future premium. Except for the long term and *premium01* (Table 3), this effect is always significant, and on average the future premium is reduced by around 0.30 Euro (with estimates ranging from 0.15 to 0.50 euro). In the even columns of Tables 3 and 4, we see a very consistent effect of an improvement in financial literacy on intertemporal choices. Looking at the changes in test scores on financial literacy –  $\Delta FL\_Score\_Post1-Pre$ ,  $\Delta FL\_Score\_Post2-Pre$  and  $\Delta Average\_FL\_Score\_Post-Pre$  – we see they are all significantly negative, meaning that the additional amount of money that subjects require to wait for one more week becomes smaller with larger improvements of the scores. In other words, those subjects who have become more financially literate after our intervention behave more patiently (and this is irrespective of whether there is an upfront delay for the smaller payment or not). In the even columns (2), (4), and (6) of Tables 3 and 4, the treatment dummy for *FL* remains only significant in the mid term, while it loses significance in the short and long term. This suggests that the main effects of the *FL*-dummy in columns (1), (3), and (5) works through the improvements in financial literacy.

Contrary to the *FL* intervention, the *MP* intervention (that taught monetary policy issues) never has any significant effect – neither a main effect nor any indirect effect through changes in the monetary policy score.

From Tables 3 and 4 we also see some differences depending on demographics. In the short and mid term, older participants need to be compensated slightly more for waiting another week. In the long term, this is no longer significant, however.<sup>25</sup> Throughout all waves, the change in the future premium is smaller for women than for men, which means that women become relatively more patient over time, compared to the changes of men.

[ Table 4 about here ]

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<sup>25</sup> This pattern might reflect earlier findings that patience measures remain fairly stable when subjects enter adulthood (which is the case in Post3). See Sutter et al. (2019) for a survey on the development of patience in childhood and adolescence.

So, overall, we find that our intervention on financial literacy has impacts on both measures of risk aversion and of patience. For certainty equivalents, the intervention has a main effect in itself, making subjects in the aggregate behave slightly more risk-averse. With respect to intertemporal choice, we have seen a positive main effect of the intervention itself, which seems to work mainly through improvements in financial literacy. In Appendix A, Tables A5 to A7, we show that these main results remain robust to an alternative specification where we consider also non-rationalizable choices by simply counting the number of times a subject prefers the lottery over the sure payment (as our counting equivalent to the CE measure in Table A5) or the number of times someone prefers the sooner payment over the later payment in the two intertemporal choice tasks (as our counting equivalent to the premium measure/measure of impatience in Tables A6 and A7). This means that our main analysis in the paper with the restriction on rationalizable choices does not influence our main results.

### 3.4 Relation to field behavior

In the baseline questionnaire (*Pre*) we had included only a few items on field behavior, which was due to the fact that we were mainly interested in measuring the impact of our intervention on observed behavior in our incentivized risk and time preference experiments. Yet, we see from the baseline data that smoking is positively correlated with certainty equivalents (Spearman's  $\rho = 0.09$ ;  $p\text{-value} = 0.065$ ,  $p\text{-value}$  obtained via wild cluster bootstrap; one-sided hypothesis) and future premia (Spearman's  $\rho = 0.19$  and  $\rho = 0.13$  for *premium01* and *premium12*, respectively; both  $p\text{-values} < 0.01$ , analysis as for CE). This means that those behaving more risk-seeking and more impatiently are more likely to smoke. Regarding financial behavior, we find that more impatiently behaving students are more likely to gamble with their money (Spearman's  $\rho = 0.11$  for *premium01* and  $\rho = 0.07$  for *premium12* with  $p\text{-value} < 0.01$  and  $p\text{-value} = 0.071$ , respectively, analysis as for smoking) and so are those that show more risk tolerance (Spearman's  $\rho = 0.07$ ,  $p\text{-value} = 0.072$ , analysis as for smoking).

In *Post3*, between 3 and almost 5 years after our intervention, we have included an extensive survey on financial behavior, as our participants have reached adulthood and are expected to be faced with more and potentially difficult financial decisions. Our survey was based on the survey by Brown et al. (2018), the financial management behavior scale by Dew and Xiao (2011), the responsible financial consumption behavior scale by Barbic et al (2018), and the brief money management scale by Ksendzova et al (2017). Since several questions in

these scales were very similar, we did not use all questions in each scale. In Appendix C, Parts C to G, we reprint the survey questions related to financial behavior that we used in *Post3*.

In Table 5 we look at how different categories of financial behavior, as measured in *Post3*, are related to our two intervention dummies (*FL* and *MP*) and to risk aversion and patience measures at the same measurement point. Panel I refers to spending behavior, including questions such as whether subjects compare prices when buying goods, or whether they pay bills on time. Panel II covers savings behavior, with questions such as whether subjects save something from their disposable income or whether they invest into pension plans. Panel III is about insurance coverage, like for one's car, or health insurance. Given that this is usually mandatory in Germany, the questions might not be very informative in this case, but we had included them for completeness as insurance coverage is an important aspect of financial behavior. Panel IV is related to financial planning behavior, based on questions about whether subjects follow an elaborate monthly spending plan or review their expenses regularly. Panel V we label as non-wasteful, non-high-risk financial behavior. This category uses the questions on smoking, betting for money or participating in lotteries (that we had already used in *Pre*), and added a question on whether subjects own bitcoins. Finally, Panel VI captures financial independence. This is based on the number of spending categories that subjects pay for themselves, rather than having parents or friends or partner pay for it. These categories are mobile telephone, clothes, lunch, sports, transportation, education, further leisure activities. This panel also includes information on whether someone still lives with their parents or on their own. While panels I-IV rely on Drew and Xiao (2011), Barbic et al. (2018) and Ksendzova et al. (2017) and target adult financial behavior, panels V and VI are based on Brown et al. (2018) and aim more at the financial situations of adolescents. In all panels, the dependent variable is always coded as "sustainable" behavior, i.e., behavior that reflects a better and more independent financial situation. For example, the financial independence scale contains the sum of expense categories that are paid by participants themselves, with a "bonus point" for having moved out from home. In a similar vein, all other scales sum up the frequencies on a 5-point likert-scale with which participants engage in the "sustainable" behavior at question, ranging from "never" to "always" (where we have reverse-coded questions on non-sustainable behavior).<sup>26</sup>

[Table 5 about here]

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<sup>26</sup> Bitcoin ownership, however, entered the scale in its original binary form.

We see from the first columns in each panel of Table 5 that our *FL*-intervention dummy is significantly positive for non-wasteful, non-high-risk financial behavior and for financial independence. Against the background of the reduced sample size in *Post3*, we consider this as modest main treatment effects. The certainty equivalents and future premia measured in *Post3* are related in expected ways to financial field behavior, particularly so the future premia. *Premium01* is in five out of six panels significantly negative, as column 3 in each panel indicates. This means that lower future premia – i.e., higher patience in these intertemporal choice tasks – is related to more sustainable behavior in each category. The results for *premium12* are qualitatively identical, albeit slightly less often significant. The relation of certainty equivalents (in the second column of each panel) is weakest among our experimental variables, yet still in the expected direction in the significant cases. More risk-averse behaving subjects have more sustainable spending behavior and better savings behavior. Overall, the results from the survey on financial behavior in *Post3* suggests that economic behavior in our risk and time preference experiments is related to financial field behavior in meaningful ways. Given that we have been able to show that an intervention on teaching financial literacy in schools has a long-lasting effect on risk aversion and patience in these tasks, this suggests that improvements in financial literacy also affect financial field behavior.<sup>27</sup>

#### 4. Conclusion

According to the OECD (2017), financial literacy is an essential skill in life. Despite its obvious importance, large fractions of citizens in many countries around the globe are financially illiterate (Lusardi and Mitchel, 2014). Teaching financial literacy may be one potential remedy to improve financial decisions of citizens. While financial literacy is rarely included in standard curricula at school (a few exceptions are discussed in Lusardi and Mitchell, 2014), several recent randomized control trials have provided evidence that education programs would have the potential to increase financial literacy (e.g., Bruhn et al., 2016, Berg and Zia, 2017, Bjorvatn et al., 2020, Frisanchi, 2023). Given that financial literacy has often been shown to correlate with sounder financial decision-making (e.g., with respect to mortgage choices, savings for

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<sup>27</sup> It looks as if our intervention also had an impact on educational choices. Recall that in *Post3* all students had left high-school. We found that those in the *FL*-intervention group were more likely to continue with tertiary education (at a university, for example) than the students in the control group (mean comparison;  $p = 0.0675$ ; obtained via wild cluster bootstrap; two-sided hypothesis; regression-adjusted for age, gender, certainty equivalents and future premia).

retirement, or earnings from savings accounts; Agarwal et al., 2010; Boisclair et al., 2017; Deuflhard et al., 2019), it remains an important question why financial literacy is linked to better field choices in many cases.<sup>28</sup>

In this paper, we have presented a field experiment in German high schools that was intended to examine whether teaching financial literacy has an effect on the participants' risk aversion and patience in risk and time preference experiments. We developed a four-week intervention on financial literacy, implemented it in 11 schools and contrasted it with two control treatments, one comprising the regular courses (in subjects related to social sciences, economics, business, and politics) and another focusing on monetary policy. A key feature of our design was to have three touchpoints in schools to measure the students' knowledge and their behavior in risk and intertemporal choice tasks, one week before the intervention, one week after it, and about half a year later. In a follow-up study, we added a fourth touchpoint to measure students' economic behavior in these incentivized risk and time experiments between three and almost five years after the intervention. This allowed us to measure short-term, mid-term and long-term effects of both the intervention *per se* and the changes in financial literacy. By having considered both risk aversion and patience, our design took into account the close relationship of risk and time preferences (Epper and Fehr-Duda, 2023), and it catered to the fact that almost all financial decision involve both an intertemporal and a risk component. Most importantly, in our opinion, our long-term follow up for up to almost five years allows us to study whether the effects of teaching financial literacy are persistent from adolescence into early adulthood.

We found that the financial literacy intervention makes subjects behave more patiently, more time-consistent, and slightly more risk averse. In comparison to our financial literacy intervention, the monetary policy intervention did not have any of the effects that we observed in the *FL* treatment. The effects of our financial literacy education were largely stable across time, meaning that they persisted for up to almost five years after the intervention, at which time all subjects had finished high-school and were already young adults (while during our intervention they were on average 16 years old). Given that there were no incentives beyond personal interest for teachers to engage with the material (and it was not even covered in graded tests), it seems reasonable to assume that including an intervention like ours in standard curricula leads to effects at least as large as those reported here.

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<sup>28</sup> Recall that financial education programs may also have unintended side effects. For instance, their focus on money can have negative effects on graduation rates or increase the use of expensive credit for consumer purchase (Bruhn et al., 2016, Bjorvatn et al., 2020).

Based on our survey, we also found that risk aversion and patience measures are related in meaningful and expected ways to various categories of financial field behavior. More risk averse and more patiently behaving subjects were more considerate in their spending behavior, more likely to save money from their disposable income, and less likely to incur debt. They were also more likely to be financially independent. All of these findings support and complement earlier work showing that behavioral measures from risk and time preference experiments are associated with individuals' health, education, financial and lifetime outcomes (e.g., Moffitt et al., 2011; Dohmen et al., 2011; Sutter et al., 2013; Golsteyn et al., 2014, Schneider and Sutter, 2022).

To conclude, we have identified a causal effect of our financial literacy intervention on risk aversion and patience as measured in our experimental tasks, and this effect persisted over our whole study period of up to almost five years. Moreover, our experimental measures are linked in meaningful ways to financial decision-making. This suggests that the well-established link between financial literacy and financial decisions (see Lusardi and Mitchell, 2014) may—at least partly – be driven by an effect of teaching financial literacy on economic decision-making as observed in our experiments. This effect also links our paper to the larger literature on the formation of economic preferences and their malleability. While the studies by Alan and Ertac (2018, 2019), Alan et al. (2019), Cappelen et al. (2020), and Kosse et al. (2020) have found that educational interventions affect children's economic decision-making, we have shown that adolescents around the age of 16 are also accessible to behavioral interventions that change their risk aversion and patience measures. Thus, our intervention has affected two important components of economic decision-making, both of which are undeniably important for many decisions in life, in particular financial ones.

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## Figures

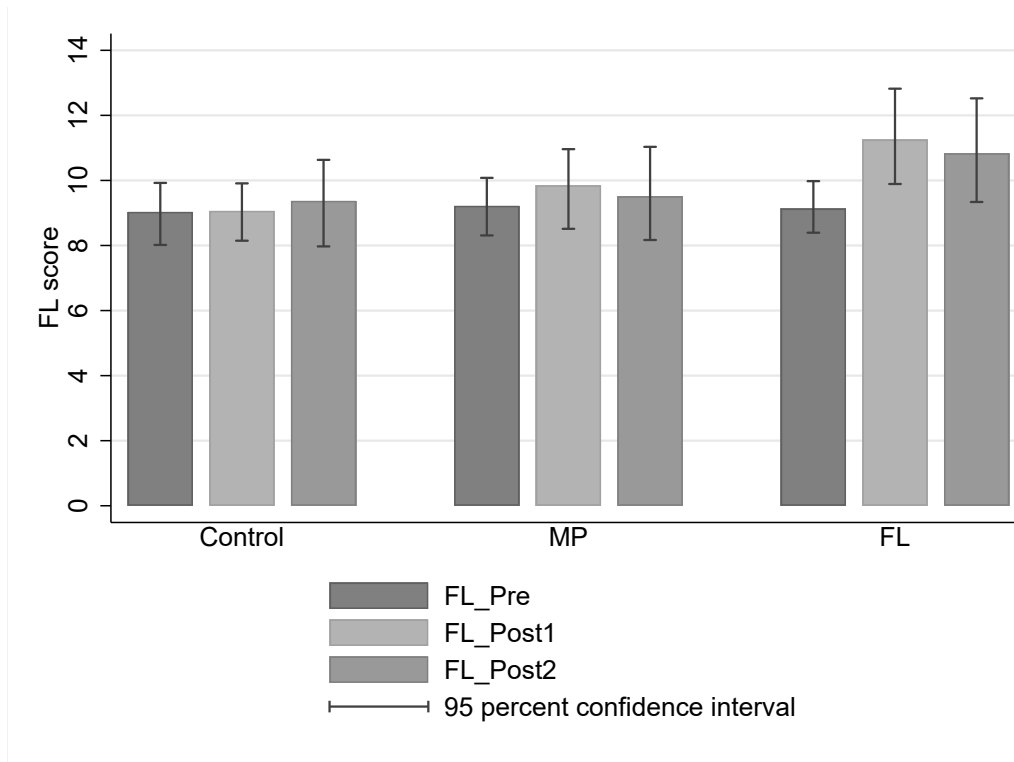


Figure 1: Scores in the financial literacy test, conditional on treatment and time of visit

*Notes:* Confidence intervals obtained via wild cluster bootstrap.

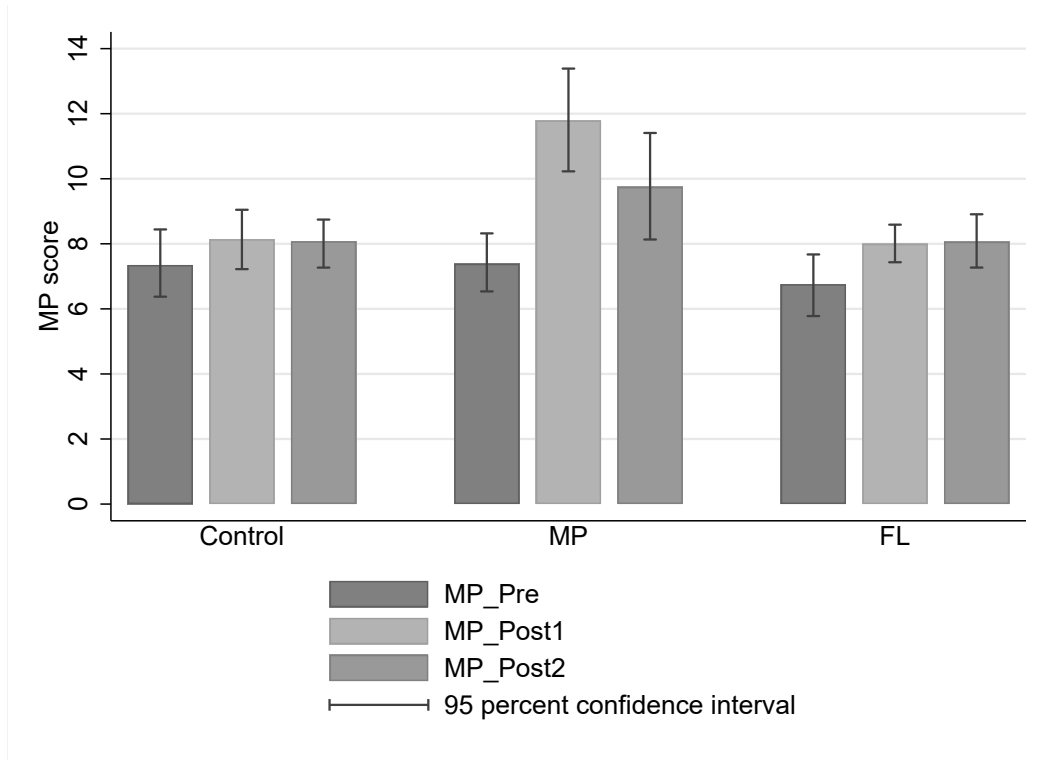


Figure 2: Scores in the monetary policy test, conditional on treatment and time of visit

Notes: Confidence intervals obtained via wild cluster bootstrap.

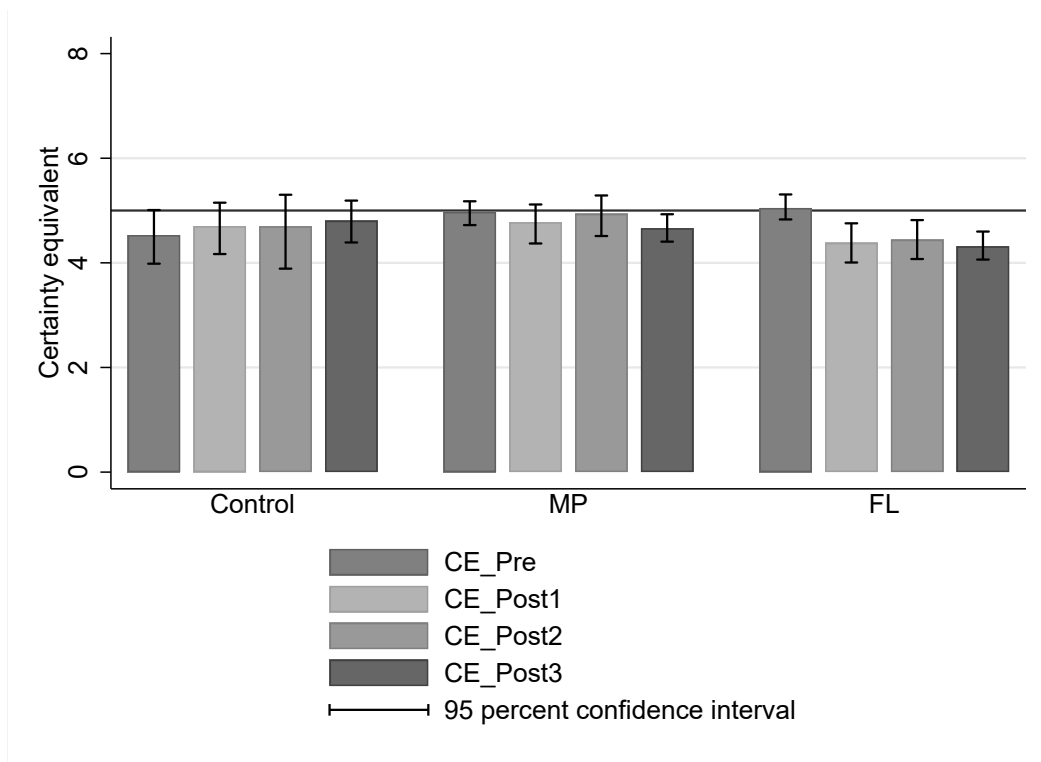


Figure 3: Certainty equivalent (CE) in risk elicitation task, conditional on treatment and time of visit

Notes: The bold horizontal line indicates the lottery's expected value, and a corresponding certainty equivalent indicates risk neutrality. Confidence intervals obtained via wild cluster bootstrap.

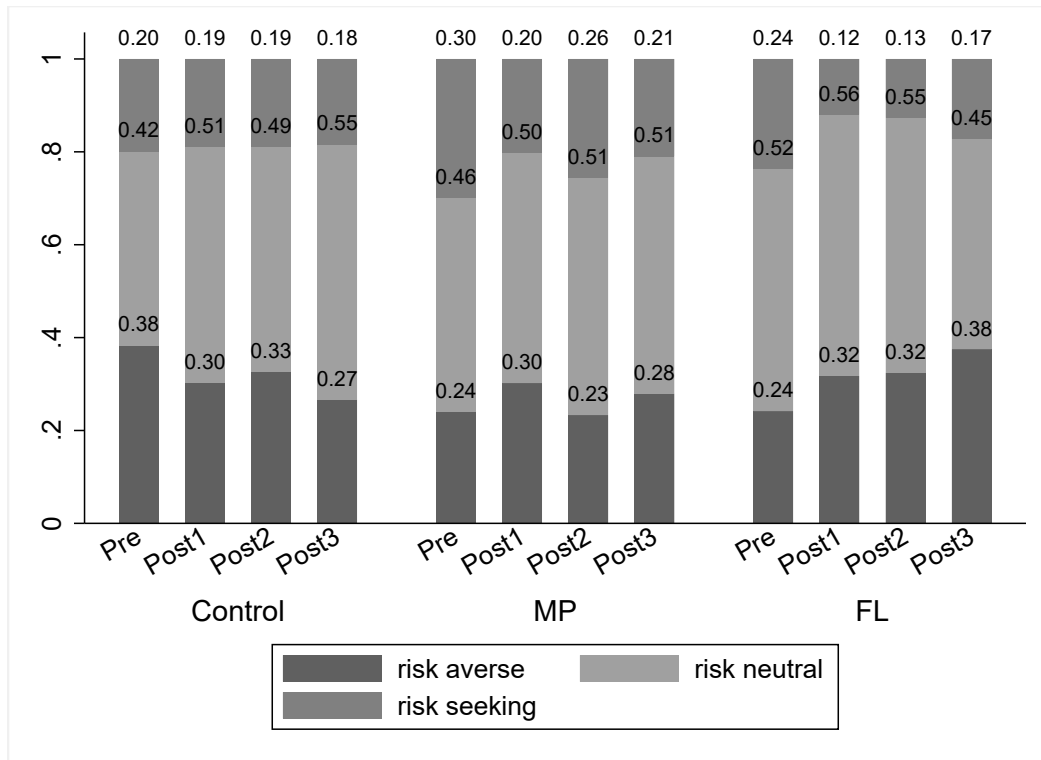


Figure 4: Classification of types in risk elicitation task, conditional on treatment and time of visit

Notes: Numbers above bars indicate relative frequencies.

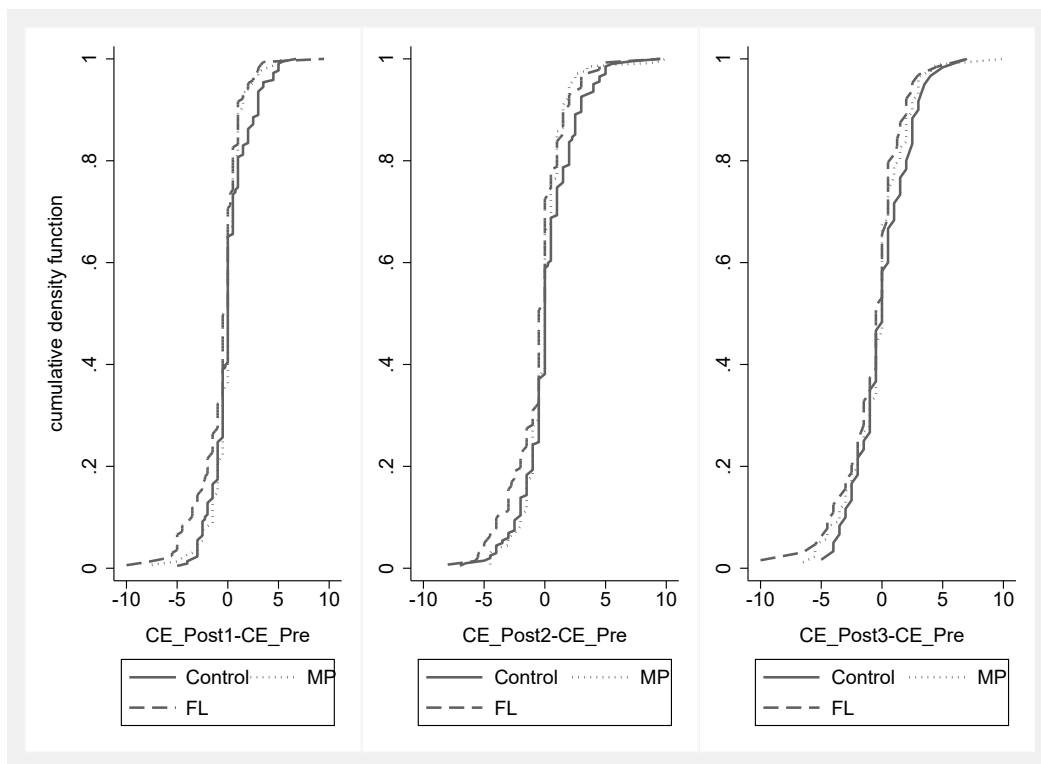
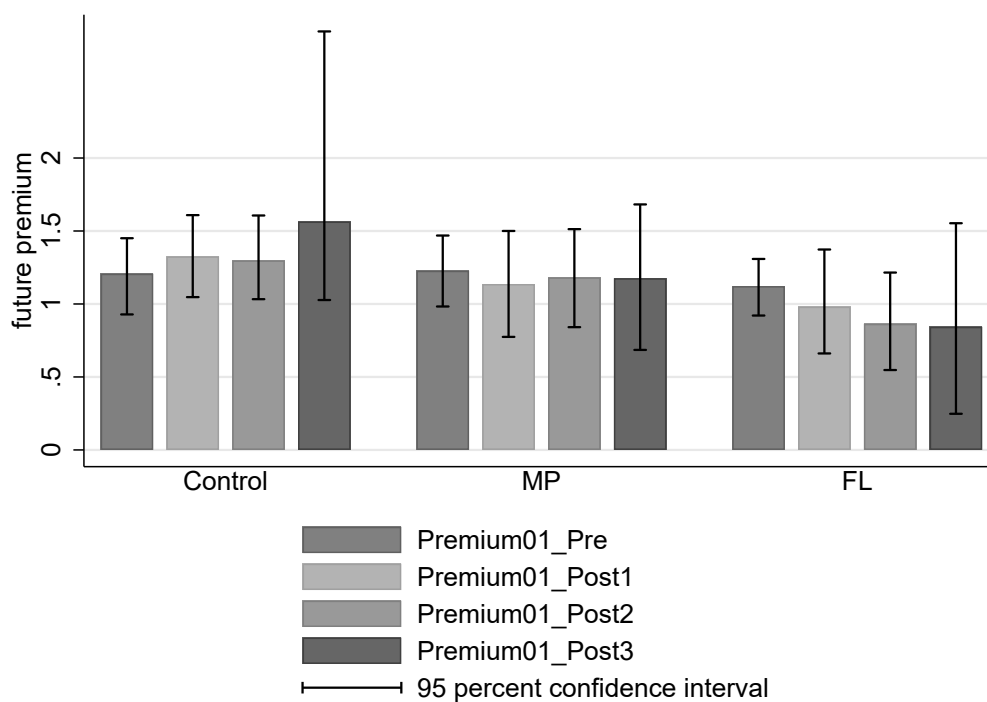
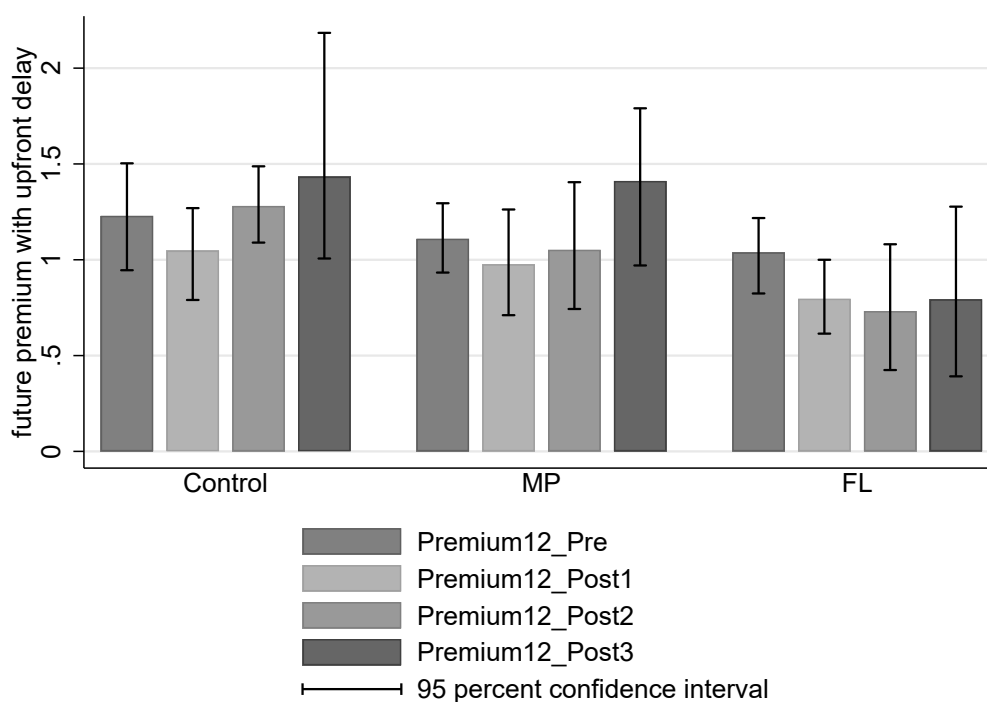


Figure 5: Cumulative density function of the change in certainty equivalents (CE) in the short term (Post1 - Pre; left panel), the longer term (Post2 - Pre; central panel), and the long term (Post3 - Pre; right panel), conditional on treatment



(a) *premium01* (payment today vs. in one week)



(b) *premium12* (payment in one week vs. in two weeks)

Figure 6: Future premium, conditional on treatment and time of visit

Notes: Confidence intervals obtained via wild cluster bootstrap.



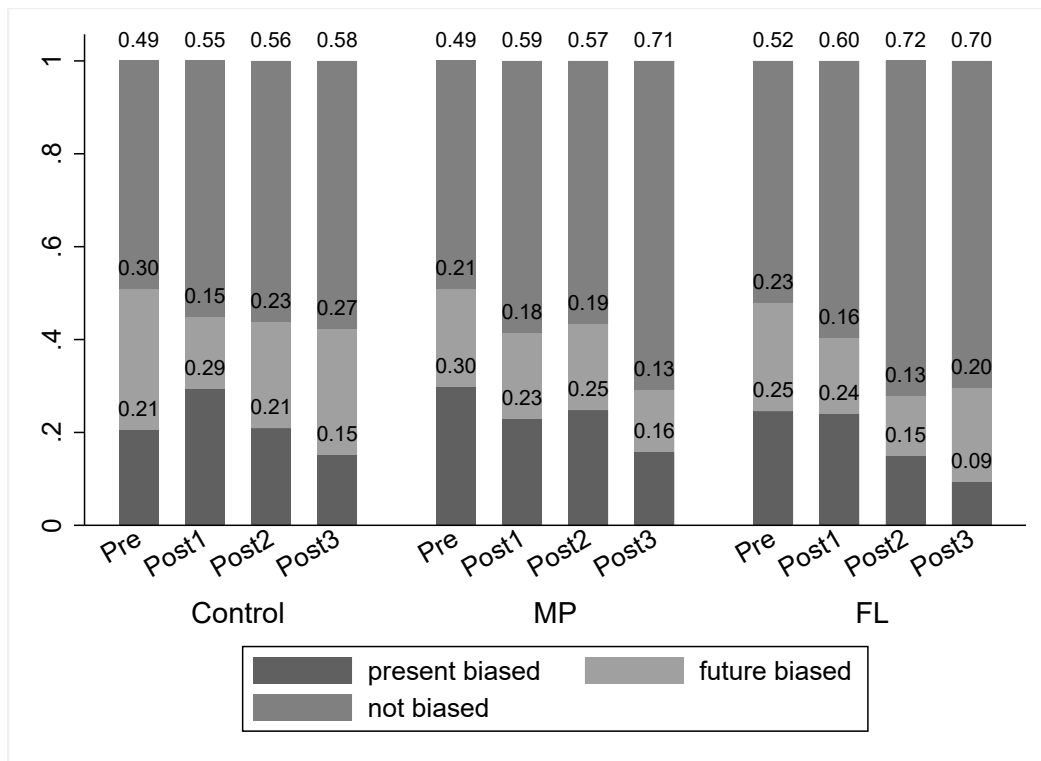


Figure 7: Classification of subjects as present-biased, future-biased or not biased in intertemporal choice, conditional on treatment and date of visit

# Tables

Table 1: Baseline characteristics of our sample and the treatment arms

	(0) Full Sample		(1) CONTROL		(2) MP		(3) FL		Balance
	Mean/SD	N	Mean/SD	N	Mean/SD	N	Mean/SD	N	F stat./p
CE_Pre	4.82 (1.73)	603	4.53 (1.83)	246	4.98 (1.72)	173	5.06 (1.54)	184	2.19 (0.14)
premium01_Pre	1.20 (1.14)	617	1.22 (1.15)	251	1.23 (1.18)	178	1.13 (1.10)	188	0.31 (0.79)
premium12_Pre	1.14 (1.11)	610	1.24 (1.15)	243	1.11 (1.12)	178	1.05 (1.04)	189	0.83 (0.53)
FL-Score_Pre	9.09 (2.80)	626	9.03 (2.83)	247	9.16 (2.83)	182	9.11 (2.75)	197	0.03 (0.98)
MP-Score_Pre	7.15 (2.95)	626	7.28 (2.90)	247	7.38 (2.92)	182	6.77 (3.01)	197	0.68 (0.59)
Female (=1)	0.52 (0.50)	638	0.46 (0.50)	252	0.52 (0.50)	186	0.59 (0.49)	200	1.71 (0.24)
Age (in years)	16.07 (2.04)	638	16.18 (2.34)	252	15.82 (1.28)	186	16.16 (2.19)	200	0.26 (0.82)
Number of Participants	645	645	257	257	186	186	202	202	645

*Notes:* This table shows baseline values of our measures of risk aversion (*CE\_Pre*), patience without and with upfront delay (*premium01\_Pre* and *premium12\_Pre*, respectively), financial literacy (*FL-Score\_Pre*) as well as of knowledge in monetary policy (*MP-Score\_Pre*) together with observable characteristics elicited before the intervention (see Section 2). In column one, we show the mean value and standard deviation of each variable for the full sample, and in columns two, three and four, we print those for the three treatment groups, the control group, the Monetary Policy group (MP) and the Financial Literacy group (FL), respectively. Column five reports the F statistic corresponding to the model fit or usefulness of a model regressing the observable variable under study on treatment indicators. P-values associated with this F-value usually inform whether the hypothesis that all mean values are equal can be rejected (or, equivalently, that a single coefficient is different from zero, indicating a difference between mean values of two groups). Here, this would not be the case, that is, statistically, there is no reason to conclude that mean values differ. Note, however, that after randomization has been performed such an interpretation is inappropriate, as we *know* that the differences stem from randomness (and assessing how big the chances are that they stem from randomness thus adds little informative value). As readers might find a translation from F-values to p-values helpful, we add these p-values here.

Table 2: Changes in certainty equivalents (CE) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ CE_Post1-Pre		$\Delta$ CE_Post2-Pre		$\Delta$ CE_Post3-Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	-0.022 (0.792)	-0.020 (0.817)	-0.049 (0.721)	-0.052 (0.727)	-0.069 (0.698)	-0.071 (0.690)
Female (=1)	-0.526*** (0.002)	-0.545*** (0.002)	-0.552*** (0.000)	-0.558*** (0.000)	-0.211 (0.486)	-0.258 (0.450)
MP	-0.031 (0.892)	-0.096 (0.657)	0.152 (0.686)	0.134 (0.724)	-0.078 (0.719)	-0.017 (0.960)
FL	-0.431** (0.017)	-0.397** (0.026)	-0.289 (0.221)	-0.390 (0.119)	-0.407*** (0.008)	-0.329** (0.040)
CE.Pre	-0.633*** (0.000)	-0.617*** (0.000)	-0.771*** (0.000)	-0.784*** (0.000)	-1.023*** (0.000)	-1.029*** (0.000)
FL-Score.Pre	0.004 (0.901)	-0.002 (0.946)	-0.004 (0.913)	0.027 (0.544)	0.046 (0.304)	0.031 (0.481)
MP-Score.Pre	0.051 (0.108)	0.067** (0.041)	0.023 (0.565)	0.004 (0.926)	0.014 (0.757)	-0.004 (0.952)
$\Delta$ FL-Score_Post1-Pre		-0.008 (0.739)				
$\Delta$ MP-Score_Post1-Pre		0.019 (0.516)				
$\Delta$ FL-Score_Post2-Pre				0.062*** (0.008)		
$\Delta$ MP-Score_Post2-Pre				-0.021 (0.446)		
$\Delta$ Average_FL-Score_Post-Pre						-0.038 (0.518)
$\Delta$ Average_MP-Score_Post-Pre						-0.024 (0.561)
Constant	3.242*** (0.005)	3.066*** (0.004)	4.591*** (0.000)	4.559*** (0.001)	5.490*** (0.009)	5.904*** (0.007)
<i>N</i>	519	516	464	453	206	203

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the CE measure, which we predicted to be negative corresponding to more risk aversion (less risk seeking; see <https://www.socialsciscience.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests).

\*\*\* Significant at the 1 percent level.  
 \*\* Significant at the 5 percent level.  
 \* Significant at the 10 percent level.

Table 3: Changes in the future premium without upfront delay (premium01) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ premium01_Post1-Pre		$\Delta$ premium01_Post2-Pre		$\Delta$ premium01_Post3-Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	0.050 (0.217)	0.048 (0.191)	0.081*** (0.004)	0.085*** (0.004)	0.013 (0.913)	-0.008 (0.954)
Female (=1)	-0.248* (0.071)	-0.269** (0.042)	-0.238** (0.015)	-0.253** (0.011)	-0.586** (0.015)	-0.763*** (0.001)
MP	-0.168 (0.339)	-0.113 (0.611)	-0.075 (0.686)	-0.067 (0.719)	-0.335 (0.464)	-0.188 (0.725)
FL	-0.230* (0.099)	-0.144 (0.230)	-0.321** (0.010)	-0.268** (0.035)	-0.382 (0.215)	0.051 (0.549)
premium01_Pre	-0.428*** (0.000)	-0.438*** (0.000)	-0.499*** (0.000)	-0.513*** (0.000)	-0.423*** (0.003)	-0.451*** (0.004)
FL-Score_Pre	-0.030* (0.083)	-0.047* (0.053)	-0.021 (0.265)	-0.040 (0.118)	-0.072 (0.148)	-0.158** (0.041)
MP-Score_Pre	-0.003 (0.853)	-0.003 (0.909)	-0.018 (0.299)	-0.015 (0.536)	-0.031 (0.578)	-0.031 (0.711)
$\Delta$ FL-Score_Post1-Pre		-0.034** (0.037)				
$\Delta$ MP-Score_Post1-Pre		-0.008 (0.758)				
$\Delta$ FL-Score_Post2-Pre				-0.040* (0.057)		
$\Delta$ MP-Score_Post2-Pre				0.002 (0.921)		
$\Delta$ Average_FL-Score_Post-Pre						-0.175*** (0.005)
$\Delta$ Average_MP-Score_Post-Pre						-0.022 (0.724)
Constant	0.241 (0.579)	0.460 (0.284)	-0.169 (0.613)	-0.046 (0.906)	1.798 (0.425)	3.108 (0.172)
<i>N</i>	540	537	472	461	208	203

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the future equivalence measure (premium), which we predicted to be negative corresponding to more patience (see <https://www.socialscisceregistry.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests).

\*\*\* Significant at the 1 percent level.  
 \*\* Significant at the 5 percent level.  
 \* Significant at the 10 percent level.

Table 4: Changes in the future premium with upfront delay (premium12) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ premium12_Post1-Pre		$\Delta$ premium12_Post2-Pre		$\Delta$ premium12_Post3-Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	0.031* (0.099)	0.032* (0.093)	0.101*** (0.005)	0.097** (0.010)	0.100 (0.386)	0.052 (0.686)
Female (=1)	-0.186 (0.100)	-0.204* (0.074)	-0.300*** (0.006)	-0.310*** (0.008)	-0.395 (0.162)	-0.631** (0.015)
MP	0.012 (0.930)	0.047 (0.753)	-0.118 (0.458)	-0.051 (0.769)	0.023 (0.949)	0.036 (0.932)
FL	-0.150* (0.066)	-0.074 (0.260)	-0.397*** (0.003)	-0.320** (0.019)	-0.504* (0.060)	0.070 (0.566)
premium12_Pre	-0.543*** (0.000)	-0.548*** (0.000)	-0.576*** (0.000)	-0.590*** (0.000)	-0.669*** (0.000)	-0.649*** (0.000)
FL-Score_Pre	-0.004 (0.780)	-0.020 (0.263)	-0.012 (0.481)	-0.023 (0.288)	-0.035 (0.513)	-0.156* (0.074)
MP-Score_Pre	-0.003 (0.855)	0.000 (0.992)	-0.019 (0.333)	-0.036* (0.051)	-0.086* (0.073)	-0.029 (0.765)
$\Delta$ FL-Score_Post1-Pre		-0.029** (0.029)				
$\Delta$ MP-Score_Post1-Pre		-0.004 (0.865)				
$\Delta$ FL-Score_Post2-Pre				-0.042** (0.011)		
$\Delta$ MP-Score_Post2-Pre				-0.028 (0.135)		
$\Delta$ Average_FL-Score_Post-Pre						-0.208*** (0.003)
$\Delta$ Average_MP-Score_Post-Pre						0.049 (0.537)
Constant	0.117 (0.697)	0.250 (0.418)	-0.485 (0.400)	-0.138 (0.846)	0.598 (0.791)	2.121 (0.346)
$N$	528	525	466	455	206	201

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the future equivalence measure (premium), which we predicted to be negative corresponding to more patience (see <https://www.socialscisceregistry.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests).

\*\*\* Significant at the 1 percent level.  
 \*\* Significant at the 5 percent level.  
 \* Significant at the 10 percent level.

Table 5: Relation Between Behavior in Incentivized Risk and Patience Tasks and Field Behavior

Panel I. Dependent Variable: (Sustainable) Spending Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	-0.069	(0.928)	-0.097	(0.899)	-0.279	(0.729)	-0.278	(0.672)
FL	0.586	(0.221)	0.475	(0.281)	0.465	(0.302)	0.148	(0.444)
CE_Post3			-0.248**	(0.024)				
premium01_Post3					-0.398***	(0.000)		
premium12_Post3							-0.347***	(0.000)
$R^2$	0.073		0.085		0.11		0.11	
Observations	247		238		233		235	

Panel II. Dependent Variable: (Sustainable) Saving Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	0.370	(0.599)	0.506	(0.479)	0.062	(0.934)	0.356	(0.608)
FL	0.289	(0.383)	0.303	(0.388)	-0.032	(0.508)	-0.068	(0.526)
CE_Post3			-0.266*	(0.080)				
premium01_Post3					-0.286**	(0.022)		
premium12_Post3							-0.213*	(0.057)
$R^2$	0.0053		0.015		0.021		0.013	
Observations	247		238		233		235	

Panel III. Dependent Variable: (Sustainable) Insurance Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	-0.073	(0.937)	0.081	(0.925)	-0.381	(0.692)	-0.056	(0.951)
FL	-0.843	(0.885)	-0.706	(0.833)	-1.122	(0.952)	-1.045	(0.937)
CE_Post3			0.000	(0.492)				
premium01_Post3					-0.180*	(0.099)		
premium12_Post3							-0.001	(0.490)
$R^2$	0.012		0.011		0.024		0.017	
Observations	247		238		233		235	

Panel IV. Dependent Variable: (Sustainable) Financial Planning Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	0.962	(0.148)	1.009	(0.155)	0.778	(0.288)	0.874	(0.171)
FL	0.409	(0.254)	0.255	(0.329)	0.235	(0.344)	-0.118	(0.566)
CE_Post3			-0.029	(0.431)				
premium01_Post3					0.045	(0.641)		
premium12_Post3							-0.075	(0.295)
$R^2$	0.018		0.022		0.013		0.026	
Observations	247		238		233		235	

Panel V. Dependent Variable: (More) Non-wasteful, Non-high-risk Financial Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	0.217	(0.625)	0.176	(0.690)	0.169	(0.716)	0.169	(0.712)
FL	0.311*	(0.076)	0.246	(0.132)	0.227	(0.191)	0.233	(0.152)
CE_Post3			-0.039	(0.262)				
premium01_Post3					-0.115**	(0.035)		
premium12_Post3							-0.040	(0.287)
$R^2$	0.15		0.15		0.16		0.16	
Observations	245		238		233		235	

Panel VI. Dependent Variable: (More) Independent Financial Behavior								
	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.	Coeff.	p-val.
MP	0.239**	(0.029)	0.219**	(0.038)	0.219*	(0.050)	0.190*	(0.067)
FL	0.233**	(0.018)	0.232**	(0.021)	0.225**	(0.032)	0.203*	(0.050)
CE_Post3			0.011	(0.720)				
premium01_Post3					-0.045***	(0.002)		
premium12_Post3							-0.040***	(0.002)
$R^2$	0.21		0.24		0.25		0.24	
Observations	244		238		233		235	

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study). P-values correspond to two-sided hypotheses, unless we pre-registered a directional hypothesis: In this table, this applies to the relation between field behavior and the financial literacy intervention (FL), the future equivalence measures (premiuma) and the certainty equivalents. The corresponding p-values thus result from one-sided tests. We control for age and gender in all specifications in this table. See Section 3.4 for definitions of the dependent variables. \*\*\* Significant at the 1 percent level / \*\* Significant at the 5 percent level / \* Significant at the 10 percent level

## Online Appendix to

# Financial literacy, experimental preference measures and field behavior – A randomized educational intervention

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## Appendix A – Additional Tables and Figures

### A1 Sample Size, Attrition, and Baseline Balance Across Waves

Table A1: Investigating Selective Attrition – Predicting Attrition by Treatment Status

	Attrition.Pre-Post1	Attrition.Pre-Post2	Attrition.Pre-Post3
	Coef./p-value	Coef./p-value	Coef./p-value
MP	0.019 (0.714)	0.049 (0.636)	-0.262*** (0.009)
FL	-0.031 (0.465)	0.052 (0.568)	-0.093 (0.458)
Constant (=Control Mean)	0.105*** (0.002)	0.171*** (0.002)	0.751*** (0.000)
Difference: MP - FL	0.049 (0.230)	-0.002 (0.982)	-0.169 (0.149)
$R^2$	0.00	0.00	0.05
Observations	645	645	645

*Notes:* This table shows OLS regression results of regressing indicator variables for attrition on treatment status indicator variables. For example, in column one, we show results of a linear probability model predicting attrition between *Pre* and *Post2*. ‘Constant’ denotes the mean of the control group, while ‘FL’ and ‘MP’ are regression coefficients, or, equivalently, differences in means compared to the control group. ‘Difference: MP - FL’ reports the difference in coefficients between FL and MP, or, equivalently, the difference in means between MP and FL, with p-values testing the hypothesis of equality in means in parenthesis. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses.

Table A2: Baseline characteristics of our sample and the treatment arms – Sample in Wave 1

	(0) Full Sample		(1) CONTROL		(2) MP		(3) FL		Balance
	Mean/SD	N	Mean/SD	N	Mean/SD	N	Mean/SD	N	F stat./p
CE.Pre	4.80 (1.73)	546	4.55 (1.83)	222	4.89 (1.70)	153	5.06 (1.58)	171	2.09 (0.17)
premium01.Pre	1.21 (1.15)	560	1.22 (1.16)	227	1.25 (1.19)	158	1.16 (1.12)	175	0.21 (0.86)
premium12.Pre	1.15 (1.12)	551	1.24 (1.17)	219	1.10 (1.12)	156	1.08 (1.05)	176	0.59 (0.64)
FL-Score.Pre	9.07 (2.82)	568	8.96 (2.86)	224	9.22 (2.81)	161	9.08 (2.77)	183	0.10 (0.93)
MP-Score.Pre	7.15 (2.92)	568	7.31 (2.90)	224	7.33 (2.88)	161	6.79 (2.96)	183	0.58 (0.64)
Female (=1)	0.52 (0.50)	575	0.47 (0.50)	226	0.51 (0.50)	163	0.59 (0.49)	186	1.65 (0.24)
Age (in years)	16.04 (2.10)	575	16.12 (2.44)	226	15.78 (1.25)	163	16.17 (2.24)	186	0.29 (0.79)
Number of Participants	580	580	230	230	163	163	187	187	580

*Notes:* For the sample analyzed in *Post1*, this table shows baseline values of our measures of risk aversion (*CE.Pre*), patience without and with upfront delay (*premium01.Pre* and *premium12.Pre*, respectively), financial literacy (*FL-Score.Pre*) as well as of knowledge in monetary policy (*MP-Score.Pre*) together with observable characteristics elicited before the intervention (see Section 2). In column one, we show the mean value and standard deviation of each variable for the full sample, and in columns two, three and four, we print those for the three treatment groups, the control group, the Monetary Policy group (MP) and the Financial Literacy group (FL), respectively. Column five reports the F statistic corresponding to the model fit or usefulness of a model regressing the observable variable under study on treatment indicators. P-values associated with this F-value usually inform whether the hypothesis that all mean values are equal can be rejected (or, equivalently, that a single coefficient is different from zero, indicating a difference between mean values of two groups). Here, this would not be the case, that is, statistically, there is no reason to conclude that mean values differ. Note, however, that after randomization has been performed such an interpretation is inappropriate, as we *know* that the differences stem from randomness (and assessing how big the chances are that they stem from randomness thus adds little informative value). As readers might find a translation from F-values to p-values helpful, we add these p-values here.

Table A3: Baseline characteristics of our sample and the treatment arms – Sample in Wave 2

	(0) Full Sample		(1) CONTROL		(2) MP		(3) FL		Balance
	Mean/SD	N	Mean/SD	N	Mean/SD	N	Mean/SD	N	F stat./p
CE.Pre	4.76 (1.68)	485	4.47 (1.81)	204	4.99 (1.63)	136	4.96 (1.48)	145	2.45 (0.13)
premium01.Pre	1.19 (1.15)	493	1.24 (1.17)	208	1.21 (1.20)	139	1.11 (1.09)	146	0.32 (0.79)
premium12.Pre	1.14 (1.11)	488	1.26 (1.16)	203	1.09 (1.10)	138	1.02 (1.01)	147	0.98 (0.50)
FL-Score.Pre	9.12 (2.80)	505	9.06 (2.83)	208	9.13 (2.84)	142	9.19 (2.75)	155	0.03 (0.99)
MP-Score.Pre	7.21 (2.88)	505	7.32 (2.79)	208	7.44 (2.78)	142	6.85 (3.07)	155	0.47 (0.72)
Female (=1)	0.54 (0.50)	509	0.47 (0.50)	208	0.55 (0.50)	145	0.61 (0.49)	156	1.25 (0.38)
Age (in years)	16.01 (2.12)	509	16.07 (2.48)	208	15.74 (1.26)	145	16.17 (2.23)	156	0.26 (0.81)
Number of Participants	515	515	213	213	145	145	157	157	515

*Notes:* For the sample analyzed in *Post2*, this table shows baseline values of our measures of risk aversion (*CE.Pre*), patience without and with upfront delay (*premium01.Pre* and *premium12.Pre*, respectively), financial literacy (*FL-Score.Pre*) as well as of knowledge in monetary policy (*MP-Score.Pre*) together with observable characteristics elicited before the intervention (see Section 2). In column one, we show the mean value and standard deviation of each variable for the full sample, and in columns two, three and four, we print those for the three treatment groups, the control group, the Monetary Policy group (MP) and the Financial Literacy group (FL), respectively. Column five reports the F statistic corresponding to the model fit or usefulness of a model regressing the observable variable under study on treatment indicators. P-values associated with this F-value usually inform whether the hypothesis that all mean values are equal can be rejected (or, equivalently, that a single coefficient is different from zero, indicating a difference between mean values of two groups). Here, this would not be the case, that is, statistically, there is no reason to conclude that mean values differ. Note, however, that after randomization has been performed such an interpretation is inappropriate, as we *know* that the differences stem from randomness (and assessing how big the chances are that they stem from randomness thus adds little informative value). As readers might find a translation from F-values to p-values helpful, we add these p-values here.



Table A4: Baseline characteristics of our sample and the treatment arms – Sample in Wave 3

	(0) Full Sample		(1) CONTROL		(2) MP		(3) FL		Balance
	Mean/SD	N	Mean/SD	N	Mean/SD	N	Mean/SD	N	F stat./p
CE.Pre	4.90 (1.81)	216	4.76 (1.82)	63	4.95 (1.78)	88	4.98 (1.84)	65	0.24 (0.82)
premium01.Pre	1.14 (1.19)	221	1.24 (1.25)	63	1.23 (1.29)	93	0.91 (0.95)	65	1.92 (0.20)
premium12.Pre	1.09 (1.16)	219	1.22 (1.27)	61	1.09 (1.23)	92	0.97 (0.95)	66	0.81 (0.58)
FL-Score.Pre	9.74 (2.81)	225	9.88 (2.69)	64	9.47 (2.80)	92	9.97 (2.95)	69	0.43 (0.76)
MP-Score.Pre	7.64 (2.93)	225	7.74 (2.84)	64	7.74 (2.97)	92	7.41 (2.99)	69	0.13 (0.92)
Female (=1)	0.48 (0.50)	227	0.34 (0.48)	64	0.54 (0.50)	95	0.54 (0.50)	68	2.29 (0.23)
Age (in years)	15.93 (1.40)	227	15.72 (1.15)	64	15.99 (1.24)	95	16.06 (1.76)	68	0.31 (0.78)
Number of Participants	228	228	64	64	95	95	69	69	228

*Notes:* For the sample analyzed in *Post3*, this table shows baseline values of our measures of risk aversion (*CE.Pre*), patience without and with upfront delay (*premium01.Pre* and *premium12.Pre*, respectively), financial literacy (*FL-Score.Pre*) as well as of knowledge in monetary policy (*MP-Score.Pre*) together with observable characteristics elicited before the intervention (see Section 2). In column one, we show the mean value and standard deviation of each variable for the full sample, and in columns two, three and four, we print those for the three treatment groups, the control group, the Monetary Policy group (MP) and the Financial Literacy group (FL), respectively. Column five reports the F statistic corresponding to the model fit or usefulness of a model regressing the observable variable under study on treatment indicators. P-values associated with this F-value usually inform whether the hypothesis that all mean values are equal can be rejected (or, equivalently, that a single coefficient is different from zero, indicating a difference between mean values of two groups). Here, this would not be the case, that is, statistically, there is no reason to conclude that mean values differ. Note, however, that after randomization has been performed such an interpretation is inappropriate, as we *know* that the differences stem from randomness (and assessing how big the chances are that they stem from randomness thus adds little informative value). As readers might find a translation from F-values to p-values helpful, we add these p-values here.

## A2 Using Raw Count Measures (Including Irrational and Inconsistent Choices)

Table A5: Changes in risk preferences (CE\_count, measured by counting the number of risky choices) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ CE_count_Post1-Pre		$\Delta$ CE_count_Post2-Pre		$\Delta$ CE_count_Post3-Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	0.057 (0.702)	0.059 (0.694)	-0.005 (0.975)	-0.005 (0.976)	-0.088 (0.694)	-0.057 (0.798)
Female (=1)	-1.098*** (0.001)	-1.166*** (0.001)	-1.276*** (0.000)	-1.292*** (0.000)	-0.501 (0.356)	-0.612 (0.293)
MP	0.135 (0.756)	0.165 (0.727)	0.281 (0.688)	0.286 (0.667)	-0.272 (0.488)	-0.199 (0.669)
FL	-0.684* (0.080)	-0.520 (0.153)	-0.252 (0.403)	-0.437 (0.313)	-0.825** (0.026)	-0.833** (0.035)
CE_count_Pre	-0.661*** (0.000)	-0.647*** (0.000)	-0.827*** (0.000)	-0.843*** (0.000)	-1.006*** (0.000)	-1.014*** (0.000)
FL-Score_Pre	-0.017 (0.751)	-0.043 (0.426)	-0.034 (0.613)	0.029 (0.689)	0.074 (0.335)	0.107 (0.139)
MP-Score_Pre	0.084 (0.155)	0.094 (0.135)	0.003 (0.961)	-0.047 (0.532)	0.022 (0.783)	-0.036 (0.728)
$\Delta$ FL-Score_Post1-Pre		-0.054 (0.249)				
$\Delta$ MP-Score_Post1-Pre		-0.001 (0.987)				
$\Delta$ FL-Score_Post2-Pre				0.125*** (0.010)		
$\Delta$ MP-Score_Post2-Pre				-0.057 (0.251)		
$\Delta$ Average_FL-Score_Post-Pre						0.016 (0.878)
$\Delta$ Average_MP-Score_Post-Pre						-0.061 (0.347)
Constant	5.219** (0.017)	5.256** (0.016)	8.382*** (0.001)	8.359*** (0.001)	9.826** (0.011)	9.584** (0.014)
N	565	562	502	491	224	219

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the future equivalence measure (premium), which we predicted to be negative corresponding to more patience (see <https://www.socialscienceregistry.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests.

\*\*\* Significant at the 1 percent level.  
 \*\* Significant at the 5 percent level.  
 \* Significant at the 10 percent level.

Table A6: Changes in the future premium without upfront delay (premium01\_count, measured by the number of impatient choices) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ premium_count01_Post1- Pre		$\Delta$ premium_count01_Post2- Pre		$\Delta$ premium_count01_Post3- Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	0.215 (0.112)	0.198 (0.127)	0.483*** (0.000)	0.491*** (0.000)	0.012 (0.963)	-0.031 (0.909)
Female (=1)	-0.959 (0.157)	-1.099* (0.099)	-1.313** (0.014)	-1.425*** (0.009)	-0.849* (0.087)	-1.311** (0.011)
MP	-0.729 (0.367)	-0.550 (0.563)	-0.384 (0.572)	-0.315 (0.649)	-0.376 (0.704)	0.090 (0.931)
FL	-1.214* (0.074)	-0.772 (0.199)	-1.637*** (0.004)	-1.327** (0.019)	-1.028 (0.166)	-0.055 (0.489)
premium01_count_Pre	-0.419*** (0.000)	-0.432*** (0.000)	-0.514*** (0.000)	-0.533*** (0.000)	-0.687*** (0.000)	-0.702*** (0.000)
FL-Score_Pre	-0.122 (0.203)	-0.227* (0.064)	-0.079 (0.407)	-0.185 (0.131)	-0.131 (0.312)	-0.342* (0.055)
MP-Score_Pre	0.009 (0.905)	0.030 (0.803)	-0.088 (0.278)	-0.079 (0.522)	-0.125 (0.323)	-0.149 (0.426)
$\Delta$ FL-Score_Post1-Pre		-0.190*** (0.009)				
$\Delta$ MP-Score_Post1-Pre		-0.015 (0.895)				
$\Delta$ FL-Score_Post2-Pre				-0.229** (0.037)		
$\Delta$ MP-Score_Post2-Pre				0.004 (0.975)		
$\Delta$ Average_FL-Score_Post-Pre						-0.415*** (0.003)
$\Delta$ Average_MP-Score_Post-Pre						-0.083 (0.562)
Constant	1.351 (0.553)	2.607 (0.279)	-1.766 (0.283)	-0.738 (0.706)	4.596 (0.304)	7.881* (0.083)
N	565	562	502	491	224	219

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the future equivalence measure (premium), which we predicted to be negative corresponding to more patience (see <https://www.socialscienceregistry.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests.

\*\*\* Significant at the 1 percent level.  
\*\* Significant at the 5 percent level.  
\* Significant at the 10 percent level.

Table A7: Changes in the future premium with upfront delay (premium12\_count, measured by the number of impatient choices) in the short term (column 1), in the mid term (column 2), and in the long term (column 3)

	$\Delta$ premium_count12_Post1- Pre		$\Delta$ premium_count12_Post2- Pre		$\Delta$ premium_count12_Post3- Pre	
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value	$\Delta$ /p-value
Age (in years)	0.351*** (0.001)	0.336*** (0.001)	0.498*** (0.000)	0.507*** (0.000)	0.284 (0.270)	0.160 (0.523)
Female (=1)	-0.794 (0.164)	-0.905 (0.117)	-1.448** (0.012)	-1.509*** (0.010)	-0.878 (0.180)	-1.449** (0.024)
MP	-0.114 (0.862)	0.023 (0.975)	-0.396 (0.511)	-0.057 (0.928)	0.022 (0.976)	0.051 (0.958)
FL	-0.924** (0.050)	-0.540 (0.196)	-1.933*** (0.001)	-1.603*** (0.007)	-1.360** (0.038)	-0.088 (0.469)
premium12_count.Pre	-0.549*** (0.000)	-0.556*** (0.000)	-0.578*** (0.000)	-0.598*** (0.000)	-0.832*** (0.000)	-0.824*** (0.000)
FL-Score.Pre	-0.039 (0.617)	-0.128 (0.175)	-0.079 (0.319)	-0.137 (0.146)	-0.006 (0.963)	-0.305 (0.116)
MP-Score.Pre	-0.045 (0.481)	-0.023 (0.825)	-0.106 (0.253)	-0.223** (0.034)	-0.222* (0.064)	-0.083 (0.698)
$\Delta$ FL-Score.Post1-Pre		-0.159** (0.015)				
$\Delta$ MP-Score.Post1-Pre		-0.011 (0.917)				
$\Delta$ FL-Score.Post2-Pre				-0.216*** (0.006)		
$\Delta$ MP-Score.Post2-Pre				-0.163* (0.061)		
$\Delta$ Average_FL-Score.Post-Pre						-0.481*** (0.001)
$\Delta$ Average_MP-Score.Post-Pre						0.115 (0.477)
Constant	-1.597 (0.329)	-0.597 (0.723)	-1.615 (0.305)	-0.039 (0.983)	0.580 (0.891)	4.410 (0.286)
N	565	562	502	491	224	219

Notes: Results from OLS regressions. P-values obtained via wild cluster bootstrapping (to account for the “small” number of clusters in our study) in parenthesis. P-values correspond to two-sided hypotheses, unless we preregistered a directional hypothesis: In this table, this applies to the relation between the financial literacy intervention (FL) and the future equivalence measure (premium), which we predicted to be negative corresponding to more patience (see <https://www.socialscienceregistry.org/trials/2953>). We therefore test a one-sided hypothesis in this case, and corresponding p-values thus result from one-sided tests.

\*\*\* Significant at the 1 percent level.  
\*\* Significant at the 5 percent level.  
\* Significant at the 10 percent level.

## A3 Distribution of Certainty Equivalents and Premia

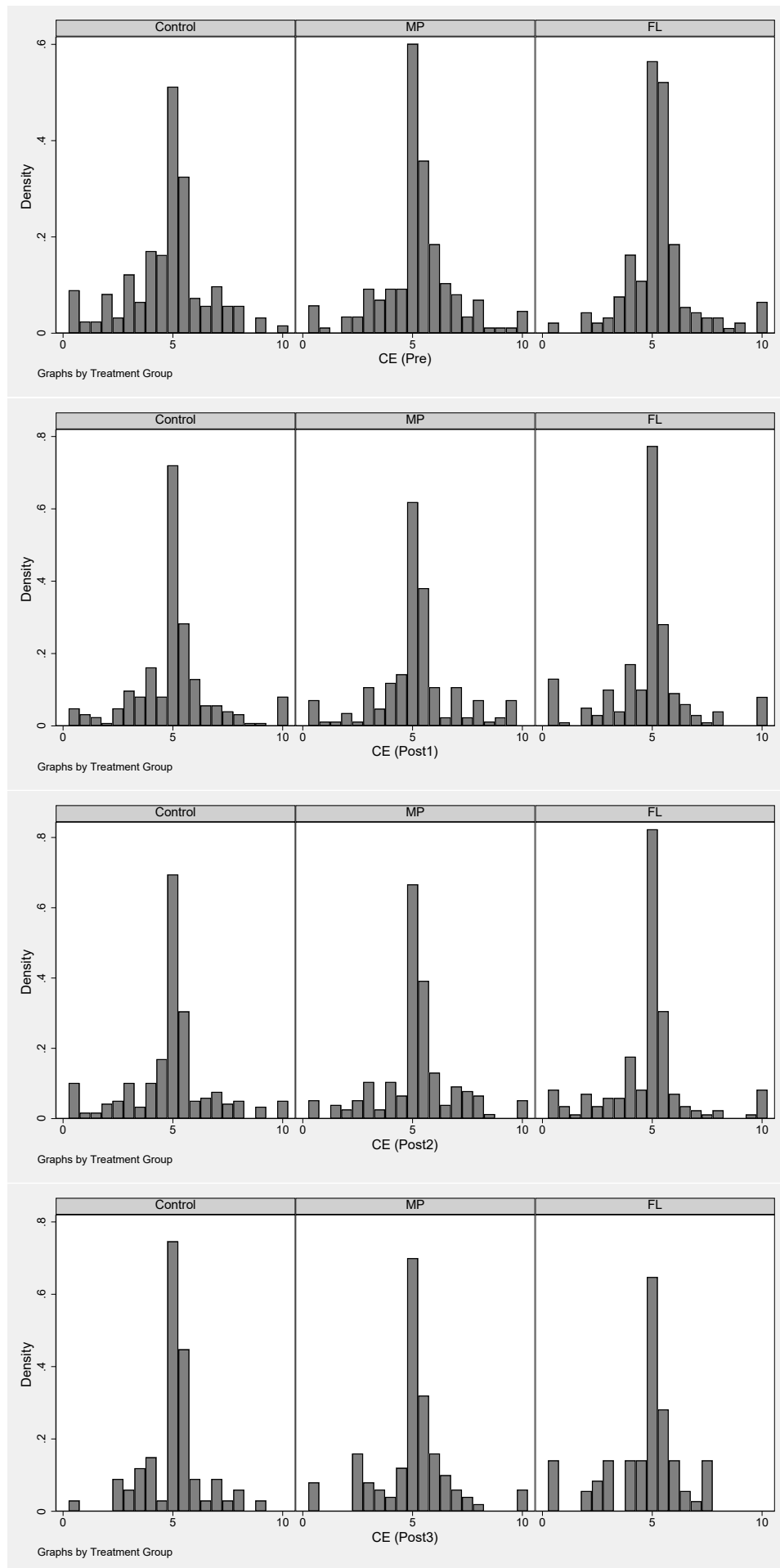


Figure A1: Distributions of Certainty Equivalents (CE) in Pre, Post1, Post2 and Post3, conditional on treatment groups

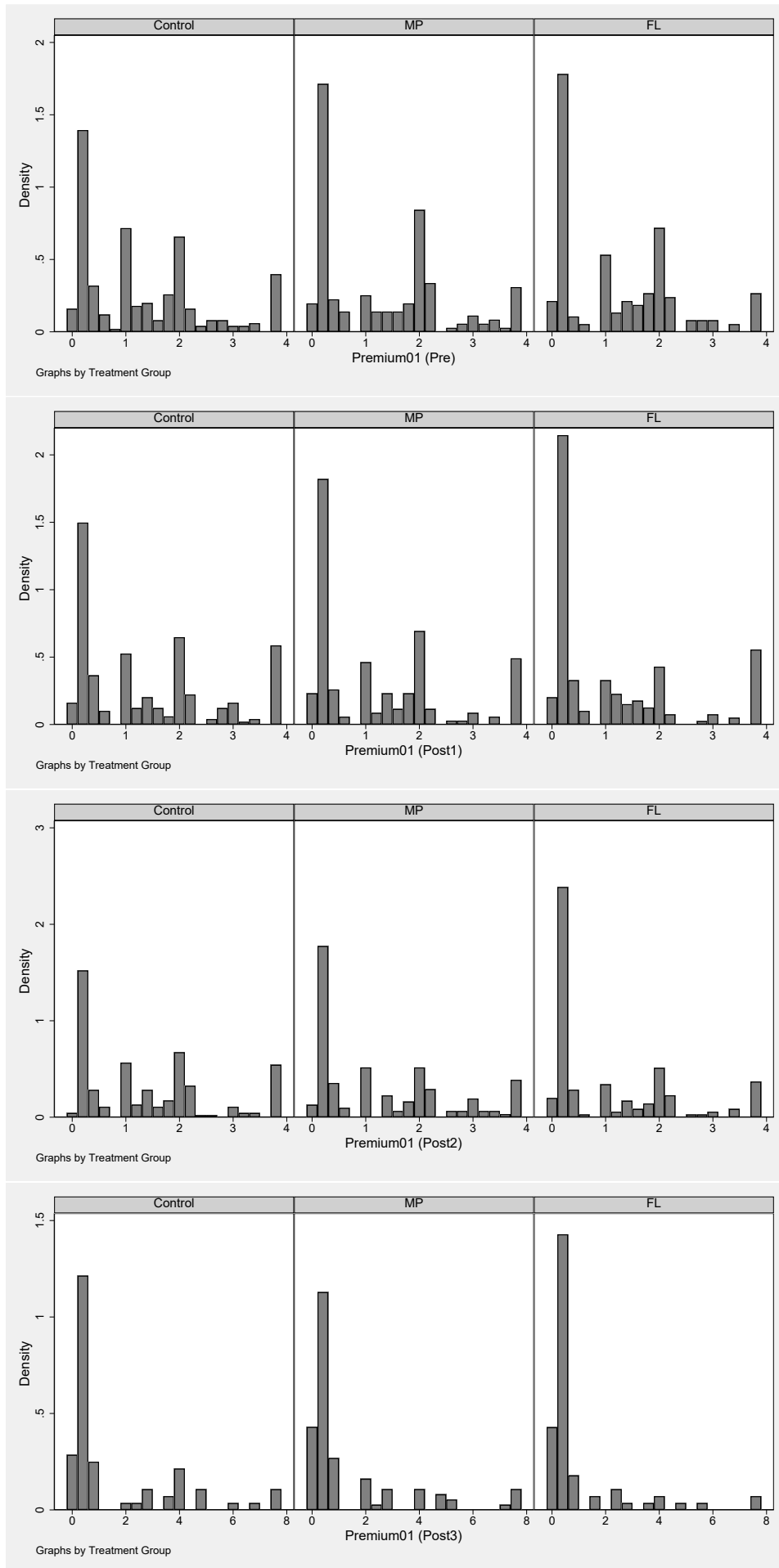


Figure A2: Distributions of Premium01 in Pre, Post1, Post2 and Post3, conditional on treatment groups

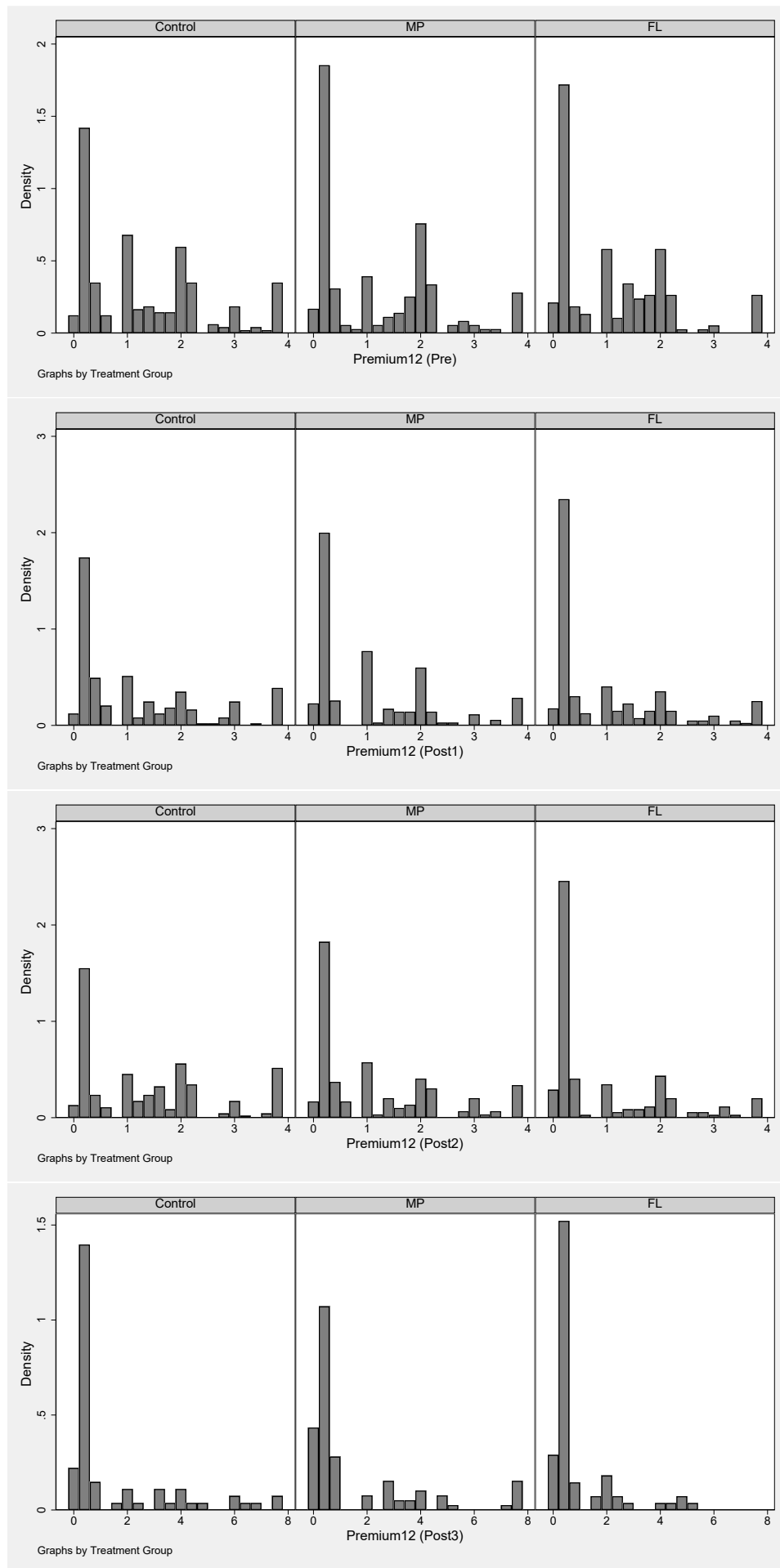


Figure A3: Distributions of Premium02 in Pre, Post1, Post2 and Post3, conditional on treatment groups

## Appendix B – Experimental instructions and material for financial literacy intervention

### B1. Instructions to elicit risk and time preferences (originally in German)

#### GENERAL INTRODUCTION

We will now read the explanatory notes on the experimental games together and discuss examples to ensure everyone has understood the explanations.

During the games and the completion of the final questionnaire, you are not allowed to talk to your classmates or use your mobile phone. Noncompliance with this rule will result in your exclusion from the study and all payments.

You can make money based on your decisions. You will shortly receive further information about this.

At the beginning, we request that you create a personalized code. The code guarantees your anonymity and enables us to make correct payments.

#### GENERATING A PARTICIPATION CODE

Your personalized code consists of a series of personal building blocks, some of which only you know. Please concentrate on creating your code, as you will need it later.

YOUR CODE IS:	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>
	(1)	(2)	(3)	(4)	(5)	(6)
1) The second letter of your first name (A-Z):					(1) =	<u>    </u>
2) The third letter of your surname (A-Z):					(2) =	<u>    </u>
3) The day of your birthday (01-31):					(3) =	<u>    </u> <u>    </u>
4) The month you were born (01-12):					(4) =	<u>    </u> <u>    </u>
5) The number of your siblings (0-...):					(5) =	<u>    </u>
6) The month of your mother's birth (01-12):					(6) =	<u>    </u> <u>    </u>

Please write down your participation code on a separate piece of paper, as you will need it frequently!

#### EXACT INFORMATION ON THE DECISION GAMES

We will now play three games together. You will make a total of 60 decisions. These decisions are numbered from 1 to 60. At the end, a classmate will draw a card from an opaque container. The number on this card indicates the decision that will be relevant to your payment. Please make all decisions carefully, because depending on how you decide, you will earn more money or less. You can make your choices in whichever order you prefer.



### PART 1: RANDOM DRAW or SAFE AMOUNT

In each of the following 20 decisions, you can choose between a random draw and a certain and safe amount. The random draw always stays the same, while the safe amount increases by €0.50 from decision to decision (from €0.50 in the first decision to €10 in the 20<sup>th</sup> decision).

The random draw works as follows: At the end of all the games, we will put ten white and ten orange balls in a container. A student will then pull one of the balls out of the container. The student will not be able to see the color of the balls. The payout will depend on the color of the ball drawn. If a white ball is drawn, you will receive 10 Euro. If an orange ball is drawn, you will not receive anything. If you opt for the random draw, you will therefore receive either 10 Euro or 0 Euro with the same probability.

- white ball      →      10 €
- orange ball    →      0 €

Now please mark in each of the lines from 1 to 20 which variant you prefer (random draw or safe amount).

No.	Random draw	or	Safe amount
1)	<input type="radio"/> Random draw	or	<input type="radio"/> 0.50€ safe
2)	<input type="radio"/> Random draw	or	<input type="radio"/> 1.00€ safe
3)	<input type="radio"/> Random draw	or	<input type="radio"/> 1.50€ safe
4)	<input type="radio"/> Random draw	or	<input type="radio"/> 2.00€ safe
5)	<input type="radio"/> Random draw	or	<input type="radio"/> 2.50€ safe
6)	<input type="radio"/> Random draw	or	<input type="radio"/> 3.00€ safe
7)	<input type="radio"/> Random draw	or	<input type="radio"/> 3.50€ safe
8)	<input type="radio"/> Random draw	or	<input type="radio"/> 4.00€ safe
9)	<input type="radio"/> Random draw	or	<input type="radio"/> 4.50€ safe
10)	<input type="radio"/> Random draw	or	<input type="radio"/> 5.00€ safe
11)	<input type="radio"/> Random draw	or	<input type="radio"/> 5.50€ safe
12)	<input type="radio"/> Random draw	or	<input type="radio"/> 6.00€ safe
13)	<input type="radio"/> Random draw	or	<input type="radio"/> 6.50€ safe
14)	<input type="radio"/> Random draw	or	<input type="radio"/> 7.00€ safe
15)	<input type="radio"/> Random draw	or	<input type="radio"/> 7.50€ safe
16)	<input type="radio"/> Random draw	or	<input type="radio"/> 8.00€ safe
17)	<input type="radio"/> Random draw	or	<input type="radio"/> 8.50€ safe
18)	<input type="radio"/> Random draw	or	<input type="radio"/> 9.00€ safe
19)	<input type="radio"/> Random draw	or	<input type="radio"/> 9.50€ safe
20)	<input type="radio"/> Random draw	or	<input type="radio"/> 10.00€ safe

## PART 2: MONEY TODAY or MONEY IN ONE WEEK

For the next 20 decisions, you can choose whether you would prefer to receive 10.10€ today or a different amount in one week. The amount in one week increases by 0.20€ from decision to decision (from 10.10€ in the 21st decision to 13.90€ in the 40th decision).

Now, please mark in each of the lines from 21 to 40 which variant you prefer (10.10€ today or the other amount in one week).

No.	Amount today	or	Amount in 1 week
21)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 10.10€ in 1 week
22)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 10.30€ in 1 week
23)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 10.50€ in 1 week
24)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 10.70€ in 1 week
25)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 10.90€ in 1 week
26)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 11.10€ in 1 week
27)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 11.30€ in 1 week
28)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 11.50€ in 1 week
29)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 11.70€ in 1 week
30)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 11.90€ in 1 week
31)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 12.10€ in 1 week
32)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 12.30€ in 1 week
33)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 12.50€ in 1 week
34)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 12.70€ in 1 week
35)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 12.90€ in 1 week
36)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 13.10€ in 1 week
37)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 13.30€ in 1 week
38)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 13.50€ in 1 week
39)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 13.70€ in 1 week
40)	<input type="radio"/> 10.10€ today	or	<input type="radio"/> 13.90€ in 1 week

### PART 3: MONEY IN 1 WEEK or MONEY IN 2 WEEKS

For the next 20 decisions, you can choose whether you would prefer to receive 10.10€ in one week or a different amount in two weeks. The amount in two weeks increases by 0.20€ from decision to decision (from 10.10€ in the 41st decision to 13.90€ in the 60th decision).

Now please mark in each of the lines from 41 to 60 which variant you prefer (10.10€ in one week or the other amount in two weeks).

No.	Amount in 1 week		Amount in 2 weeks	
41)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 10.10€ in 2 weeks	
42)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 10.30€ in 2 weeks	
43)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 10.50€ in 2 weeks	
44)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 10.70€ in 2 weeks	
45)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 10.90€ in 2 weeks	
46)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 11.10€ in 2 weeks	
47)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 11.30€ in 2 weeks	
48)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 11.50€ in 2 weeks	
49)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 11.70€ in 2 weeks	
50)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 11.90€ in 2 weeks	
51)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 12.10€ in 2 weeks	
52)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 12.30€ in 2 weeks	
53)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 12.50€ in 2 weeks	
54)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 12.70€ in 2 weeks	
55)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 12.90€ in 2 weeks	
56)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 13.10€ in 2 weeks	
57)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 13.30€ in 2 weeks	
58)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 13.50€ in 2 weeks	
59)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 13.70€ in 2 weeks	
60)	<input type="radio"/> 10.10€ in 1 week	or	<input type="radio"/> 13.90€ in 2 weeks	

**PAYMENT:**

We will place the money you have earned today in an envelope at the end of the study and write your personalized code on it.

If a decision from Part 2 or Part 3 is randomly selected for payment, and

- you have opted for receiving the sum today, you will be handed the envelope today.
- you have opted for receiving the sum in a week, you will be handed the envelope in a week.
- you have opted for receiving the sum in two weeks, you will be handed the envelope in two weeks.

In order for us to ensure that all candidates receive their own envelopes rather than someone else's, the handover will proceed as follows:

- 1) Your teacher will hand you your envelopes. Your teacher does not know how much money each envelope contains.
- 2) The teacher will call out the first three elements of the code.
- 3) Should these first three elements correspond to your own code, you should then add the last three, thus completing the code, in order to receive your envelope.

**Thank you for participating!**

## B2. Tests on financial literacy and monetary policy literacy

### TEST



Dear student,

We would like to promote economic education in German schools. This is why we have been involved in the design and research of economic educational processes in schools for many years. For this purpose, we are dependent on the cooperation with our partner schools. Our current project involves eleven different schools from different regions in Germany. The focus is on two thematic areas:

- (A) "Financial literacy"
- (B) "Monetary policy".

These areas are part of a learning programme developed by us in cooperation with the Diligentia Foundation for Empirical Research. The Diligentia Foundation is a non-profit organization dedicated exclusively to the promotion of science, research and education.

With our project, we would like to find out, among other things, whether pupils actually acquire economic education through the learning programme and in which areas we need to improve the materials further.

#### **Procedure:**

The course consists of a total of eight lessons. At each school, three classes take part in the study. One focuses on financial education, the other on monetary policy. The third class only participates in the entrance and final tests, but does not receive any teaching in the thematic areas.

Today's **entrance test consists of three parts (A, B, C) and will last for 45 minutes**. If you should have finished earlier, please take the time to check whether you have answered all the questions correctly. It goes without saying that the data will be processed anonymously. Regardless of this, we would like to ask you to process all test parts in a concentrated and careful manner, so that we can assess the level of performance in your class realistically.

We will inform you in detail about the results after the evaluation.

**Thank you very much for your cooperation, and good luck!**

Matthias Sutter and Anna Untertrifaller (Max Planck Institute, Bonn)  
Michael Weyland and Manuel Froitzheim (University of Siegen)

**Notes on all three test parts:**

- You have 45 minutes in total. During this time, please complete all tasks.
- The order in which you work on the tasks is arbitrary.
- Apart from a calculator, no further aids are allowed.
- Please note the following for the multiple-choice tasks: Tick a maximum of one box per task. *No* points are subtracted if you give a wrong answer. If you tick more than one box, your answer will be invalid.
- Legibility: Please write legibly and mark your answers clearly.
- We will randomly select five students per class for payment.

<b>Part A: Financial literacy</b>
-----------------------------------

Tasks 1A to 1E refer to the topic "payslip".  
Please take a look at Clara Homann's payslip:

<b>Metallverarbeitung Schneider GmbH</b> <b>Albertstraße 74, 50825 Köln</b>
--

Salary and Wage			
Year: 2016	Month: May	Tax bracket: 1	
Homann, Clara	Born on 10 April 1990	Personnel no. 342012011	
Earnings	Hours	Rate (€)	Euro
Standard wage, gross	175,00	20,20	3535,00
Overtime	20,50	5,05	103,53
Gross wage			<b>3638,53</b>
Deductions		Rate (%)	Euro
1.			604,50
2.			33,24
3.			340,20
4. Health insurance			305,64
5. Nursing care insurance			55,49
6. Unemployment insurance			54,40
7. Church tax			54,58
<b>Amount paid out</b>			<b>2190,48</b>

<b>1A. Please mark the correct answer. The following is <u>not</u> a branch of statutory social insurance:</b>	
Pension insurance.	<input type="radio"/>
Nursing care insurance.	<input type="radio"/>
Life insurance.	<input type="radio"/>
Unemployment insurance.	<input type="radio"/>
<b>1B. Please mark the correct answer: Apart from the gross wage, Clara's employer has to pay for her...</b>	
... income tax.	<input type="radio"/>
... social security contributions.	<input type="radio"/>
... church tax.	<input type="radio"/>
... solidarity tax.	<input type="radio"/>
<b>1C. The description of the deductions in lines 1 to 3 is missing in the payslip. Please enter the following unsorted terms in the correct order in lines 1 to 3 of the payslip. Use the abbreviations in brackets to do this:</b> Pension insurance (PI). Solidarity tax (ST). Income tax (IT).	
<b>1D. Assign the correct tax bracket (1, 2, 3, 4, 5) to the following characteristics. Write down the appropriate number after the corresponding definition.</b>	
Married sole or principal earner	Tax bracket
Single or living alone without children	Tax bracket
Married double earners	Tax bracket
Single or living alone with children	Tax bracket
Married with additional income	Tax bracket
<b>1E. Please mark the correct answer: The absolute amounts increase in the following order:</b>	
Net hourly wage, gross hourly wage, labour cost per hour	<input type="radio"/>
Gross hourly wage, net hourly wage, labour cost per hour	<input type="radio"/>
Labour cost per hour, gross hourly wage, net hourly wage	<input type="radio"/>
Net hourly wage, labour cost per hour, gross hourly wage	<input type="radio"/>

**Tasks 2A to 2C refer to the following decision situation:**

For a long time, Fritz Müller has wanted to do sports regularly again. His great passion since childhood has been playing table tennis. Now he has made up his mind: Fritz will become a member of the table tennis club "Grün Weiß Lindenthal". The annual fee is 500 euro – for this fee, he can go to training for one year. After three weeks, however, he develops a "tennis elbow". His family doctor explains to him that this is a disease of the tendons around the elbow, which is caused by chronic strain. A typical symptom of this is severe pressure pain on the outside of the elbow. Fritz decides to continue playing on a regular basis because the club does not want to refund the annual fee of 500 euro.

<b>2A. Please mark the correct answer: Fritz's decision can be explained...</b>	
... both by the theory of sunk costs and by the principle of mental accounting.	<input type="radio"/>
... by the theory of sunk costs, but not by the principle of mental accounting.	<input type="radio"/>
... by the principle of mental accounting, but not by the theory of sunk costs.	<input type="radio"/>
... neither by the theory of sunk costs nor by the principle of mental accounting.	<input type="radio"/>
<b>2B. Please mark the correct answer: "Sunk costs" means...</b>	
... sunk costs that do not exist.	<input type="radio"/>
... sunk costs that need to be taken into account for all decisions.	<input type="radio"/>
... costs that have already been incurred and that often lead to correct decisions because they continue to be taken into account.	<input type="radio"/>
... costs that have already been incurred and that often lead to wrong decisions because they continue to be taken into account.	<input type="radio"/>
<b>2C. Please mark the correct answer: Through the principle of "mental accounting", decisions are...</b>	
... optimized only in thought.	<input type="radio"/>
... optimized only within the corresponding partial account.	<input type="radio"/>
... optimized only within the total account.	<input type="radio"/>
... optimized only if banks are included in the decision-making process.	<input type="radio"/>



**Tasks 3A and 3B refer to the following decision situation:**

In a lottery you are allowed to turn a wheel of fortune on which the numbers 1, 2 and 3 can be seen. The three numbers appear with the following probability:

Number	1	2	3
Probability	1/2	1/4	1/4

**3A. Game 1: You have to pay a stake of 50 cents and may then spin the wheel of fortune once. If a "1" appears, 1 € is paid out, and nothing else happens. Enter the expected value for the win!**

The expected value for the win is €.

**3B. Game 2: You have to pay a stake of 50 cents and may then spin the wheel of fortune twice. If two fields with the same designation appear, 1 € is paid out, and nothing else happens. Enter the expected value for the win!**

The expected value is €.

**4. There are three balls in an urn, each with a number on it (2, 2, -3). The numbers are drawn in a concealed manner and represent your profit or loss in euro. Is it worthwhile to participate in the lottery? Please mark the correct answer.**

- |  |                       |
|--|-----------------------|
| Yes, because the expected value is positive.     | <input type="radio"/> |
| No, because the expected value is negative.      | <input type="radio"/> |
| Yes, because one wins in two out of three cases. | <input type="radio"/> |
| No, because one can lose more than one can win.  | <input type="radio"/> |

**5. In casino roulette, there are 18 red and 18 black fields. The last couple of times, the roulette ball stopped on "red" five times in a row. Please mark the correct answer.**

- |  |                       |
|--|-----------------------|
| It is more likely that "red" will appear again in the next round.              | <input type="radio"/> |
| It is more likely that "black" will appear again in the next round.            | <input type="radio"/> |
| It is equally probably for "red" or "black" to appear again in the next round. | <input type="radio"/> |
| I can't / don't want to offer an opinion.                                      | <input type="radio"/> |

**6. Please mark the correct answer: "Loss aversion" can explain ...**

- |   |                       |
|---|-----------------------|
| ... the fact that many investors only bet on high returns.          | <input type="radio"/> |
| ... the fact that many investors want to avoid losses at all costs. | <input type="radio"/> |
| ... an investment strategy based on the minimum principle.          | <input type="radio"/> |
| ... an investment strategy based on the maximum principle.          | <input type="radio"/> |

7. Please mark the correct answer: <i>Homo economicus</i> attempts...	
... to strive for maximum use through minimum means.	<input type="radio"/>
... to achieve a given goal with as little effort as possible.	<input type="radio"/>
... to achieve the maximum with the least possible effort.	<input type="radio"/>
... to strive for minimum use with the given means.	<input type="radio"/>

8. Please mark the correct answer: <i>Homo economicus</i> ...	
... always acts rationally according to the economic principle.	<input type="radio"/>
... pays attention to his or her status within a social group.	<input type="radio"/>
... tries to achieve maximum yield with minimum effort.	<input type="radio"/>
... acts against the interests of his fellow humans.	<input type="radio"/>

9. Please mark the correct answer. The ultimatum game means:	
Most people are not satisfied with 1 euro because they apply the maximum principle.	<input type="radio"/>
Most people offer only 1 euro, as they apply the minimum principle.	<input type="radio"/>
<i>Homo economicus</i> accepts 1 euro, because 1 euro is better than nothing.	<input type="radio"/>
<i>Homo economicus</i> offers nothing.	<input type="radio"/>

10. Assume you have 100 euro in your savings account, and the interest rate is 5% per year. If you leave the money in your savings account for exactly two years, how much money will be in your savings account? Please mark the correct answer.	
100 euro.	<input type="radio"/>
More than 100 euro, but less than 110 euro.	<input type="radio"/>
Exactly 110 euro.	<input type="radio"/>
More than 110 euro.	<input type="radio"/>
11. Compare the following investment strategies: Which usually offers the greatest security? Please mark the correct answer.	
Investing in a single share.	<input type="radio"/>
Investing in an equity fund.	<input type="radio"/>
Investing in fixed-income securities and in an equity fund.	<input type="radio"/>
I can't / don't want to offer an opinion.	<input type="radio"/>

12. The "magic triangle" of investment does <u>not</u> include:	
Security.	<input type="radio"/>
Liquidity.	<input type="radio"/>
Return.	<input type="radio"/>
Capital.	<input type="radio"/>

13. Anton and Barbara are the same age. At the age of 25, Anton starts saving 2,000 euro per year, while Barbara saves nothing. At 50, Barbara starts saving 4,000 euro per year, while Anton continues to save 2,000 euro per year. Today, they are both 75 years old. The interest rate is 1% per year. Who has saved more money?	
Both have saved the same amount.	<input type="radio"/>
Barbara has saved more in total, since she saved more each year.	<input type="radio"/>
Anton has saved more.	<input type="radio"/>
I can't / don't want to offer an opinion.	<input type="radio"/>

14. Assume that in ten years the prices of all goods have doubled due to inflation. Your income doubles as well. In ten years, will you be able to afford as much with your income as you do today, or more, or less?	
As much as today.	<input type="radio"/>
More than today.	<input type="radio"/>
Less than today.	<input type="radio"/>
I can't / don't want to offer an opinion.	<input type="radio"/>

15. Let's assume that the interest rate on your savings account is 1% per year and the inflation rate is 2% per year. After five years, will you be able to buy as much as today, or more, or less with the balance in your savings account? Please mark the correct answer:	
As much as today.	<input type="radio"/>
More than today.	<input type="radio"/>
Less than today.	<input type="radio"/>
I can't / don't want to offer an opinion.	<input type="radio"/>

16. With an average inflation of 4%, the purchasing power of 1,000 euro in five years will be	
1216,65 € .	<input type="radio"/>
821,93 €.	<input type="radio"/>
815,37 €.	<input type="radio"/>
800 €.	<input type="radio"/>

**Part B: Monetary policy**

**17. The Maastricht Treaty...**

... was signed in 1994 and envisaged the progressive establishment of an Economic and Monetary Union (EMU) by 1998 at the latest.	<input type="radio"/>
... was signed in 1992 and envisaged the progressive establishment of an Economic and Monetary Union (EMU) by 1999 at the latest.	<input type="radio"/>
... was signed in 1992 and envisaged the progressive establishment of an Economic and Monetary Union (EMU) by 2002 at the latest.	<input type="radio"/>
... was signed in 1992 and envisaged the progressive establishment of an Economic and Monetary Union (EMU) by 2005 at the latest.	<input type="radio"/>

**18. The exchange rate from euro to DM is 1 euro = 1.95583 DM. So, if you exchanged 10,000 DM for euro on 31 December 2001, you received...**

... 5,113 euro.	<input type="radio"/>
... 19,558 euro.	<input type="radio"/>
... 10,000 euro.	<input type="radio"/>
... 1,955 euro.	<input type="radio"/>

**19. Which of the following statements correctly represents the regulations governing the issue of euro banknotes and coins?**

The authorization to issue euro banknotes and coins must always be granted by the EU Commission.	<input type="radio"/>
Despite the introduction of euro banknotes, national currencies remain legal tender.	<input type="radio"/>
The Deutsche Bundesbank continues to have sole responsibility for deciding on the issue of German euro banknotes after the introduction of the euro.	<input type="radio"/>
The authorization to issue euro banknotes and coins is the exclusive right of the ECB.	<input type="radio"/>

**20. Which of the following statements on the organization of the European Central Bank (ECB) is not correct?**

The ESCB consists of the ECB and the national central banks.	<input type="radio"/>
The ECB's Governing Council consists of the President, the Vice President and four other members.	<input type="radio"/>
The ESCB is managed by the decision-making bodies of the ECB, namely the Governing Council and the Executive Board.	<input type="radio"/>
The ECB's Governing Council consists of the members of the Executive Board and the governors of the national central banks.	<input type="radio"/>

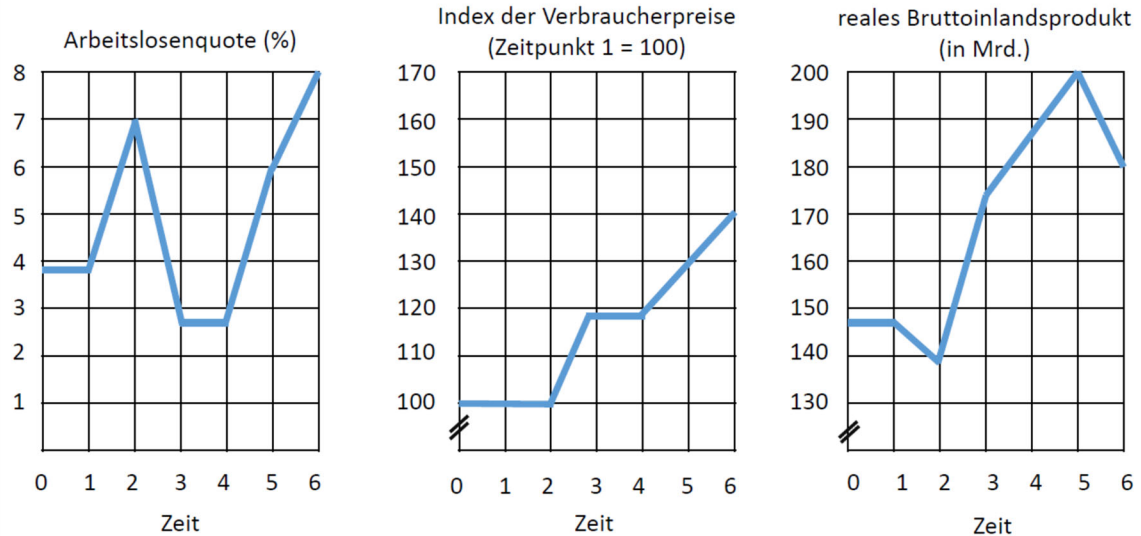
<b>21. The President of the Deutsche Bundesbank attends the meetings of the Governing Council "ad personam". This means that he or she...</b>	
... takes part as a representative of the German government.	<input type="radio"/>
... takes part as an independent expert.	<input type="radio"/>
... takes part as a representative of the Deutsche Bundesbank.	<input type="radio"/>
... does not take part at all.	<input type="radio"/>

<b>22. The convergence criteria include...</b>	
... exchange rate stability, level of short-term interest rates, price level.	<input type="radio"/>
... fiscal discipline, exchange rate stability, minimum inflation.	<input type="radio"/>
... price stability, limitation of long-term interest rates, fiscal discipline.	<input type="radio"/>
... deflation, falling prices, economic decline.	<input type="radio"/>

<b>23. Please answer the three questions that follow. These relate to the following table:</b>														
	<table> <tr> <th>Year</th><th>Price of the shopping cart</th><th>Price index</th></tr> <tr> <td>1</td><td>1680</td><td>100</td></tr> <tr> <td>2</td><td>1790</td><td></td></tr> <tr> <td>3</td><td>1840</td><td></td></tr> </table>	Year	Price of the shopping cart	Price index	1	1680	100	2	1790		3	1840		
Year	Price of the shopping cart	Price index												
1	1680	100												
2	1790													
3	1840													
<b>23A. For the first year, the inflation rate, based on the data provided, ...</b>														
... is 2.8%.		<input type="radio"/>												
... is 6.5 %.		<input type="radio"/>												
... is 10%.		<input type="radio"/>												
... cannot be calculated for the first year.		<input type="radio"/>												
<b>23B. For the second year, the inflation rate, based on the data provided, ...</b>														
... is 2.8%.		<input type="radio"/>												
... is 6.5 %.		<input type="radio"/>												
... is 10%.		<input type="radio"/>												
... cannot be calculated for the second year.		<input type="radio"/>												
<b>23C. For the third year, the inflation rate, based on the data provided, ...</b>														
... is 2.8%.		<input type="radio"/>												
... is 6.5 %.		<input type="radio"/>												
... is 10%.		<input type="radio"/>												
... cannot be calculated for the third year.		<input type="radio"/>												
<b>24. What does the "no bail-out" clause imply?</b>														
No possibility to withdraw from the euro.		<input type="radio"/>												
No communication between the national central banks.		<input type="radio"/>												
No mutual liability of member states.		<input type="radio"/>												
No possibility to withdraw from the EU.		<input type="radio"/>												

25.

### Die wirtschaftliche Situation in Land X



**25A. In which period did Country X show both rising unemployment and a high inflation rate?**

In the period from 1 to 2.	<input type="radio"/>
In the period from 2 to 3.	<input type="radio"/>
In the period from 3 to 4.	<input type="radio"/>
In the period from 4 to 5.	<input type="radio"/>

**25B. In which period does production increase in Country X with a relatively low inflation rate?**

In the period from 1 to 2.	<input type="radio"/>
In the period from 2 to 3.	<input type="radio"/>
In the period from 3 to 4.	<input type="radio"/>
In the period from 4 to 5.	<input type="radio"/>

**26. The convergence criterion of 'budgetary discipline' is breached if...**

... the nominal long-term interest rates are more than two percentage points above those of the three EU countries with the best price stability.	<input type="radio"/>
... public debt exceeds 50% of the GDP.	<input type="radio"/>
... the inflation rate is more than 1.5 percentage points above that of the three EU countries with the best price stability.	<input type="radio"/>
... the annual government deficit exceeds 3% of the GDP.	<input type="radio"/>

<b>27. The fact that national and supranational bodies are prohibited from giving instructions to the European Central Bank or the national central banks is called...</b>	
... personal independence.	<input type="radio"/>
... financial independence.	<input type="radio"/>
... functional independence.	<input type="radio"/>
... institutional independence.	<input type="radio"/>
<b>28. With a single currency, exchange rate fluctuations are eliminated. What advantages does this offer?</b>	
It increases costs.	<input type="radio"/>
It creates planning security.	<input type="radio"/>
It leads to less competition.	<input type="radio"/>
It leads to the vulnerability to global disruptions in foreign exchange markets increasing.	<input type="radio"/>
<b>29. The mutual exclusion of liability is understood to mean...</b>	
... the fact that in a monetary union no more debts may be incurred.	<input type="radio"/>
... the fact that no member state of the monetary union is liable for the debts of another country.	<input type="radio"/>
... the fact that in a monetary union no country has to be solely liable for its debts.	<input type="radio"/>
... the fact that each member state of the monetary union is liable for the debts of the other countries.	<input type="radio"/>
<b>30. Suppose Mr Schmitz works as a train conductor and receives a nominal wage of 24,450 euro from his employer in 2014 (after 24,000 euro the year before). Calculate Mr Schmitz's real wage in the event of the Federal Statistical Office calculating an inflation rate of 2.0 percent for 2014 (compared to 2013). Mr. Schmitz's real wage:</b>	

<b>31. Take an appropriate measure to ward off inflation and determine the consequences of your decision.</b>			
Key interest rate	O stays the same	O is raised	O is lowered
Credits for banks	O become more expensive	O become cheaper	O cost the same as before
Credits for consumers	O become more expensive	O become cheaper	O cost the same as before
Credit demand	O decreases	O rises	O stays the same
Demand for goods	O stays the same	O is raised	O is lowered
Prices	O go down	O stabilize or go up	O rise more slowly or go down

<b>32. Take an appropriate measure to ward off deflation and determine the consequences of your decision.</b>			
Key interest rate	O stays the same	O is raised	O is lowered
Credits for banks	O become more expensive	O become cheaper	O cost the same as before
Credits for consumers	O become more expensive	O become cheaper	O cost the same as before
Credit demand	O decreases	O rises	O stays the same
Demand for goods	O stays the same	O is raised	O is lowered
Prices	O go down	O stabilize or go up	O rise more slowly or go down



***Part C: Opinion on lessons***

The second part is now also over! This final section is about your opinion on the lessons in politics, economics and social sciences. If the lessons were interrupted due your dropping the subject, or because of holidays, etc., please use the last lesson in the subject as a basis. Please tick the answer that you deem most appropriate:

	Completely agree	Tend to agree	Tend to disagree	Completely disagree
1. Most of the students in the course worked in a concentrated manner during the last lesson.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I worked in a concentrated manner during the last lesson.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I have learned a lot in business class recently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I have the feeling that I have thoroughly absorbed the contents of the last lesson.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I find the topics of the last lesson important.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I would like to learn more about economic topics.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. The teaching methods applied in the last lesson should continue to be used in the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. The teaching materials used in the last lesson should continue to be used in the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Overall I found the organization of the last lesson to be successful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. The last lesson was fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**If the teaching materials and methods used in the last lesson are to be used again in the future, care should be taken to ensure that... (if necessary, use the reverse side)**

**Further comments (if necessary, use the reverse side):**

**Thank you for your support!**

### B3. Questions on field behavior

In the past month, how often did you do the following:

	never	rarely	some- times	frequently	very frequently
... bet with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... participate in gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... smoke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... buy something on the internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## B4. Translation of material covered in the eight units on financial literacy

(this material was originally in German and presented on a tablet on separate screens (that do not always match the page format used here))

### 1. Case study: Würtgen Construction Machinery

#### 1.A.1 Salary statement from 'Württemberg Construction Machinery'

Simon Hegele works for the company Baumaschinen Würtgen GmbH (Württemberg Construction Machinery Ltd). The company is based in Cologne and is the world market leader. Simon is not married and has no children. After his intermediate school-leaving certificate, an apprenticeship as a specialist for metal technology, and a few years of professional experience at Würtgen, he has completed further training to become a state-certified technician in the field of machine technology. Since May 2017, he has been organizing the manufacture and maintenance of road construction machinery. He has never before given his salary statement any particular attention. But since starting his new job, he has been waiting quite eagerly for his new salary. And at last his salary statement has arrived!

Baumaschinen Würtgen GmbH			
Bertholdstraße 74, 50825 Köln			
Salary statement			
Year: 2017	Month: May	Tax bracket: 1	
Simon Hegele	Born on 10 March 1992	Personnel no.: 472012011	
Designation of earnings	Hours	Rate (€)	Euro
Gross standard wage	175	20.20	3535.00
Overtime supplement	20.5	5.05	103.53
Gross wage			3638.53

Designation of deductions	Euro
Income tax	604.50
Solidarity tax	33.24
Church tax	54.40
Health insurance (employee)	305.64
Nursing care insurance (employee)	55.49
Pension insurance (employee)	340.20
Unemployment insurance (employee)	54.58
<b>Amount paid</b>	<b>2190.48</b>

Simon is quite baffled. He is obviously very happy about the high gross wage and the supplements, but he really hasn't expected the deductions to be that high: **"If I earn over 3600 Euro and get less than 2200 Euro out of it, something is bound to be wrong!"** But before going to his employer to complain, he first wants to find out for himself.

### Task 1:

Help Simon to clarify the facts of the case. Please proceed as follows: First fill out the following table. Transfer the missing absolute values, calculate the corresponding percentages, and then determine the percentage of the net employee wage in relation to the gross employee wage.

	<b>Absolute value (in Euro)</b>	<b>Relative value (in percent)</b>
<b>Gross employee wage</b>	3638.53	100,00
Income tax		
Solidarity tax		
Church tax		
Health insurance (employee)		
Nursing care insurance (employee)		
Pension insurance (employee)		
Unemployment insurance (employee)		
Social security contributions (employee)		
Total deductions (employee)		
<b>Net employee wage</b>	2190.48	

### Solution suggestion

	Absolute value (€)	Relative value (%)
<b>Gross employee wage</b>	<b>3638.53</b>	<b>100%</b>
Income tax	604.50	16.6%
Solidarity tax	33.24	0.97%
Church tax	54.40	1.5%
Health insurance (employee)	305.64	8.4%
Nursing care insurance (employee)	55.49	1.53%
Pension insurance (employee)	340.20	9.35%
Unemployment insurance (employee)	54.58	1.5%
Social security contributions (employee)	755.91	20.78%
Total deductions (employee)	1448.05	39.8%
<b>Net employee wage</b>	<b>2190.48</b>	<b>60.2%</b>

The percentage of the net employee wage in relation to the gross employee wage is 60.2% for Simon.

#### Task 2:

Check whether the values match the entries in the glossary – in other words, whether the salary statement is correct.

Work on the task in the electronic textbook or your copybook.

### **Solution suggestion**

All values on the salary statement match those in the glossary, so the statement is correct.

### **Task 3:**

Now fill out the following table and determine the labor costs incurred by Simon's employer. Use the glossary once again.

	<b>Absolute value in Euro</b>	<b>Relative value in percent</b>
<b>Gross employee wage</b>	3638.53	100,00
<b>Net employee wage</b>	2190.48	60.20
Health insurance (employer)		
Nursing care insurance (employer)		
Pension insurance (employer)		
Unemployment insurance (employer)		
Accident insurance (employer)		
Social security contributions (employer)		
<b>Labor costs</b>		
Labor costs per hour		100.00
Gross hourly wage		
<b>Net hourly wage</b>		

### Solution suggestion

<b>Net employee wage</b>	<b>2190.48</b>	<b>60.2%</b>
Health insurance (employer)	265.61	7.3%
Nursing care insurance (employer)	46.39	1.275%
Pension insurance (employer)	340.20	9.35%
Unemployment insurance (employer)	54.58	1.5%
Accident insurance (employer)	47.30	1.3%
Social security contributions (employer)	754.08	20.7%
<b>Labor costs</b>	<b>4392.61</b>	<b>120.7%</b>
Labor costs per hour	25.10	100%
Gross hourly wage	20.79	82.8%
<b>Net hourly wage</b>	<b>12.52</b>	<b>49.9%</b>



### Didactic note

The questions and comments in the following tasks typically lead to a lively discussion among the students. Important aspects of the debate on the future of the welfare state are initiated here.

#### Task 4:

Compare the labor costs per hour with Simon's net hourly wage. What do you notice? What would you (not) have expected?

Work on the task in the electronic textbook or your copybook.

#### Task 5:

- Which deductions do you feel are too high, which are appropriate, and which, in your opinion, should increase further?
- Which deductions – realistically speaking – are likely to increase in the future? Why?

Work on the task in the electronic textbook or your copybook.

### Taxes and contributions

These are all monetary payments to the federal, state, and local governments, as well as to religious communities, which citizens are obliged to make. They include taxes (e.g., income tax), contributions (e.g., for health insurance), and fees (e.g., for garbage collection).

#### Employer contribution

The employer's contribution is the employer's share of social security contributions. As a rule, the contributions to statutory health insurance, statutory nursing insurance, statutory pension insurance, unemployment insurance, and occupational accident insurance are paid in equal measure by the employee and the employer. Exceptions: In the case of accident insurance, the employer is the sole contributor; in the case of statutory health insurance, the employee's contribution rate is slightly higher than that of the employer.

#### Employee contribution

The employee's contribution is the employee's share of social security contributions. As a rule, the contributions to statutory health insurance, statutory nursing insurance, statutory pension insurance, unemployment insurance, and occupational accident insurance are paid in equal measure by the employee and the employer. Exceptions: In the case of accident insurance, the employer is the sole contributor; in the case of statutory health insurance, the employee's contribution rate is slightly higher than that of the employer.

### Remuneration

Compensation for work performed

#### Labor costs

All expenses incurred by the employer as a result of the employee's engagement, in particular the wage or salary and the employer's contributions to social security.

### Unemployment insurance

Unemployment insurance is a state-organized compulsory insurance of the working population, and thus a branch of the statutory social insurance. Contributions are paid in equal parts by the employee and the employer and, since 1 January 2011, amount to 3% of gross wages (1.5% paid by the employer and 1.5% by the employee). This insurance has existed in Germany since 1927 and entitles the employee to the following benefits: unemployment benefit, reduced working hours allowance, financing of further training measures, career guidance, and employment placement services.

### Brutto (Gross)

The term comes from the Italian (“raw, whole”) and means “before deduction of taxes and the employee’s social security contributions”. Another example: The gross price already contains the VAT (gross price = net price + VAT). General formula: Gross = net + tare.

## Gross wage

The total remuneration (wage or salary, bonus, supplements) received by an employee for work performed, before deduction of tax and social security contributions. The gross wage is the basis for calculating taxes and social security contributions.

## Health insurance

The statutory health insurance (SHI) is a state-organized compulsory insurance for the working population, and thus a branch of the statutory social insurance. The contributions are paid by the employee and the employer. The general contribution rate has a binding lower contribution limit of 14.6 percent (7.3 percent each for employee and employer). The health insurance fund can itself determine the employee’s income-dependent additional contribution.

The average additional contribution rate in the statutory health insurance is 1.1 percent in 2017, i.e., the average contribution rate for employees as a whole is 8.4 percent of gross wages. The statutory health insurance has existed in Germany since 1883, and most German citizens are members of it, as there is a compulsory insurance for employees, pensioners, students, and the unemployed. The compulsory insurance threshold determines the income level above which an employee is no longer compulsorily insured in the SHI. It currently amounts to a gross annual wage of 57,600 Euro (as of 1 January 2017). Those who are not, or do not have to be, insured in the statutory health insurance usually conclude a contract with a private health insurance. These are mainly employees with a high income, freelancers, the self-employed, and civil servants.

## Income tax

All income from non-self-employment is subject to this tax. It must be withheld by the employer from the gross wage and transferred to the tax office (wage tax deduction procedure). If the income tax withheld in the course of a year is higher than the amount actually payable, the tax office makes a correction (annual adjustment of income tax).

## Netto (Net)

The term comes from the Italian (“clean, pure”) and means “after deduction of taxes and employee social security contributions”. Another example: The net price does not yet contain VAT (net price = gross price - VAT). General formula: Net = gross - tare.

## Nursing care insurance

The statutory care insurance serves to cover the risk of the need for care. It is a state-organized compulsory insurance for the working population, and thus a branch of the statutory social insurance. Contributions are paid in equal parts by the employee and the employer. They currently amount to 2.55% of the gross wages (1.275% for the employee, and 1.275% for the employer); for childless people, it is 2.8% of the gross wages (1.525% for the employee, and 1.275% for the employer). The statutory care insurance has existed in Germany since 1994. Most citizens in Germany belong to it, because the compulsory insurance for employees, pensioners, students, and the unemployed in the statutory health insurance is transferred to the statutory nursing care insurance (“the nursing care insurance follows the health insurance”).

## Pension insurance

The statutory pension insurance serves primarily as a means of providing for the retirement of employees. It is a state-organized compulsory insurance for the working population, and thus a branch of the statutory social insurance. Contributions are paid in equal parts by the employee and the employer and, since 1 January 2017, amount to 18.7% of the gross wage (9.35% for the employee, and 9.35% for the employer). The statutory pension insurance has existed in Germany since 1889.

## Solidarity tax

The solidarity tax (known colloquially as “Soli”) is a supplementary levy to income tax. The solidarity surcharge amounts to 5.5 percent of the income tax. Its introduction in 1991 was justified with the cost of German unification.

## Social security

State-organized compulsory insurance for the working population, consisting of the following five branches: statutory health insurance, nursing care insurance, statutory pension insurance, unemployment insurance, and statutory accident insurance. The contributions are based on a certain percentage of the gross wage and are usually paid equally by the employee and the employer. Exceptions: In the case of accident insurance, the employer is the sole contributor; and in the case of statutory health insurance, the employee's contribution rate is slightly higher than that of the employer.

## Social security contributions in 2017

<b>Social insurance</b>	<b>Total contribution rate</b>	<b>Employee contribution</b>	<b>Employer contribution</b>
<b>Health insurance</b>	<b>15.80%</b>	<b>8.40%</b>	<b>7.30%</b>
<b>Nursing care insurance</b>	<b>2.55% or 2.80%</b>	<b>1.275% or 1.525%</b>	<b>1.275%</b>
<b>Pension insurance</b>	<b>18.70%</b>	<b>9.35 %</b>	<b>9.35%</b>
<b>Unemployment insurance</b>	<b>3.00%</b>	<b>1.50%</b>	<b>1.50%</b>

## Taxes / Tax brackets

Payments to the government, normally intended to provide government revenue; they do not constitute compensation for a specific service provided by the government. They should be distinguished from fees (e.g., for garbage collection) and contributions (e.g., for health insurance).

A distinction is made between several tax classes, which are presented here in simplified form:

**Tax bracket 1:** Single or living alone, no children

**Tax bracket 2:** Single or living alone, with children

**Tax bracket 3:** Married single earner or main earner

**Tax bracket 4:** Married, double income

### **Accident insurance**

State-organized compulsory insurance of the working population. The contributions are based on the accident risk in the respective trade, are borne solely by the employer, and amount to an average of about 1.3% of gross wages. The purpose of the accident insurance is to prevent accidents at work, occupational diseases, and work-related health hazards, and to restore the health and capacity of the insured persons by all appropriate means once accidents at work or occupational diseases have occurred. The accident insurance has existed in Germany since 1884.

## 2. Calculation tool: Online salary planner

### 2.A.1 Online salary planner

#### Task 6:

You will find an [online salary planner](#) on the internet. Try to research the gross earnings of two people you know. Find out all further required information about these two cases, enter it into the online salary planner, and enter the result in the following table to save your results anonymously.

Gross employee wage:

Solution: \_\_\_\_\_

Income tax:

Solution: \_\_\_\_\_

Solidarity tax:

Solution: \_\_\_\_\_

Employee health insurance:

Solution: \_\_\_\_\_

Employee nursing insurance:

Solution: \_\_\_\_\_

Employee pension insurance:

Solution: \_\_\_\_\_

Employee unemployment  
insurance:

Solution: \_\_\_\_\_

Employee social security  
contributions:

Solution: \_\_\_\_\_

Net employee wage:

Solution: \_\_\_\_\_

#### Task 7:

What do you notice regarding the amount of the deductions? What did you (not) expect?

Work on the task in the electronic textbook or your copybook.

### 3. The theater ticket experiment

#### 3.A.1 Decision situation A

##### Didactic note

The following pages of the textbook contain the theatre ticket experiment. For the experiment, divide the class into two groups as heterogeneously as possible (Group A and Group B). Two students each work together in the following experiment. The students of group A first work on the page “Theatre ticket experiment – Decision situation A”, and the students of group B first work on the page “Theatre ticket experiment – Decision situation B”. After about three minutes, each student should make a decision. Once each decision has been made, the students are asked to open the other decision situation and to work on it during the following two minutes.

Once all students have made a decision, you can continue on the page “Theatre ticket experiment – Developing a hypothesis”.

You want to go to the theatre and have already bought a ticket for 20 Euro. When you arrive at the box office, you realize that you have lost the ticket. But there are still tickets to be had in the same category at the same price.

##### Task 8:

Do you buy a new ticket for 20 Euro or do you decide not to go to the theatre?

*Source: Kahneman/Tversky 1984*

#### 3.A.2 Decision situation B

You want to go to the theatre and a ticket costs 20 Euro. You have reserved one, but still have to pick it up at the box office. Once you have arrived there, you realize that you have lost a 20-Euro note that had been in your wallet.

However, you still have enough money for a ticket, and there are still tickets available in the same category at the same price.

##### Task 9:

Do you buy a new ticket for 20 Euro or do you decide not to go to the theatre?

*Source: Kahneman/Tversky 1984*

### 3.A.3 Developing a hypothesis

#### Decision situation A

You want to go to the theatre, and have already bought a ticket for 20 Euro. When you arrive at the box office, you realize that you have lost the ticket. But there are still tickets to be had in the same category at the same price. Do you buy a new ticket for 20 Euro, or do you decide not to go to the theatre?

I decide to buy a new ticket.

I decide not to go to the theatre.

#### Decision situation B

You want to go to the theatre, and a ticket costs 20 Euro. You have reserved one, but still have to pick it up at the box office. Once you have arrived there, you realize that you have lost a 20-Euro note that had been in your wallet. However, you still have enough money for a ticket, and there are still tickets in the same category available at the same price. Do you buy a new ticket for 20 Euro, or do you decide not to go to the theatre?

I decide to buy a new ticket.

I decide not to go to the theatre.

#### Task 10:

Develop hypotheses regarding the extent to which the decisions in situation A differ from the decisions in situation B.

Work on the task in the electronic textbook or your copybook.

### 3.A.4 Analysis



### Didactic note

Both situations are identical from an economic point of view, as both A and B suffered a loss of assets of 20 €. The *type* of asset loss (lost cash or lost theatre ticket) is irrelevant. From a purely rational point of view, it should therefore not be relevant to the decision. For regardless of whether I decide in favor of or against a visit to the theatre, the loss of 20 € has already occurred in both cases. In the language of economics, one speaks here of “sunk costs”. But the decision that has to be made should not be justified retroactively. Rather, the additional costs incurred by the visit to the theatre (20 €) should be weighed against the additional benefits. In short, there should be no difference in the answers to the two questions if the parties involved make a “rational” decision. However, this is usually the case when conducting the experiment. For example, in a study by Nobel Prize winner Kahneman, 54% of people in Situation A decide against buying a new ticket – compared to only 12% in Situation B. And it was similar with us. Both groups tended to decide against buying a new ticket in situation A and, in the case of situation B, tended to buy a new ticket.

**Task 11:**

You want to go to the theatre, and have already bought a ticket for 20 Euro. When you arrive at the box office, you realize that you have lost the ticket. But there are still tickets to be had in the same category at the same price. Do you buy a new ticket for 20 Euro, or do you decide not to go to the theatre?

**Task 12:**

You want to go to the theatre, and a ticket costs 20 Euro. You have reserved one, but still have to pick it up at the box office. Once you have arrived there, you realize that you have lost a 20-Euro note that had been in your wallet. However, you still have enough money for a ticket, and there are still tickets available in the same category at the same price. Do you buy a new ticket for 20 Euro, or do you decide not to go to the theatre?

**Task 13:**

How do the two situations differ?

How can the results be explained? Do you have an explanatory approach (a theory)?

Work on the task in the electronic textbook or your copybook.

**Solution suggestion**

When an investment of time, money, or other resources – already made – causes people to make decisions that they would not otherwise make, this is referred to as a sunk-costs effect. This distortion particularly affects decisions concerning the continuation of projects.

**3.A.5 Further examples****Task 14:**

Do you know any further examples for this phenomenon?

Work on the task in the electronic textbook or your copybook.

## 4. The calculator experiment

### 4.A.1 Decision situation A

#### Didactic note

The following pages of the textbook contain the calculator experiment. For the experiment, divide the class into two groups as heterogeneously as possible (Group A and Group B). Two students each work together in the following experiment. The students of group A first work on the page “Calculator experiment – Decision situation A”, and the students of group B first work on the page “Calculator experiment – Decision situation B”. After about three minutes, each student should make a decision. After each decision has been made, the students are asked to open the other decision situation and to work on it in the following two minutes.

Once all students have made a decision, you can continue on the page “Calculator experiment – Developing a hypothesis”.

You go into a shop and want to buy two things: a pair of trousers for 125 Euro and a calculator for 15 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away.

#### Task 15:

Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

*Source: Kahneman und Tversky 1984*

### 4.A.2 Decision situation B

You go into a shop and want to buy two things: a pair of trousers for 15 Euro and a calculator for 125 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away.

#### Task 16:

Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

*Source: Kahneman und Tversky 1984*

### Decision situation A

You go into a shop and want to buy two things: a pair of trousers for 125 Euro and a calculator for 15 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away.

Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

### Decision situation B

You go into a shop and want to buy two things: a pair of trousers for 15 Euro and a calculator for 125 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away.

Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

#### Task 17:

What do you notice about the results? How do the two situations differ?

Work on the task in the electronic textbook or your copybook.

#### 4.A.4 Analysis

##### Didactic note

Both situations are identical from an economic point of view, as a saving of 5 Euro (benefit) has to be compared with an effort of 20 minutes (cost) for both A and B. The type of economization (cheap calculator versus cheap trousers) is irrelevant. It should therefore not be relevant for the decision – from a purely rational point of view. It doesn't matter whether I decide to take the additional trip in the first or second case: the 20-minute time loss occurs in both cases, and the savings are identical. However, our results show that many more students choose the trip in situation A than in situation B. Kahneman and Tversky explain this effect by means of the theory of mental accounting.

**Task 18:**

You go into a shop and want to buy two things: a pair of trousers for 125 Euro and a calculator for 15 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away. Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

**Task 19:**

You go into a shop and want to buy two things: a pair of trousers for 15 Euro and a calculator for 125 Euro. However, the salesperson points out that the calculator is 5 Euro cheaper in another store, which is about 20 minutes away. Do you bother to go on a 20-minute bike trip to the other branch to save the 5 Euro?

**Task 20:**

How can the results be explained? Do you have an explanatory approach (a theory)?

Work on the task in the electronic textbook or your copybook.

**Solution suggestion**

People tend to keep so-called “mental accounts”, in which they classify different projects or asset positions. Decisions are then often optimized within the corresponding account, and the overall view of the account is lost. Decisions concerning the continuation of projects are particularly affected by this distortion.

#### 4.A.5 Further examples

**Task 21:**

Do you know any further examples for this phenomenon?

Work on the task in the electronic textbook or your copybook.

## 5. The tennis-elbow task

### 5A.1 Tennis-elbow task - Role A

#### Task 22:

You will work on the following tasks with a partner. Find a partner, and one of you will open this page, while the other will open the following page.

#### Task 23:

Read the text and then explain the term “sunk costs” to your partner, using the following example.

For a long time, Simon Hegele has been wanting to do sports again regularly. Since his childhood, his great passion has been tennis. Now he has decided to join the tennis club “Blau Weiß Rodenkirchen”. The annual fee is 600 Euro – for this fee, he can use all the club’s tennis courts for one year. After three weeks, however, he develops a so-called tennis elbow. His doctor explains to him that this is a disease of the tendons around the elbow, which is caused by chronic strain. A typical symptom is severe pain on the outside of the elbow. Simon decides to continue playing regularly, as the tennis club does not want to refund his annual fee of 600 Euro.

#### Task 24:

Your partner will now read the text below and then explain the term “mental accounting” to you, using the example in the text. You can check your partner's explanation by using the overview in the box below.

For a long time, Simon Hegele has been wanting to do sports again regularly and has therefore decided to go to the gym regularly. Immediately after the trial session, which he enjoyed very much, he has therefore booked the annual subscription “Fit with Fun”. The annual fee is 600 Euro – for this fee, he can use all the club’s equipment for one year. After three weeks, however, he develops a pain in his elbow. His doctor explains to him that this is a disease of the tendons around the elbow, which is caused by chronic strain. The typical symptom is severe pain on the outside of the elbow. Simon decides to continue going to the gym regularly, as the gym does not want to refund his annual fee of 600 Euro.

## Overview

### Mental accounting

People tend to keep so-called “mental accounts”, in which they classify different projects or asset positions. Decisions are then often optimized within the corresponding account, and the overall view of the account is lost. Decisions on the continuation of projects are particularly affected by this distortion. This also applies to Simon: He doesn't want to have paid the 600 Euro for nothing. He wants to “allocate” the project positively to his mental account.

#### 5A.2 Tennis-elbow task - Role B

##### Task 25:

You will work on the following tasks with a partner. Find a partner, and one of you will open this page, while the other will open the following page.

##### Task 26:

Your partner will now read the text below and then explain the term “sunk costs” to you, using the example in the text. You can check your partner's explanation by using the overview in the box below.

For a long time, Simon Hegele has been wanting to do sports again regularly. Since his childhood, his great passion has been tennis. Now he has decided to join the tennis club “Blau Weiß Rodenkirchen”. The annual fee is 600 Euro – for this fee, he can use all the club's tennis courts for one year. After three weeks, however, he develops a so-called tennis elbow. His doctor explains to him that this is a disease of the tendons around the elbow, which is caused by chronic strain. A typical symptom is severe pain on the outside of the elbow. Simon decides to continue playing regularly, as the tennis club does not want to refund his annual fee of 600 Euro.

## Overview

### Sunk Costs

When an investment of time, money, or other resources – already made – causes people to make decisions that they would not otherwise make, this is referred to as a sunk-costs effect. This distortion particularly affects decisions concerning the continuation of projects. This also applies to Simon: Although the 600 Euro are “sunk costs” and should no longer influence his decision to continue playing, they do have a decisive influence on his decision. He continues playing because he made a (wrong) decision in the past.

#### Task 27:

Read the text and then explain the term “mental accounting” to your partner, using the following example.

For a long time, Simon Hegele has been wanting to do sports again regularly and has therefore decided to go to the gym regularly. Immediately after the trial session, which he enjoyed very much, he has therefore booked the annual subscription “Fit with Fun”. The annual fee is 600 Euro – for this fee, he can use all the club’s equipment for one year. After three weeks, however, he develops a pain in his elbow. His doctor explains to him that this is a disease of the tendons around the elbow, which is caused by chronic strain. The typical symptom is severe pain on the outside of the elbow. Simon decides to continue going to the gym regularly, as the gym does not want to refund his annual fee of 600 Euro.



## 6. The first experiment with shares

### 6.A.1 Decision situation A

#### Task 28:

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you his BASF shares worth 10,000 Euro. What are you going to do with them? (There are only three alternatives.)

*Source: Samuelson/ Zeckhauser 1988*

### 6.A.2 Decision situation B

#### Task 29:

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you 10,000 Euro in cash. What are you going to do with that? (There are only three alternatives.)

*Source: Samuelson/ Zeckhauser 1988*

### 6.A.3 Developing a hypothesis

#### Decision situation A

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you his BASF shares worth 10,000 Euro. What are you going to do with them? (There are only three alternatives.)

- Acquire shares in money market funds
- Keep the BASF shares
- Acquire government bonds

#### Decision situation B

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you 10,000 Euro in cash. What are you going to do with that? (There are only three alternatives.)

- Acquire shares in money market funds
- Buy BASF shares
- Acquire government bonds

### Task 30:

Develop hypotheses on the extent to which the decisions in situation A differ from the decisions in situation B.

Work on the task in the electronic textbook or your copybook.

#### Overview

**Money market funds** invest the funds they receive from investors primarily in short-term forms of investment, such as bank deposits, variable-interest securities, and fixed-interest securities with a residual term of no more than twelve months. Investors may redeem the units sold to them by money market funds (money market fund units) at any time, i.e., convert them back into liquid assets.

**Shares** are interests in a stock corporation, with which corresponding membership rights are associated. The share enables the corporation to raise equity capital. It splits the share capital of the stock corporation into smaller shares. The share certifies a proportion of the share capital, profit distributions, capital increases from company funds, and liquidation proceeds. The price of the share itself is redefined by stock-exchange trading.

**Government bonds** are interest-bearing securities issued by a government. The government uses the bond to raise money on the international capital market, which it needs for government operations and investments. Government bonds issued by countries with sound government budgets are considered very safe. The safest government bonds are bonds issued by countries with an AAA rating, the highest credit rating (Germany, Switzerland, Canada, and Australia). However, history has provided many examples where even a state could no longer service its debts and had to declare national bankruptcy. Developing countries, but also industrialized countries with high debt burdens, have a lower credit rating and pay higher interest on their bonds to obtain money, because they offer less security, and therefore an investment is riskier for investors. Recent examples of payment defaults on government bonds are Greece and Argentina.

#### 6.A.4 Analysis

### Didactic note

Both situations are almost identical from an economic point of view. In situation A, the shares worth €10,000 could easily be sold and then invested in money market fund units or government bonds. So if you prefer an investment in money market fund shares or government bonds to an investment in shares, you should choose this option.

However, our results show, as do all known scientific studies, that the proportion of those who do not want to change anything about the investment is particularly high.

Most people want things to stay the way they are. If they have the choice between an existing situation and change, they are more likely to decide against change – they prefer the status quo. Samuelson & Zeckhauser (1988) describe the tendency to do nothing in decision-making situations, or to stick to a decision made, i.e., to remain in the status quo, as status-quo distortion. The more alternatives are available, and the less knowledge about the alternatives and their consequences is available, the more pronounced the status quo bias is.

#### Task 31:

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you his BASF shares worth 10,000 Euro. What are you going to do with them? (There are only three alternatives.)

#### Task 32:

Your uncle from Rostock, whom you unfortunately never met, has passed away. He has left you 10,000 Euro in cash. What are you going to do with that? (There are only three alternatives.)

#### Task 33:

How can the results be explained? Do you have an explanatory approach (a theory)?

Work on the task in the electronic textbook or your copybook.

### Solution suggestion

The question whether an alternative leads to a change in the current state (status quo) or preserves it often influences people's decision-making behavior. The status-quo bias says that people tend to want things to stay the way they are. They have a preference for the status quo.

### 6.A.5 Further examples

**Task 34:**

Do you know any further examples for this phenomenon?

Work on the task in the electronic textbook or your copybook.

## 7. The experiment with the wheel of fortune

### 7.A.1 Decision situation A

#### Task 35:

Which variant will you choose?

**Variant I:** You will receive 900 Euro for sure.

**Variant II:** You will turn a wheel of fortune. Please note:

*Source: Kahneman 2014*

### 7.A.2 Decision situation B

#### Task 36:

Which variant will you choose?

**Variant I:** You will lose 900 Euro for sure.

**Variant II:** You will turn a wheel of fortune. Please note:

*Source: Kahneman 2014*

### 7.A.3 Developing a hypothesis

## Decision situation A

Which variant will you choose?

**Variant I:** You will receive 900 Euro for sure.

**Variant II:** You will turn a wheel of fortune. Please note:

The probability of your winning 1,000 Euro is 90%. The probability of not winning anything at all is 10%.

## Decision situation B

Which variant will you choose?

**Variant I:** A certain loss of 900 Euro.

**Variant II:** You will turn a wheel of fortune. Please note:

The probability of your not losing anything is 10%. The probability of losing 1,000 Euro is 90%.

### Task 37:

Develop hypotheses on the extent to which the decisions in situation A differ from the decisions in situation B.

Work on the task in the electronic textbook or your copybook.

## 7.A.4 Analysis

### Task 38:

Which variant will you choose?

**Variant I:** You will lose 900 Euro for sure.

**Variant II:** You will turn a wheel of fortune. Please note:

**Task 39:**

Which variant will you choose?

**Variant I:** You will lose 900 Euro for sure.

**Variant II:** You will turn a wheel of fortune. Please note:

**Task 40:**

From a purely rational point of view, therefore, the decision situations are identical. But how, then, can the different results be explained? Please formulate a well thought-out explanation (a theory) as homework!

Work on the task in the electronic textbook or your copybook.

## 8. The second experiment with shares

### 8.A.1 Decision situation A

Simon Hegele is now 50 years old. He needs 5,000 Euro to cover the costs of his daughter's wedding. Therefore he wants to sell some of his shares. Among the shares he owns, which are currently worth about 5,000 Euro, are Strawberry shares and Blueberry shares. The price of both shares has remained stable in recent weeks, and the forecasts are positive for both companies.

#### **Task 41:**

Please decide: Which shares should Simon sell?

*Source: following Kahneman 2014*

### 8.A.2 Decision situation B

Simon Hegele is now 50 years old. He needs 5,000 Euro to cover the costs of his daughter's wedding. Therefore he wants to sell some of his shares. Among the shares he owns, which are currently worth about 5,000 Euro, are Strawberry shares and Blueberry shares. The Strawberry shares are currently worth considerably more than Simon originally paid for them. The Blueberry shares, however, are currently worth less than Simon originally paid for them. The price of both shares has remained stable in recent weeks, and the forecasts are positive for both companies.

#### **Task 42:**

Please decide: Which shares should Simon sell?

*Source: following Kahneman 2014*

### 8.A.3 Developing a hypothesis



## Decision situation A

Simon Hegele is now 50 years old. He needs 5,000 Euro to cover the costs of his daughter's wedding. Therefore he wants to sell some of his shares. Among the shares he owns, which are currently worth about 5,000 Euro, are Strawberry shares and Blueberry shares. The price of both shares has remained stable in recent weeks, and the forecasts are positive for both companies.

Please decide: Which shares should Simon sell?

He should sell the Strawberry shares.

He should sell the Blueberry shares.

## Decision situation B

Simon Hegele is now 50 years old. He needs 5,000 Euro to cover the costs of his daughter's wedding. Therefore he wants to sell some of his shares. Among the shares he owns, which are currently worth about 5,000 Euro, are Strawberry shares and Blueberry shares. The Strawberry shares are currently worth considerably more than Simon originally paid for them. The Blueberry shares, however, are currently worth less than Simon originally paid for them. The price of both shares has remained stable in recent weeks, and the forecasts are positive for both companies.

Please decide: Which shares should Simon sell?

He should sell the Strawberry shares.

He should sell the Blueberry shares.

### Task 43:

Develop hypotheses on the extent to which the decisions in situation A differ from the decisions in situation B.

Work on the task in the electronic textbook or your copybook.

## 8.A.4 Analysis

### Didactic note

Economically speaking, the two situations are almost identical. In situations A and B, the price of each share is stable, and the forecasts are positive for both companies. From an economic point of view, it does not matter that the Blueberry shares have lost value – their acquisition costs are “sunk” (on **sunk costs**, see lesson 3).

In fact, however, many investors are guided by the goal of not incurring losses (on **loss aversion**, see above). They form mental accounts and think along the following lines: “If I close the Strawberry shares account, I could make a profit on the Strawberry shares account. I like that better than closing the Blueberry account and posting a failure there. I would rather hold the Blueberry shares and try to book a success there in the long run.” (On **mental accounting**, see lesson 3.)

### Task 44:

**How can the results be explained? Do you have an explanatory approach (a theory)?**

Work on the task in the electronic textbook or your copybook.

### Solution suggestion

If a share incurs losses, it is often held until it is back above its entry price. Sunk-cost effects, mental accounting, and loss aversion therefore ensure that investors typically hold loss-making shares for too long.

## 9. The fund experiment

### 9.A.1 Decision situation A

#### Didactic note

The teacher explains the situation as follows:

It's a question of choosing between different types of investment. Both investment forms – building-loan contract and real-estate fund – have advantages and disadvantages. A building-loan contract is a savings contract that the investor enters into with a building society. Building-society loans are mainly used for private property financing. The building-loan contract has the advantage, for example, of being subsidized by the state (with capital-forming benefits, an employee savings bonus, and a housing construction premium) and is a secure form of investment. However, there are also disadvantages to this form of investment. For instance, despite the state subsidy, the average returns are generally lower than those on real-estate fund savings. The idea of real-estate fund saving is based on bundling the capital of several investors to invest it in real estate. If things go well, high value growth is possible with a long savings period. However, this greater increase in value is more uncertain than, for example, in the case of building-society savings.

#### Task 45:

Which variant will you choose?

**Variant I:** A “Germany” real-estate fund, with an average return of 5% in the last three years

**Variant II:** A building-society contract with an average return of 5% in the last three years

*Source: DSV 2012*

### 9.A.2 Decision situation B

#### Task 46:

Which variant will you choose?

Variant I: A “Germany” real-estate fund, with an average return of 5% in the last three years

Variant II: A “Europe” real-estate fund, with an average return of 4% in the last three years

Variant III: A building-society contract with an average return of 5% in the last three years

*Source: DSV 2012*

### 9.A.3 Developing a hypothesis

#### Decision situation A

Which variant will you choose?

**Variant I:** A “Germany” real-estate fund, with an average return of 5% in the last three years

**Variant II:** A building-society contract with an average return of 5% in the last three years

#### Decision situation B

Which variant will you choose?

**Variant I:** A “Germany” real-estate fund, with an average return of 5% in the last three years

**Variant II:** A “Europe” real-estate fund, with an average return of 4% in the last three years

**Variant III:** A building-society contract with an average return of 5% in the last three years

#### Task 47:

Develop hypotheses on the extent to which the decisions in situation A differ from the decisions in situation B.

Work on the task in the electronic textbook or your copybook.

### 9.A.4 Analysis

### Didactic note

If an advisor wants to convince a customer of a certain form of investment (e.g., A instead of B), it is often sufficient to offer a further, slightly worse variant (A-) in addition to the variant (A) preferred by the customer. The “Europe fund” puts the “Germany fund” in a better light; the customer can compare and feels strengthened in his or her decision.

#### Task 48:

Look at decision situation A and make a choice.

#### Task 49:

Look at decision situation B and make a choice.

#### Task 50:

Please look at the results. What do you notice?

What is the difference between the two situations? And how can the results be explained?

Work on the task in the electronic textbook or your copybook.

### Solution suggestion

If the wording of a decision problem influences the decision itself, one speaks of so-called “framing effects”. Such framing effects occur because people make different decisions for the same problem, with different ways of formulating it.

## 9.A.5 Further examples

**Task 51:**

Do you know any further examples for this framing effect? Look for an advertisement from magazines, TV, or radio, in which a framing effect occurs. Use this example to explain what is meant by “framing”.

Work on the task in the electronic textbook or your copybook.

## 10. The ultimatum game

### 10.A.1 Thinking through financial decisions – The ultimatum game

#### Didactic note

The interactive learning strand is based on the **ultimatum game**. In this game, a player (Player A) is offered a fictitious sum of 10 Euro by a game master and has to split the 10 Euro between himself (Player A) and another player (Player B). The two players are not allowed to talk to each other. The other player (Player B) can accept or refuse the offered distribution. If the player accepts the distribution, both players keep the money. If the player rejects the distribution, both players lose the money. The game is used to illustrate the importance of social comparisons in financial decisions.

In the first task, the students click on the button “New Game”. The computer automatically assigns two people to each other who are ready to play. Player A is shown the following message:

*Imagine you are offered ten euros. There is only one catch: You have to give part of the money to a fellow player, in your case X (name of player B). You decide how much of your money you give away. However, X (name of player B), who knows the rules of the game, must agree with your offer. If X agrees to the split, you will both get your share. If X finds that you are offering him too little and therefore rejects your split, you will both go away empty-handed. Make X (name of player B) an offer. Use the slider and then click on “offer”. In the second step, X (name of player B) will be shown your decision and will have the opportunity to accept or reject the offer. You are not allowed to talk to X (name of player B).*



The interface shows two sliders for distributing 10 euros. The first slider is labeled 'You' and the second is labeled 'Other'. Each slider has a '0' button and a blue bar representing the amount. Below the sliders is a large orange button labeled 'Offer'.

**Figure:** Perspective of student A

[Close](#)



The interface shows two sliders for distributing 10 euros. The first slider is labeled 'You' and the second is labeled 'Other'. Each slider has a '0' button and a blue bar representing the amount. Below the sliders is a large orange button labeled 'Offer'.

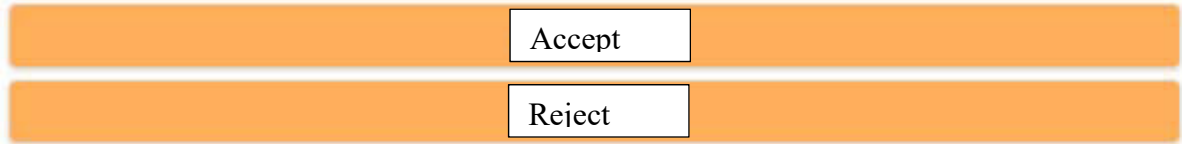
After player A has sent the offer, in our case a division of 6 Euro for player A and 4 Euro for player B, player B will receive the following message:

*The offer made by Y (name of player A) is:*

*X (name of player A): 6 Euro*

*Y (name of player B): 4 Euro.*

*Do you accept or reject this decision?*

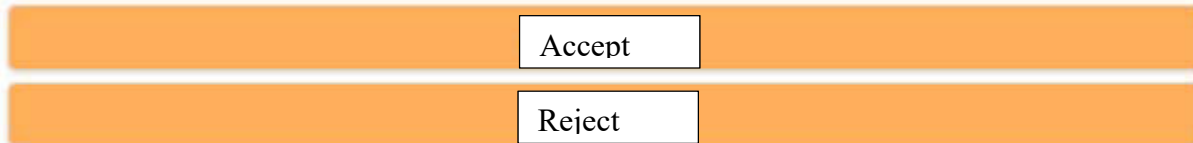


Accept

Reject

**Figure:** Perspective of student B

[Close](#)



Accept

Reject

**Figure:** Perspective of student B



On the following pages, the results are discussed.

### **Task 52:**

Carry out the following economic experiment several times.

### **Didactic note**

Both analyses are concealed in the student perspective and are only shown once the experiment has been carried out. The second chart with the values of all students from all learning groups is interesting mainly because of the larger sample.

## **10.A.2 Analysis**

### **Task 53:**

What decisions (amount of offers) have the students from group A made, and why?  
Why did the students from group B reject the offers? Why not?  
Would the students from group B have accepted a lower offer? How low could the offer have been?

Work on the task in the electronic textbook or your copybook.

### Didactic note

The decision on how many Euro to give away would be such that a merely self-interested player would only give away exactly one Euro. He himself would keep 9 Euro. The opponent would also accept this division, as she would get more, with one Euro, than if she rejected the offer and received nothing. This type of decision-maker, who acts according to a selfish calculation, is often labelled as “homo economicus”. In contrast to “homo economicus”, however, “homo sapiens” tends to make a decision that is as fair as possible for both. In other words, homo sapiens has an **inequality aversion**.

#### 10.A.3 Task 1

##### Task 54:

The ultimatum game shows that (check and discuss whether right or wrong)

Most people have an unfairness aversion.

All people take 1 Euro and are satisfied.

Very few people are satisfied with 1 Euro.

Almost all people offer only 1 Euro.

Homo economicus takes 1 Euro, because 1 Euro is better than nothing.

Homo economicus offers nothing.

#### 10.A.4 Task 2

##### Task 55:

The classic homo economicus...

...acts only according to his own interests and preferences.

...acts against the interests of his fellow man.

...pays attention to his status within a social group.

...always acts rationally according to the economic principle

...tries to achieve maximum return with minimum effort.

#### 10.A.5 Transferring the results from the ultimatum game

### **Task 56:**

Transfer the results from the ultimatum game to our other experiments:

How would homo economicus act...

...in the theatre-ticket experiment?

...in the calculator experiment?

...in the tennis-elbow situation?

...in the first experiment with shares?

...in the experiment with the wheel of fortune?

...in the second experiment with shares?

...in the fund experiment?

Are there arguments against the decision-making behavior of homo economicus in the individual situations?

Should we generally base our financial decisions more on the decision-making behavior of homo economicus?

Work on the task in the electronic textbook or your copybook.

## 11. Developing an investment strategy

### 11.A.1 Developing an investment strategy

Simon Hegele is still working for the **company** Baumaschinen Würtgen GmbH. By now he completely understands his salary statement. And he is also familiar with typical errors of reasoning when dealing with **money**.

Despite the high deductions (taxes, social security contributions, etc.), he managed to **save** 500 Euro a month last year – not least because until recently he lived with his parents. He now wants to invest the total amount – exactly 6000 Euros – as profitably as possible for three years, because then he wants to buy a new car. He is prepared to give up his savings for three years in return. Initial research by his brother-in-law Rainer – who has completed a bank apprenticeship and is very knowledgeable – leads to the following results:

Offer no.	Name	Return	Special Feature
1	Savings bond of the Versu Bank	1.2% per annum	Annual payment of interest
2	Savings bond of the Europa Bank	1.0% per annum	Interest is credited to the <b>account</b>
3	Savings bond of the Rabö Bank	0.4% per annum	Legal period of notice (3 months)
4	Growth saving with Hanseatenbank	0.8% in Year 1 1.0% in Year 2 1.2% in Year 3	From 1,500 Euro
5	Call money account with Consörsbank	1.5% guaranteed for one year; 50 Euro <b>bonus</b> for new customers	Interest rate from year 2 is 0.5%
6	Fixed deposit with DHF Bank	1.4% per annum	From 10,000 Euro; if less: 1.2% per annum

## OVERVIEW

### Fixed Deposit

Fixed-term deposits are a form of saving in which the duration and the interest rate are agreed in advance. Whereas the funds invested in a call money account can be accessed on a daily basis, here the saver must wait until the end of the agreed term. As compensation for the investment over an agreed duration in the fixed-term deposit account, the saver receives more interest. Even a fixed-term deposit with a term of 1 year offers significantly higher interest rates than the best call money accounts.

## **Return**

In finance, "return" is the effective interest rate, expressed as a percentage of a reference value, which an investor in financial products – or another form of investment – achieves within one year.

## **Savings Bond**

A savings bond is a fixed-interest and very secure form of investment. Here you invest money over a fixed term (usually you can choose between one and ten years). For this capital investment, you get interest, which is fixed for the entire term and therefore does not change. The biggest disadvantage of savings bonds is that you cannot get hold of the money during the term of the savings bond. Therefore, you should only invest the money in a savings bond that you definitely will not need until the end of the investment. You can get savings bonds at any normal bank. Normally there are no fees for this savings product.

## **Savings Book**

A savings account is an account at a bank where the deposits of a saver are recorded. The standard form of such a savings account is the so-called savings book. This represents a savings certificate in which all deposits and withdrawals as well as the saver's interest income are recorded. Traditionally issued in paper form, the savings book has for years been increasingly replaced by the paperless *SparCard* (savings card), where all deposits and withdrawals as well as the interest income are recorded on a card. A savings account can only be operated with a positive balance. This is referred to as credit-based account management.

## **Call Money**

A call money account is particularly suitable for short-term and temporary investments. There are various call money accounts on the market, which can be compared mainly on the basis of the interest rate offered. The advantage of a call money account is that there is usually no notice period to observe and you can dispose of your money flexibly at any time. Depending on what is on offer, you will receive an attractive interest rate and can switch to a better offer if necessary (bonuses for new customers are popular). The banks usually offer their call money accounts free of charge. However, unlike a current account, a call money account cannot be used as a clearing account.

## **Growth Saving**

Growth saving means you receive interest on your money, which increases the longer you save. Banks usually advertise the particularly high interest rate in the last year of the term ("attractive interest rate"). With growth saving, you usually invest your money over a relatively long period of three to five years. The annual return over the entire term usually does not exceed the return on the best fixed-term deposit offers.

**Task 57:**

Please begin by calculating the payout amount in increments after 3 years. Complete the following table in order to do that:

Name	Initial Capital	Interest Year 1	Capital after 1 Year	Interest Year 2	Capital after 2 Years	Interest Year 3	Final Capital
1. Savings bond of the Versu Bank							
2. Savings bond of the Europa Bank							
3. Savings bond of the Rabö Bank							
4. Growth saving with Hanseatenbank							
5. Call money account with Consörsbank							
6. Fixed Deposit with DHF Bank							

Evaluation

### 11.A.2 Inflation-rate task

**Task 58:**

Calculate the purchasing power of 1,000 € in 5 and 10 years, with an assumed average inflation of 2%, 4%, and 8%.

	2 percent	4 percent	8 percent
after 5 years			
after 10 years			

**Suggested solution (and explain calculations)**

	2 %	4 %	8%
<i>after 5</i> <i>years</i>	905.73 €	821.93 €	680.58 €
<i>after</i> <i>10</i> <i>years</i>	820.34 €	675.56 €	463.19 €

**Task 59**

If the same mountain of goods, which will still be worth 1,000 Euro in 2015, costs 1020 Euro after one year, i.e., in 2016, inflation will be 2%. Here, one calculates:  $1,000 \cdot 1.02 = 1,020$ .

Hence, how much (in 2015 terms) would one be able to buy with 1,000 Euro in 2016?

## Appendix C – Online data collection November 2021 to March 2022

Dear participants!

A few years ago, when you were at school, you took part in a project at the Max Planck Institute in Bonn. At that time, it was about researching economic preferences (such as patience or risk attitudes) and financial decisions. You were also able to earn money in our tasks and knowledge tests in the process.

Today we would like to invite and ask you to participate in a follow-up survey. For completing the following questionnaire you will receive 50 Euro participation fee. In addition, you can earn up to another 50 Euros depending **on your input, so that you can earn up to 100 Euros for the survey within about 30-40 minutes, certainly 50 Euros of that**. The funds for this study come from the budget of the Max Planck Society for conducting basic research. We can therefore pay you a comparatively high participation fee.

### Conditions of participation

You can only participate in this study and also earn money if you have already participated in our first survey between 2017 and 2019 in one of the 11 schools and 30 classes. As a reminder of that earlier study, you can click [HERE](#) and [HERE](#) to see 2 decision sheets we used then and on which you made decisions then. Another condition of participation is that you agree to allow us to link your data from this post-survey with your data from 2017 to 2019 through the anonymous code.

Today's survey consists of 4 parts. We can pay your participation and your decisions only if you work on all 4 parts in a concentrated and careful way.

### Voluntariness and anonymity

Participation in the study is voluntary. You may terminate your participation in this study at any time without giving any reason and without incurring any disadvantages (however, you can only be paid if you complete all parts). The data and personal communications collected in the course of this study will be treated confidentially. For example, those project staff members who have personal data through direct contact with you are bound by confidentiality. Furthermore, the publication of the results of the study will be anonymous, i.e. your data cannot be assigned to you personally.

### Data protection

The collection of your personal data described above is completely anonymized, i.e. at no point (except for payment - see next paragraph) is your name requested. Your answers and results are stored

under a personal code that you yourself have created based on a rule and that no one but you knows. This means that it is not possible for anyone to associate your data with your name. The anonymized data is stored for at least 10 years. However, whenever you want, you can ask us to delete the data we have collected from you. To do this, you do not have to tell us your name, just your code. In addition to the right to erasure, you also have the right to information, correction of your data and data portability at any time. For further questions, please send us an e-mail. The email addresses is [datenschutz@econ-ebook.de](mailto:datenschutz@econ-ebook.de).



**Payout**

The necessary data for the payout will be stored separately from the other data until the payout and will be deleted after the payout.

The study leaders

Prof. Dr. Matthias Sutter (Max Planck Institute for the Study of Common Good Bonn),

Prof. Dr. Michael Weyland (Ludwigsburg University of Education) and

Dipl.-Gymf. Manuel Froitzheim (University of Siegen).

There are 73 questions in this survey.

**Consent forms****Declaration of consent for study participation**

I have been informed about the study, its procedure, significance and scope, and have read and understood the study information. I have had the opportunity to clarify all open questions. I have the right to ask for further information about the study at any time. I voluntarily agree to participate in the study described in the study information. I have been informed that I may withdraw from this study participation at any time without incurring any disadvantage.

Please select only one of the following answers:

- Yes
- No

**Data protection consent statement**

I have read and understood the study information. I have been informed that my consent is voluntary and that I can withdraw it at any time for the future. I have also been advised of my other rights as a data subject. I consent to the collection, processing and analysis of my data by the Max Planck Institute for the Study of Common Good and the cooperation partners PH Ludwigsburg and University of Siegen. The collected data may be used by the Max Planck Institute and the cooperation partners within the framework of scientific research for the explained purpose. I consent to research data being deposited without my name being mentioned for the publication of research results in scientific journals for their review. I agree that research data from this study may be merged and analyzed with previously collected data on this project.

Please select only one of the following answers:

- Yes
- No

**Access code**

Your personalized code consists of a set of personal building blocks, some of which only you know. Please focus when creating your code, as you will need it later.

Please use the data that was valid in school at the time of the survey.

**Second letter of your first name**

**Third letter of your last name**

**Month of your mother's birthday:**

**Day of your birthday**

**Your birth month**

**Number of your siblings**

**School**

Please select only one of the following answers:

- Nicolaus August Otto School Diez
- Beethoven Grammar School Bonn
- Mountain school St. Elisabeth
- Commercial Vocational College Oberberg Location Gummersbach
- Vocational College Canisiusstift Ahaus
- CJD Christophorus School Königswinter
- Grammar school Netphen
- Homburg Grammar School Nümbrecht
- Private Ernst-Kalkuhl-Gymnasium with boarding school
- Franziskus Grammar School Nonnenwerth
- Municipal Siebengebirgsgymnasium
- Cardinal Frings Beuel

## Activities

**Please indicate how often you have done the following in the last six months: \***

Please select the applicable answer for each item:

	Never	Rare	Sometimes	Often	Always
Compared prices when buying a product or service					
All bills paid on time					
Maintains a written or electronic record of monthly expenditures					
Remained within the budget or spending plan					

	Never	Rare	Sometimes	Often	Always
Money saved from each salary					
Saved for a long-term goal, e.g., car, education, home, etc.					
Money deposited in a retirement account or saved for retirement					
Bonds, shares or investment funds purchased					

## Insurances

**Please rate your behavior regarding insurance within the last year. \***

Please select the applicable answer for each item:

	Never	Rare	Sometimes	Often	Always
Maintained or acquired adequate health insurance coverage					
Maintained or purchased adequate property insurance such as auto, liability, or homeowner's policies					
Life insurance maintained or purchased					

## Payment products

**Please tick which products you have.**

Please select all that apply:

- Account
- Call money account
- Passbook
- Credit card
- Shares/bonds
- Bitcoin or other digital currencies
- Gold
- Loan

Multiple answers are possible for this question

## Statements

**Please indicate how often in the last six months the following statements apply to you:**

Please select the applicable answer for each item:

	Never	Rare	Sometimes	Often	Always
I live within my means.					
I pay my monthly bills before their due date.					
I try to anticipate and plan for future financial income and expenses.					
When shopping for consumer goods on a day-to-day basis, I am informed to make rational decisions that are in line with my financial capabilities.					
I try to stay informed and educated in the area of successfully managing personal finances.					
When I buy an item, the first thing I consider is whether I can afford it.					
I regularly set aside money for possible unexpected expenses.					
I review the adequacy of the insurance coverage I have.					
I am getting into more and more debt.					
I spend more money than I have.					
I follow a weekly/monthly budget.					
I regularly review and evaluate my spending.					
I estimate household income and expenses.					

## General questions

### Do you have a bank account?

Please select only one of the following answers:

- Yes
- No

### Approximately what current amount of money was available to you last month?

Please enter your answer(s) here:

- Total
- of which income from occupation/secondary job
- thereof pocket money
- thereof Bafög

- of which from other sources (e.g. gifts)

### **Approximately how much of that did you save?**

Please enter your answer here:

### **If you have ever spent more than you actually had available, how did you finance the rest?**

Please select all that apply:

- from savings
- borrowed from friends
- borrowed from relatives
- taken a credit
- has never happened
- other:

### **Have you ever lent money to someone else?**

Please select only one of the following answers:

- Yes
- No

### **Which of the following expenses do you pay yourself, that is, with your own money? Which expenses do your parents pay? What do you pay jointly (both your parents and you pay part)? \***

Please select the applicable answer for each item:

	<b>I pay myself</b>	<b>pay my parents</b>	<b>we pay together</b>	<b>did not have these expenses</b>
Cell phone				
Clothing				
Lunch				
Sports				
Transportation (e.g. bus or train tickets, ...)				
Expenses for training/studies (e.g. books, ...)				
Other leisure activities (e.g. going out, cinema, ...)				

### **How often ...**

Please select the applicable answer for each item:

	never	rare	occasionally	often	very often
... do you bet with friends for money?					
... do you participate in games of chance?					
... do you smoke?					

## Decision sheet 1: random draw or secure amount

In each of the following 20 decisions you can choose between a random draw and a secure amount. The random draw always remains the same, while the safe amount increases by €1 from decision to decision (from €1 in the first decision to €20 in the twentieth decision).

The random draw always means that you will receive 20 euros or nothing. In this case, the computer decides with equal probability whether the result is 20 euros or 0 euros.

If one of these choices on this sheet becomes payout relevant and you have chosen the safe amount, you will get this amount. If you have chosen the random draw on the relevant line, the computer will decide with equal probability whether you get 20 euros or nothing.

**Please tick now in each of the lines 1 to 20 which variant (random draw or secure amount) you prefer.**

Please select the applicable answer for each item:

	Random draw	Safe amount
1) Random draw		
2) Random draw		
3) Random draw		
4) Random draw		
5) Random draw		
6) Random draw		
7) Random draw		
8) Random draw		
9) Random draw		
10) Random draw		
11) Random draw		
12) Random draw		
13) Random draw		
14) Random draw		
15) Random draw		
16) Random draw		
17) Random draw		

	Random draw	Safe amount
18)	Random draw	
19)	Random draw	
20)	Random draw	

## Decision sheet 2: Money within 24 hours or money in a week

For the next 20 decisions you can choose whether you prefer to receive 20,20€ in the next 24 hours or an equal or higher amount in 1 week. The amount in 1 week will increase by 0.40€ from decision to decision (from 20.20€ in the twenty-first decision to 27.80€ in the fortieth decision).

If one of these decisions on this sheet becomes disbursable, you will receive the corresponding amount at the time you choose.

**Please tick now in each of the lines 21 to 40 which variant (20,20€ in the next 24 hours or the other amount in a week) you prefer.**

Please select the applicable answer for each item:

	Amount within 24 hours	Amount in one week
21)	20,20 Euro in the next 24 hours	
22)	20,20 Euro in the next 24 hours	
23)	20,20 Euro in the next 24 hours	
24)	20,20 Euro in the next 24 hours	
25)	20,20 Euro in the next 24 hours	
26)	20,20 Euro in the next 24 hours	
27)	20,20 Euro in the next 24 hours	
28)	20,20 Euro in the next 24 hours	
29)	20,20 Euro in the next 24 hours	
30)	20,20 Euro in the next 24 hours	
31)	20,20 Euro in the next 24 hours	
32)	20,20 Euro in the next 24 hours	
33)	20,20 Euro in the next 24 hours	
34)	20,20 Euro in the next 24 hours	
35)	20,20 Euro in the next 24 hours	
36)	20,20 Euro in the next 24 hours	
37)	20,20 Euro in the next 24 hours	
38)	20,20 Euro in the next 24 hours	
39)	20,20 Euro in the next 24 hours	
40)	20,20 Euro in the next 24 hours	

## Decision sheet 3: Money in one week or money in two weeks

For the next 20 decisions, you can choose whether you prefer to receive 20.20€ in 1 week or an equal or higher amount in 2 weeks. The amount in 2 weeks will increase by 0.40€ from decision to decision (from 20.20€ in the forty-first decision to 27.80€ in the sixtieth decision).

If one of these decisions on this sheet becomes disbursable, you will receive the corresponding amount at the time you choose.

**Please mark now in each of the lines 41 to 60 which variant (20,20€ in 1 week or the other amount in 2 weeks) you prefer.**

Please select the applicable answer for each item:

	Amount in 1 week	Amount in 2 week
41) 20,20€ in 1 week		
42) 20,20€ in 1 week		
43) 20,20€ in 1 week		
44) 20,20€ in 1 week		
45) 20,20€ in 1 week		
46) 20,20€ in 1 week		
47) 20,20€ in 1 week		
48) 20,20€ in 1 week		
49) 20,20€ in 1 week		
50) 20,20€ in 1 week		
51) 20,20€ in 1 week		
52) 20,20€ in 1 week		
53) 20,20€ in 1 week		
54) 20,20€ in 1 week		
55) 20,20€ in 1 week		
56) 20,20€ in 1 week		
57) 20,20€ in 1 week		
58) 20,20€ in 1 week		
59) 20,20€ in 1 week		
60) 20,20€ in 1 week		

## Personal data

Age

Please enter your answer here:



**What mathematics grade (in points) did you have on your last school report card?**

Please select only one of the following answers:

- 15 / 1+
- 14 / 1
- 13 / 1-
- 12 / 2+
- 11 / 2
- 10 / 2-
- 9 / 3+
- 8 / 3
- 7 / 3-
- 6 / 4+
- 5 / 4
- 4 / 4-
- 3 / 5+
- 2 / 5
- 1 / 5-
- 0 / 6

**What is your current occupation?**

Please select only one of the following answers:

- Work
- Training
- Study
- School
- Voluntary social year
- Federal Volunteer Service
- Other

**Gender**

Please select only one of the following answers:

- Female
- male

**Part 4: Knowledge questions**

See Appendix B2 - Part A: Financial literacy

**Conclusion**

In order to maximize participation in our follow-up survey, we would like to ask for your assistance: If you have contact with former classmates who participated in our survey at school, you can send the survey link and the following code [INDIVIDUAL CODE] to their classmates. For each classmate who completes the survey after you send him or her the code, you will receive an additional 20 euros after the survey is completed. If the person in question has already participated in our survey before you sent it to him or her, then you will get 1 euro for your effort. So if you forward the link and the code quickly, you can earn more extra money, but we can pay it out separately only after the survey is completed.

Since we intend to contact participants repeatedly in the long term as part of this project, we would like to ask you to provide us with a contact option. You can revoke this option at any time.

**If you have received a code from a classmate, then you can enter the code here so that your classmate will receive the corresponding bonus.**

Please enter your answer here:

## **Payoff experiment**

By chance, the decision [DECISION] was selected in part 2. In the random draw, the computer randomly determined [RESULT RANDOM DRAW], where 0 represents the safe amount and 2 represents 0 euros.

In order for us to send you your entire payout, you can choose between a transfer to your account and a transfer via Paypal (if you have an account there). For this we need one of the following information. As assured at the beginning, this data for the payout is stored separately from the other data and deleted after the payout.

**What procedure do you want for the disbursement of the money?**

Please select only one of the following answers:

- Bank transfer
- Paypal
- No payout

**Option A: To transfer the money to your account.**

**Option B: Transfer the money to your Paypal account**

Please enter your answer here:

Please enter here the email address connected to your Paypal account

Thank you for participating in the survey. If you have any questions or comments, please send us a message at [froitzheim@digitale-wirtschaftsbildung.de](mailto:froitzheim@digitale-wirtschaftsbildung.de).

Thank you very much for answering the questionnaire.