

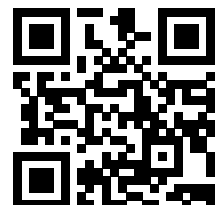


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Determinants of Financial Literacy and Behavioral Bias among Adolescents*

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Abstract

Building on cross-sectional data for Austrian high school students from fifth to twelfth grade, we investigate the correlations between socio-economic background variables and a comprehensive set of variables related to financial decision-making (i.e., financial knowledge, behavioral consistency, economic preferences, field behavior, and perception of financial matters). We confirm the findings of previous literature that the male gender is positively associated with financial knowledge and risk-taking and that there is a strong and beneficial correlation between math grades and healthy financial behavior (e.g., saving). Moreover, we find that students' behavioral consistency is positively correlated with measures of financial attitude (e.g., self-assessed future financial well-being and financial education received from parents). Finally, our results indicate that financial education, as perceived by the students, is primarily provided by parents.

JEL classification: C93, D81, D91, G53, J13

Keywords: financial literacy, behavioral biases, economic preferences, field behavior, perception, experiment, adolescents.

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1 Introduction

In this study, we investigate socio-economic and demographic determinants of financial literacy and behavioral bias among adolescents using an online experimental approach. Our aim is to establish which characteristics play an important role when taking on a holistic perspective on financial decision-making. To this end, we conduct a pre-registered online study with Austrian high school students where we elicit their financial knowledge, economic preferences (i.e., risk and time preferences), field behavior (i.e., gambling, general risk attitude, saving, and temptation), and degree of feeling prepared for their financial future (i.e., belief about future financial problems, assessment of financial education received in school and at home). Additionally, we innovate by examining their susceptibility to behavioral bias by analyzing choices across a set of classic bias-inducing tasks.

Financial literacy has attracted increased attention in recent years from both policy makers and researchers. Although frequently used as a synonym for financial knowledge, Huston (2010) introduced a conceptualization of financial literacy that includes not only the dimension of knowledge, but also that of application. In a similar vein, Atkinson and Messy (2012) emphasize the various dimensions that make up the overall construct of financial literacy, particularly highlighting (i) financial knowledge, (ii) financial behavior, and (iii) financial attitude. Their definition was also adopted by the OECD (2018, p. 4), who views financial literacy as “a combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial well-being”.¹ Consequentially, financial mistakes at an early stage in life can have devastating long-term effects, which is why the OECD (2015) recognizes financial literacy to be of particular relevance for the young.

In order to fight financial illiteracy, many countries around the globe have introduced national financial literacy strategies, including Austria (BMF, 2021). Among others, these strategies also feature interventions and education programs for children and adolescents. While earlier research had questioned the effectiveness of financial education programs (e.g., Hathaway and Khatiwada, 2008; Willis, 2011; Hastings, Madrian, and Skimmyhorn, 2013), more recent literature suggests that education interventions indeed positively affect financial knowledge and financial behavior (for a systematic literature review and meta-analysis, see, e.g., Amagir et al., 2018; Kaiser and Menkhoff, 2020). Of equal importance

¹Financial well-being itself can be described as the perception of maintaining current and anticipated future desired living standards (Brüggen et al., 2017).

for policy makers and educators, another strand of literature has produced ample evidence that financial literacy strongly correlates with various socio-economic variables, such as gender, education, or wealth factors (e.g., Lusardi, Mitchell, and Curto, 2010; Lusardi and Mitchell, 2011; van Rooij, Lusardi, and Alessie, 2011).² Investigating the multi-faceted dimensions of financial literacy as defined by the OECD (2018), prior research indicates that these socio-economic effects are not necessarily homogeneous across all dimensions. In a comprehensive multinational study, the OECD (2020) finds that men score consistently higher in financial knowledge, but that there are no overall or systematic gender differences in financial behavior and financial attitudes. For some countries, however, women do exhibit significantly higher behavioral and attitude scores, while for others this relationship is inverse. Turning to the subgroup of adolescents, Arceo-Gomez and Villagómez (2017) analyze financial literacy among Mexican high school students and observe a gender effect favoring females in financial behavior. As for family background, they find that the educational level of fathers is negatively associated with their children’s financial knowledge and attitude. Differences in behavior are also observed by Razen et al. (2020), who report a lower inclination to gamble among females. At the same time, they find that the male gender *and* the educational level of the father are positively associated with the financial knowledge scores of Austrian high school students. Amagir et al. (2020) report a positive effect of the male gender on measures of financial attitude and financial behavior for high school students in the Netherlands. Moreover, the latter three studies highlight a positive effect of mathematical abilities on financial literacy. As insinuated above, identifying determinants of financial literacy can help policy makers and educators to design more effective intervention programs, as a “one-size-fits-all” approach might not be suitable for financial education (Amagir et al., 2020).

In the present study, we expand on this strand of research by conducting a comprehensive analysis of the determinants of financial literacy among high school students in a controlled experimental setting. To this end, we investigate whether demographic and socio-economic variables correlate with a broader set of variables located alongside financial knowledge, behavior, and attitude. Importantly, we work out further facets of these core dimensions of financial literacy, which leads us to the following research question:

Which demographic and socio-economic factors correlate with the (i) financial knowledge,

²In reference to earlier literature, Lusardi and Mitchell (2011) define financial literacy in terms of knowledge and awareness of basic financial concepts, which they, as well as many other contributors in the field (e.g., van Rooij, Lusardi, and Alessie, 2011), measure using a quiz.

(ii) susceptibility to behavioral bias, economic preferences, field behavior, and (iii) perceived preparedness (attitudes) on financial matters of adolescents?

We address our research question by conducting a pre-registered online experiment³ with 771 high school students from fifth to twelfth grade in the Austrian federal state of Tyrol. The experiment was implemented via oTree (Chen, Schonger, and Wickens, 2016). In particular, for every set of variables (i.e., financial knowledge, behavioral biases, economic preferences, field behavior and perceived preparedness, demographics), we designed one coherent block containing tasks or questions.⁴

In the first block (*financial knowledge*), subjects answer the “Big Five” financial literacy questions proposed by Lusardi and Mitchell (see Lusardi, 2011) covering basic financial concepts, such as interest rates, inflation, diversification, the relationship between bond prices and interest rates, and loan pricing. In the second block (*behavioral consistency*), we implement a novel “behavioral consistency score” using a within-subject treatment design where participants have to indicate their choices in two slightly different versions of bias-inducing tasks (i.e., in two slightly different treatments). The biases we cover are known to be relevant for economic decision-making in general and include the decoy effect (Ariely and Jones, 2008), anchoring (Tversky and Kahneman, 1974; Ariely, Loewenstein, and Prelec, 2003), framing (Kahneman and Tversky, 1984), mental accounting (Thaler, 1980; Kahneman and Tversky, 1984), and the conjunction fallacy (Kahneman and Tversky, 1983). We obtain the behavioral consistency score for each subject by summing up the number of consistent tasks, where we define the behavior of a subject to be consistent for a respective task if the choices across both treatments of the task are identical (e.g., regarding anchoring, one treatment is run with an anchor, while the other treatment is identical but without anchoring information). In the third block (*economic preferences*), we elicit risk and time preferences following literature standards by using the two non-incentivized hypothetical experiments of Eckel and Grossman (2002) for risk preferences and Collier and Williams (1999) for time preferences, respectively. In the fourth block (*field behavior and perceived preparedness on financial matters*), we collect field behavior by asking subjects for their engagement in gambling (Razen et al., 2020) and saving (Bernheim, Garrett, and Maki, 2001), their ability to resist temptations (Razen et al., 2020), as well as their self-

³The pre-registration as well as the code of the experimental software and scripts of the data analysis are accessible at https://osf.io/wxvc9/?view_only=6f601190af5c41d087da51a7d48909eb.

⁴Note that the blocks do not directly represent the three dimensions of financial literacy. Rather, the tasks and questions are thematically summarized.

reported willingness to take risks (Dohmen et al., 2011). For perceived preparedness on financial matters, we elicit subjects' agreement with a set of statements, including expected financial problems in the future and their beliefs about learning enough about finance from either their school or their parents. Finally, in the last block (*demographics*), we survey data on demographic and socio-economic variables including, age, gender, confession, the highest educational level of their parents, math and German grades, as well as the school grade and the school type adolescents were attending at the time of participating in the experiment.

Our main findings are as follows. First, we support findings from past literature (Eckel and Grossman, 2008; Andreoni et al., 2020; Razen et al., 2020), as we also observe a significant gender effect on financial knowledge and financial behavior. In particular, we find that scores on the financial knowledge quiz, experimentally elicited risk preference, self-assessed gambling behavior, and self-assessed willingness to take risks are positively correlated with students being male. Moreover, we also find that the educational level of the father, but not of the mother, is positively associated with students' financial knowledge score. Second, we report the importance of mathematical abilities for various measures of beneficial financial decision-making. We find that mathematical abilities are positively correlated with students' savings behavior, and we obtain suggestive evidence that students who are more proficient in math, on average, are better at delaying gratification and less willing to take risks in general. Third, we observe religious culture effects in all dimensions of financial literacy. Foremost, we find that Muslim students, on average, score significantly lower on the financial knowledge quiz than their Roman Catholic peers. Fourth, we find school-grade effects on financial attitudes and school-type-specific effects on all dimensions of financial literacy. More specifically, we find that students' school grade, a proxy for measuring age differences, is negatively correlated with students' assessment of the financial education they receive in school. Furthermore, we report suggestive evidence that students in the upper cycle of academic secondary school perform better on the financial knowledge quiz and have more patience compared to students attending vocational schools. When asked about their self-assessment, on the other hand, students from vocational schools or colleges of higher vocational education report higher preparedness levels for their financial future than their peers. Fifth, we find a significant positive relationship between sound financial behavior and various measures of financial attitude. In particular, we show that students with a higher behavioral consistency score and greater ability to resist temptation less often anticipate having financial problems in the future. Moreover, self-assessed financial education in school is positively correlated with savings behavior and self-assessed

ability to resist temptation. Finally, the self-assessed financial education students receive from their parents is positively correlated with their behavioral consistency score and their saving behavior. Combining this evidence, we infer that healthy financial behavior (i.e., consistent behavior and regularity in saving) is primarily taught by parents, which also has direct implications for students' confidence about their future financial situation. In an exploratory analysis, we indeed find that financial education, as perceived by students, is primarily provided by parents.

We contribute to the existing literature along two dimensions. First, by using an experimental approach compared to other studies, we are able to narrow down which socio-economic and demographic factors correlate significantly along multiple dimensions of financial literacy (i.e., which of these factors matter in financial decision-making in general). On the one hand, this helps policy makers to identify which of these factors they need to address in education programs, in particular, in order to improve the quality of overall financial decision-making. On the other hand, our results can also be used in future research to further explore why these gaps in financial decision-making are present among specific groups of adolescents. Second, we establish an operationalization of consistent behavior in the form of a behavioral consistency score, a tool to objectively measure someone's susceptibility to behavioral bias—i.e., a trait of human behavior which has been largely neglected in the financial literacy literature so far. This can also be implemented in future research to cover the aspect of decision-making quality in day-to-day choices.

2 Experimental Design

In this section, we describe the experimental procedure, the experimental tasks, and the recruitment process of participating schools. Screenshots of the translated experiment can be found in Appendix A.

2.1 Experimental procedure

The online experiment took place in participating schools in class between March and July 2021, a period of lockdown in Austria due to the Covid-19 pandemic. During this time, some schools had implemented a hybrid-class teaching system with half of the students in the room with the teacher and the other half studying at home. In order to ensure controlled data collection, no communication between participants was allowed during the experiment, and we deliberately advised teachers to pay attention to this implementation rule. In the case when participating schools used hybrid-class teaching, we advised teachers to conduct the online experiment with all students but to place particular focus on the ones in class. If that was not possible, we suggested conducting the experiment only with students in class. However, in this paper, only students who filled out the survey in class are considered.

For every set of variables related to financial decision-making (i.e., financial knowledge, behavioral consistency, economic preferences, field behavior, and perceived preparedness on financial matters) we designed one specific block containing tasks or questions. In order to reduce potential recognition effects, we arranged the different blocks in an order such that the time between the first and the second treatments was maximized, meaning that all the other experimental blocks were placed in between them. Figure 1 depicts a flow chart of the experiment showing the order of the blocks as well as the tasks and questions included.

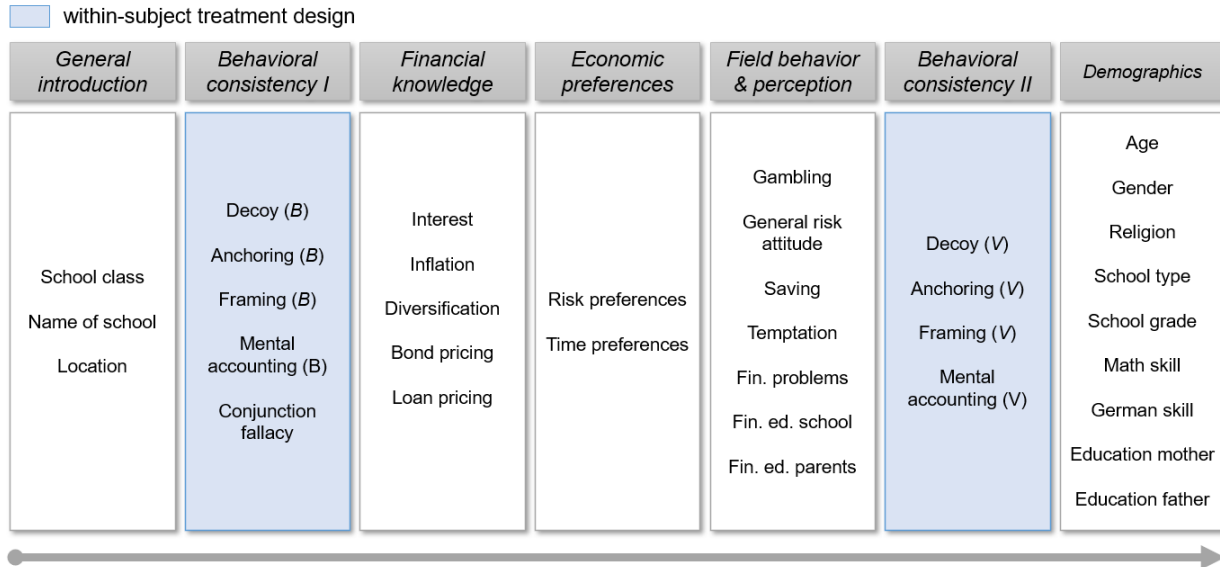


Figure 1: Flow chart of the experiment. This figure illustrates the order of blocks in the experiment alongside the variables of interest we elicit in each block, respectively. During the experiment, participants go through each block from left to right. First, participants have to indicate which school and school class they are in, as well as whether they are participating in school or from home. In the next block, they are confronted with the baseline (B) versions of the bias-inducing tasks, together with the task covering the conjunction fallacy. Subsequently, they have to answer the financial knowledge quiz, and after that, economic preferences in the form of risk and time preferences are elicited. Then, subjects have to self-assess their agreement on four statements related to their field behavior (i.e., gambling, general risk attitude, saving, and temptation) and with three statements regarding their perception on financial matters (i.e., financial problems, financial education in school and at home). Following that, they have to indicate their choices in the bias-inducing variants (V) of the tasks in the behavioral consistency block. Lastly, they fill out a questionnaire that collects their demographics as well as their socio-economic variables.

2.2 Experimental tasks

General introduction. After some remarks on the experimental procedure and the rules for participating in the experiment, subjects had to answer which class and school they were attending. This was used for clustering subjects (i.e., standard errors) in the analysis.⁵

Behavioral consistency. In this block, we measure the susceptibility to behavioral bias by implementing a novel behavioral consistency score. In particular, we test for five behavioral biases, using slightly adapted versions of bias-inducing tasks. Testing for behavioral

⁵Additionally, subjects also had to indicate whether they were participating from school in class or from home. Initially, it was planned to add an analysis of the influence of the modus operandi (controlled setting in school vs. non-controlled setting from home) on outcomes. However, only 70 high school students were participating in the study from home. Therefore we abstain from this methodological expansion.

biases usually requires two treatment conditions, where subjects have to indicate their choices in two slightly different versions of bias-inducing tasks. For this reason, we implement a within-subject treatment design with two different versions (a baseline version (B) and a bias-inducing variant (V), where applicable) for the respective tasks. Additionally, note that we distinguish among three types of behavior: *consistent*, *biased*, and *erratic*. Consistent behavior refers to subjects' behavior that is in line with models of rational choices, meaning that subjects' choices are identical across both versions of the corresponding tasks. Moreover, biased behavior measures subjects' behavior, that corresponds to the respective behavioral bias. Accordingly, we define erratic behavior as a behavior, that is *neither* consistent *nor* predicted by the respective behavioral bias. The five behavioral biases we include are as follows:

- (i) Decoy: Based on the task by Ariely and Jones (2008), subjects have to choose between different types of subscriptions for their favorite magazine. In (B), subjects have to choose between a digital-only subscription for €29 and a subscription offering a print magazine and online access for €62. However, in (V), a print-only subscription for €62 is added to the set of choices. Clearly, this option is dominated by the subscription plan offering both kinds of access for the same price and, hence, should not influence subjects' choices. In particular, we define behavior to be consistent if they take the same type of subscription in both versions of the task (i.e., either the €29 online-only or the €62 printed- and online subscription in both versions). Accordingly, we define behavior to be biased when subjects, through the presence of the dominated choice in the available choice set, get distracted by the more expensive options (i.e., choose the €29 subscription in [B] and one of the two €62 subscriptions in [V]). Lastly, we classify behavior as erratic when subjects opt for the more expensive €62 subscription in (B) but then switch to the cheaper option of €29 when the dominated option is present in (V).
- (ii) Anchoring: Originally from Ariely, Loewenstein, and Prelec (2003) and adapted in Razen et al. (2020), subjects are presented with a description of standard Bluetooth headphones. In (B), subjects have to indicate their willingness-to-pay. Similarly, subjects in (V) have to state their willingness-to-pay, but beforehand, they are asked whether they would pay more than €75 for the headphones or not. Serving as an arbitrary anchor, this question should not alter the willingness-to-pay of subjects. Therefore, we define subjects' behavior to be consistent if the willingness-to-pay across both versions of the task are exactly the same. Furthermore, we specify as biased behavior the case when the willingness-to-pay in (V) gets distracted toward

the anchor—e.g., it decreases from (B) to (V) in the case when it was initially higher than €75 in (B), or it increases from (B) to (V) when it was initially lower than €75 in (B). In contrast, we determine as erratic behavior the case when subjects' willingness-to-pay is distorted in the opposite direction of the anchor—e.g., it increases from (B) to (V) in the case when it was initially higher than €75 in (B), or it decreases from (B) to (V) when it was initially lower than €75 in (B).

- (iii) Framing: Building on the Asian disease problem of Kahneman and Tversky (1981), subjects have to make a hypothetical choice between a safe payout and a risky gamble in one decision problem, which is framed differently across the two versions. In (B), the decision problem is presented in a negative frame, i.e., subjects receive an endowment of €100 and have to choose between one option offering a gamble of losing €0 or €100 with equal probability and a safe option, where they lose €50 for sure. In contrast, in (V), the decision problem is presented in a positive frame, i.e., subjects receive no endowment and have to choose from one option offering a lottery with a gain of either €0 or €100 with equal probability and a safe option with a win of €50 for sure. Since both versions are essentially the same decision problem just presented in two different frames, subjects should also pick the same choice irrespective of the frame. Thus, we define behavior to be consistent when a subject chooses either the risky or the riskless option in both versions of the task. Moreover, we define the behavior of a subject to be biased if it exhibits preferences predicted by Prospect Theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992), meaning they take the risky option in the negative frame (B) and the riskless option in the positive frame (V). Alternatively, we classify it as erratic behavior when a subject chooses the riskless option in the negative frame (B) and the risky option in the positive frame (V).
- (iv) Mental accounting: In this slightly modified version of the jacket and calculator task (Kahneman and Tversky, 1984; Thaler, 1980), subjects indicate if they are willing to walk 20 minutes to another branch of a store in order to save €5 when buying a jacket for €125 and a calculator for €15. While in (B), subjects are offered the €5 discount on the purchase of the jacket; in (V), they would get it on the calculator. As the monetary discount of €5 is the same in both versions, subjects' choices should not differ across treatments. Hence, we define it as consistent behavior when subjects either accept or refuse to go for the discount in both versions. In particular, we specify it as biased behavior when subjects will not take the opportunity to get the discount on the €125 jacket in (B) but take it on the €15 calculator in (V), inferring

that they open up separate mental accounts for the expenses according to mental accounting theory (Thaler, 1980), making it more appealing for them to take the discount on the cheaper item. In contrast to that, we declare behavior to be erratic when subjects are willing to take the discount on the €125 jacket in (*B*) but not on the €15 calculator in (*V*).

- (v) Conjunction fallacy: For the last task in this block, we make use of a modified version of the “Linda problem” proposed by Kahneman and Tversky (1983). Subjects obtain a description of a person named Linda having certain attributes. Then, subjects have to address whether it is more likely that Linda is a bank teller or that Linda is a bank teller and active in the climate protection movement. By using standard probability theory, it is evident that the second statement cannot be more probable than the first statement as the second is a subset of the first. Furthermore, note that this task is an exception compared to the other tasks since only one choice is sufficient enough to detect the presence of the bias. Hence, we only distinguish between consistent and biased behavior for this case. Correspondingly, we define consistent behavior in this task as when a subject chooses the first statement to be more likely, and we specify the behavior to be biased when subjects indicate the second statement to be more probable.

We obtain the behavioral consistency score by summing up the number of consistent tasks; hence, it ranges from a total of 0 to 5 points. Moreover, the order of the tasks for both treatments is randomized following three predefined task sequences.⁶

Financial knowledge. To elicit subjects’ knowledge regarding basic financial concepts, we follow the standard procedure in the literature by including the “Big Five” financial literacy quiz from Lusardi and Mitchell (see Lusardi, 2011). In particular, three out of five questions cover basic concepts in finance, including interest, inflation, and diversification, while the other two assess advanced financial understanding, including bond pricing and loan pricing.⁷ Here our main variable of interest is the sum of the correct answers on the

⁶First: Decoy, Anchoring, Framing, Mental Accounting, Conjunction Fallacy. Second: Mental Accounting, Framing, Anchoring, Decoy, Conjunction Fallacy. Third: Framing, Anchoring, Decoy, Mental Accounting, Conjunction Fallacy. The conjunction fallacy task is always placed in the first treatment block.

⁷Note that one might argue against adding the more advanced question in a quiz for adolescents as loan pricing and bond pricing, in particular, require a more sophisticated financial understanding. Nevertheless, we deliberately include these questions to cover concepts that go beyond the mere basics, being relevant also for adolescents at the end of their school life cycle.

financial knowledge quiz, ranging from 0 to 5 points in total.

Economic preferences. To measure subjects' risk preferences, we follow Eckel and Grossman (2002), where subjects make a choice between six different lotteries. Each lottery offers two possible payoffs with equal probability, starting from an equal payoff pair of €10/€10 in the first lottery and increasing the difference between the payoffs for each subsequent lottery. More specifically, from Lottery 1 to Lottery 5, the first payoff decreases by €2, while the second payoff increases by €3 for each lottery, hence offering a payoff pair of €2/€22 in Lottery 5. Ultimately, Lottery 6 then offers a payoff pair of €0/€24, which keeps the expected payoff identical to Lottery 5 but increases the variance associated with it, thus making it attractive only to risk-neutral or risk-seeking subjects. However, as a higher-numbered lottery is associated with higher risk, the number of the lottery chosen can be used as a measure of someone's risk tolerance. This gives us a number ranging from 1 to 6 in total.

Furthermore, to measure time preferences, we implement a multiple-price list (Coller and Williams, 1999; Angerer et al., 2015). Here, subjects are confronted with six scenarios in which they have to decide between a payment today and a larger payment in six months. While the amount paid out today is constant at €10 for each scenario, the amount in the future increases by €1 in each scenario, starting with €11 in the first scenario and ending with €16 in the last scenario. Time preferences determine the switching point from which subjects prefer payoff in six months over payoff today. Thus, an earlier switching point indicates higher time preferences, meaning that the subjects require lower compensation to wait an additional six months for the money. Finally, to ensure understanding of these tasks, we additionally include three short comprehension questions that subjects have to answer according to the decision they made. These questions need to be answered correctly in order to continue the experiment.

Field behavior and perceived preparedness on financial matters. For field behavior, we first ask subjects for their engagement in gambling (Razen et al., 2020) on a 5-point scale ranging from 1 (*never*) to 5 (*very often*). Similarly, we elicit their agreement on two statements about healthy financial behavior on a 5-point Likert scale (1: *strongly disagree* to 5: *strongly agree*), including regular saving behavior (Bernheim, Garrett, and Maki, 2001) and their ability to resist temptations (Razen et al., 2020). Furthermore, we use the question on self-reported willingness to take risks from Dohmen et al. (2011), where, in line with previous literature, the Likert scale ranges from 0 (*not willing to take*

risks) to 10 (*very willing to take risks*).⁸ For perceived preparedness on financial matters, we ask subjects for their agreement with a set of statements, including expected financial problems in the future and their belief about to learning enough about finance from either their school or their parents in order to make sound financial decisions. Again, we use here a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Demographics and socio-economic variables. The demographic and socio-economic variables include gender, confession, the student’s previous-year grades in mathematics and German, as well as the educational level of both parents. Moreover, we also elicit the school grade of students and the school type to account for the school system in Austria. More details on the Austrian schooling system can be found in Appendix B.

2.3 Recruitment of schools

We recruited schools by sending out letters inviting participation, where in order to take part in the study, the principal, the teachers, as well as the students had to confirm their participation.⁹ As a reward for taking part in the study, we prepared teaching materials on anchoring and framing in the form of presentations and group exercises, which were sent to teachers after they completed the survey.

⁸We deliberately not include the financial version of the scale, because we assume that students this age have not engaged in a lot of financial decisions at their and due to that, they are not able to distinguish between general and financial risk taking in particular.

⁹If students were younger than fourteen years at the time they took part in the study, their parents had to confirm their participation due to the rules of the Tyrolean Directorate of Education.

3 Results

3.1 Descriptive analysis

To briefly summarize the Austrian schooling system (BMBWF, 2021), students who complete primary school can either attend general or academic secondary school (lower cycle). After four years in one of these, students then have to decide whether they want a more vocational-oriented education, (i.e., first going to pre-vocational school and then to a part-time vocational school while doing an apprenticeship), or to acquire the qualification necessary to study at a university, (i.e., obtaining A-levels at either the upper cycle of academic secondary school or a college of higher vocational education, which additionally offers an apprenticeship-like education). A systematic overview of the Austrian schooling system is illustrated in Figure 2, and more detailed information can be found in Appendix B.

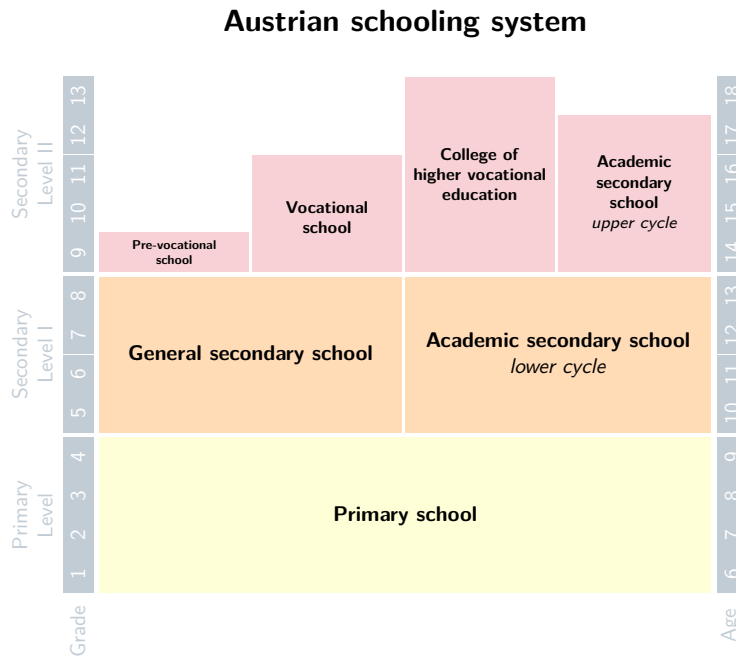


Figure 2: Austrian schooling system. This figure shows the different school types alongside the school grade and students’ usual age when attending these until adulthood, starting with primary level (i.e., primary school), followed by secondary level I (i.e., the general or lower cycle of academic secondary school), and ending with secondary level II (i.e., pre-vocational school, vocational school, college of higher vocational education, and upper cycle of academic secondary school).

Figure 3 depicts the relative distribution of school types and school grades among participating students. In total, 771 students from 15 schools and 54 classes participated in the experiment in class. The average age was 14.66, years with a standard deviation of 2.28 years. Regarding the gender composition, the sample was fairly balanced as 49% were females and males, respectively, while 2% indicated being diverse. In terms of the heterogeneity stemming from religion, 72% of students were Roman Catholic, and 10% each were either Muslim students or without any confession. Orthodox, Protestants, and members of other religions made up the remaining 7%. Concerning school type, 22% and 23% attended general secondary school and the lower cycle of academic secondary school, respectively. Furthermore, 8% were in pre-vocational school, while 11% attended vocational school. The other 37% of students declared their intention to pursue A-levels as 23% were in the upper cycle of academic secondary school and 14% indicated visiting a college of higher vocational education. With reference to the school levels, roughly 45% were in secondary level I of the Austrian schooling system, meaning they were between 5th and 8th grade when participating in the survey. Accordingly, the other 55% were between 9th and 12th grade, the secondary level II of the Austrian schooling system.¹⁰

¹⁰In terms of students' skills in mathematics, 53% of high school students stated that they had achieved good to excellent grades in the last school year (i.e., scores of 4 and 5 in our scale). Only 3% indicated receiving an insufficient grade (i.e., 1) in the previous year's math classes, usually disqualifying them from continuing on to the next school grade in the upcoming school year (due to the difficulties in teaching and schooling introduced at the beginning of the Covid-19 pandemic, the federal ministry for education, science and research of Austria declared to abstain from this rule and allow students with maximal one insufficient on their school report card to continue to the next grade). With respect to German skills, 58% had achieved a good or excellent grade, and 2% stated that their grade was an insufficient. Concerning student-assessed educational level of parents, 24% and 25% of students' mothers and fathers held a university degree, respectively. Furthermore, 22% of female and 26% of male parents had completed vocational education, and only 3% of mothers and 2% of fathers were described to be without any education. However, roughly a quarter of participants (i.e., 25% for the educational level of the mother and 26% for the educational level of the father, respectively) indicated to not know the educational level of their parents. More descriptive statistics, together with illustrations of the other variables elicited in the experiment, are shown in Appendix C

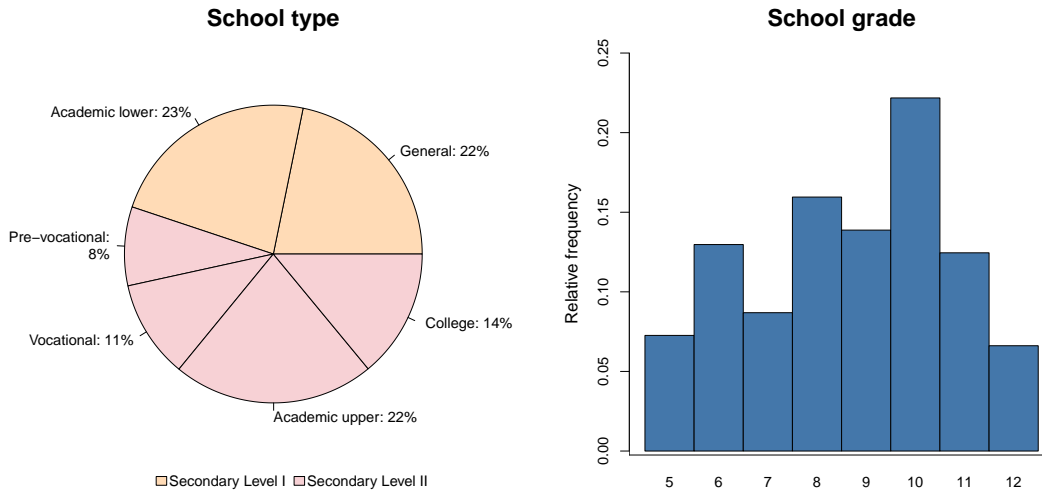


Figure 3: Distribution of school types and school grades. This figure shows the relative distribution of school types (Secondary level I: General school and lower cycle of academic secondary school; Secondary level II: Pre-vocational school, vocational school, upper cycle of academic secondary school and college for higher vocational education), and school grades (from 5th to 12th grade).

3.2 Main Analysis

Tables 1 and 2 summarize the main findings of our first pre-registered analysis specification where we explore the determinants of (i) financial knowledge and (ii) financial behavior, focusing on potentially relevant demographic and socio-economic variables known from previous literature. For this purpose, we use our experimentally elicited variables FIN-KNOW (i.e., score on the financial knowledge quiz), BEHCON (i.e., behavioral consistency score), RISK (i.e., experimentally elicited risk attitudes), TIME (i.e., experimentally elicited time preferences), GAMBLING (i.e., self-assessed engagement in gambling), GENERAL RISK (i.e., self-assessed willingness to take risks), SAVING (i.e., self-reported saving behavior), and TEMPTATION (i.e., self-reported ability to resist temptations) as dependent variables in ordinary least square models, where demographic and socio-economic variables serve as our explanatory variables.

In our second pre-registered specification, we model (iii) financial attitude using the perceived preparedness on financial matters. Here we use the same model as in the first specification, where NO FINANCIAL PROBLEMS (i.e., belief of not having future financial problems), FINEDU SCHOOL, and FINEDU PARENTS (i.e., belief of learning enough about

finance in school or from parents, respectively) are regressed on demographic and socio-economic variables, but we additionally include the previously used dependent variables (i.e., FINKNOW, BEHCON, RISK, TIME, GAMBLING, GENERAL RISK, SAVING, and TEMPTATION) in the vector of explanatory variables. The results for this specification are shown in Table 3.

Due to the high number of students who did not know the educational level of their parents, we apply non-pre-registered and exploratory robustness checks of our results by running the same type of regressions with the parental educational levels as metric variables using median imputation. The results generally stay the same; and the regressions can be found in Appendix C. Note that for all hypothesis tests, we use significance thresholds proposed by Benjamin et al. (2018), where only p -values < 0.005 are considered to be *significant* and p -values < 0.05 are referred to as *suggestive evidence*, also complementing a solution to multiple hypothesis testing in our regressions. Furthermore, in formulating our results, we aim to point out which demographic and socio-economic variables matter across multiple dimensions of financial literacy in order to make inferences about which variables play a key role in financial decision-making in general.

Result 1: *Financial knowledge scores, experimentally elicited risk tolerance, and self-reported risky field behaviors (i.e., gambling and general willingness to take risks) are positively associated with the male gender. Additionally, financial knowledge scores are positively correlated with the educational level of the father.*

Support: We find evidence for a significant gender effect alongside financial knowledge and financial behavior in terms of risk-taking. In particular, the male gender is significantly positively associated with financial knowledge, experimentally elicited risk preference, as well as self-assessed engagement in gambling and general risk attitude (columns 1 and 3 of Table 1 and columns 1 and 2 of Table 2, respectively). This means that male students, on average, achieve higher scores on the financial knowledge quiz and have a higher risk tolerance, whether it be experimentally elicited or through self-assessments of gambling or in general, compared to their female counterparts. Furthermore, fathers having obtained a university degree is positively correlated with the financial knowledge scores of students (column 1 of Table 1). Note that the other coefficients detailing the educational level of the father (against the base category vocational school) are not significant but increase in their magnitude. This suggests an overall positive correlation between fathers' educational level and the financial knowledge scores of their children, which is supported by our robustness check where we implement the educational level of parents as metric variables (column

1 of Table C4 in Appendix C). Overall, this is in line with previous literature suggesting similar male effects on financial literacy (Razen et al., 2020) and literature outlining how female adolescents show higher levels of risk aversion than male adolescents (e.g., Andreoni et al., 2020), which represents a robust pattern for the general population (e.g., Eckel and Grossman, 2008).

Result 2: *Self-reported saving behavior is positively associated with skills in mathematics. Moreover, there is suggestive evidence that mathematical abilities are positively correlated with experimentally elicited time preference, and negatively associated with self-assessed willingness to take risks.*

Support: Our second result summarizes the importance of mathematical abilities for various measures of financial behavior. As outlined in column 2 of Table 2, we find that mathematical abilities are positively associated with students' agreement to save on a regular basis, meaning that students with a better grade in math report to save more regularly on average. In addition, when looking at conventional statistical significance levels, we find suggestive evidence that math skills are positively associated with students' experimentally elicited time preference (column 4 of Table 1). However, we find in column 2 of Table 2 suggestive evidence that math skills are negatively correlated with self-reported willingness to take risks. Taken together, this supports previous findings that highlight the importance of numeracy in healthy financial behavior and good financial decision-making (e.g., Lusardi, 2012; Skagerlund et al., 2018).¹¹

Result 3: *Financial knowledge and self-reported inclination to gamble (suggestive evidence) are both lower for Muslim students.*

Support: We find significant and suggestive evidence for religious culture effects in several dimensions of financial literacy. In particular, we find that Muslim students perform, on average, worse on the financial knowledge quiz compared to Roman Catholics. Alessie, Van Rooij, and Lusardi (2011) reported that for a representative sample of Dutch households, people with religious beliefs belonging to the minority (including Muslims in the Netherlands) are less knowledgeable in finance, which is in line with our findings. However, this does not indicate that one's confession directly determines the capability

¹¹Additionally, the coefficient for math skills is on the edge of conventional significance levels for financial knowledge and the behavioral consistency score. Also consider that there is suggestive evidence that German skills are also positively correlated with saving regularity (column 2 in Table 2), which further points in the direction that cognitive abilities, which are capable of predicting adolescents' school grades (e.g., Hofer et al., 2012), are positively related to sound financial decisions (Ballinger et al., 2011; Agarwal and Mazumder, 2013).

of understanding financial concepts. Rather, it highlights potential target groups who would particularly benefit from financial education programs teaching financial concepts. Moreover, we find suggestive evidence that the behavioral consistency score of high school students is negatively correlated with being Orthodox or Protestant (column 2 of Table 1). Additionally, we find suggestive evidence that Protestants' agreement with not having financial problems in the future is, on average, higher than that of Roman Catholics, which accords with literature stating that Protestants have a higher awareness of individual financial responsibility (Renneboog and Spaenjers, 2012). However, the suggestive evidence found here should be interpreted very cautiously since the share of students belonging to either the Orthodox or Protestant confession is relatively low (3% and 2%, respectively). Therefore, we do not consider these suggestive findings as main findings in the subsection of religious effects.

Result 4: *Self-assessed financial education in school is negatively correlated with students' school grade and also negatively associated with general and both cycles of academic education. Additionally, there is suggestive evidence that the financial knowledge score and experimentally elicited time preferences are positively associated with attending the upper cycle of academic secondary school and that self-assessed gambling behavior is positively correlated with attending a college of higher vocational education.*

Support: Our fourth result compiles the effects across school grades and school types. As can be seen in column 2 of Table 3, the coefficient of school grade exhibits a negative and significant sign for students' self-assessed financial education in school, meaning that on average, when students get to the next school grade, they rate the financial education they receive in school lower. Because school grade is also an adequate measure of age difference, this suggests that students recognize their deficits in financial literacy as they age and progress through their schooling careers (i.e., as they approach adulthood). Furthermore, the indicators of general secondary school and both cycles of academic secondary school show a significant and negative coefficient. This indicates that students without a focus on vocational education rate their financial education in school worse compared to students of vocational schools.

Moreover, we find suggestive evidence that financial knowledge scores and experimentally elicited time preferences are positively correlated with attending the upper cycle of academic secondary school (columns 1 and 4 of Table 1). Combining the former with the suggestive evidence of column 2 of Table 3 provides interesting suggestive evidence worthy of further investigation: Although students in the upper cycle of academic secondary school perform, on average, best on the financial knowledge quiz, they feel less well prepared to

make good financial decisions in the future. There are two potential explanations for this seeming conundrum. Interestingly, we find evidence for both of them: (i) Students attending schools in the upper academic cycle set particularly high benchmarks when it comes to rating their level of education. Indeed, this hypothesis is corroborated by the fact that they also report being less prepared to make good financial decisions *by their parents* (column 3 of Table 3). In other words, the effect is not restricted to the education they receive at school but is rather the expression of a general desire for more education in this regard. Another explanation is that (ii) there is no direct relationship between someone’s financial literacy and their *perceived* preparedness to make good financial decisions in the future. While we know from the literature that financial literacy does eventually positively affect financial well-being, our results do not hint at a relationship between financial literacy and students *feeling prepared* to make good decisions. What does support students’ confidence in their financial decisions, however, is their capability to actually make good decisions, as measured by our consistency score (column 1 of Table 3). This seems to be an important observation with respect to the discussion of how students’ confidence in their financial decision-making could be improved. A promising way to achieve this is through “experiential learning” (Amagir et al., 2018), (i.e., students learn how to make good financial decisions via exercises that mirror real-life situations). For example, Kaczkó and Razen (2022) suggest that economic experiments, in particular, can be used as a suitable didactic approach to this type of learning, emphasizing reflective thoughts about behavioral biases for example. Not least, this channel also further corroborates hypothesis (i) as students from the upper academic cycle, on average, also achieve the highest consistency scores (although this effect is not significant; see column 2 of Table 1), yet still long for more education in school and from their parents.

Finally, we find suggestive evidence that attending a college of higher vocational education is positively related to self-assessed engagement in gambling. This could be explained by the fact the students in this school type are already part of the workforce via apprenticeships and, thus, obtain a regular income.

Result 5: *Agreement on not having future financial problems and both, self-reported financial education in school and self-reported parental financial education are positively correlated with self-assessed savings behavior. Furthermore, financial education in school and agreement on not having future financial problems are positively correlated with self-assessed ability to resist temptation. In addition, not having future financial problems and financial education received by parents are positively correlated with students’ behavioral consistency scores.*

Support: Our final result describes the relationship between various measures of financial behavior and financial attitude. As can be seen in columns 1 to 3 of Table 3, self-assessed financial education provided in school and by parents is positively correlated with self-reported saving behavior, and there is suggestive evidence that this is also true of students' agreement on not having financial problems in the future. In summary, this means that students who report to save more regularly, on average, feel more prepared regarding their financial circumstances, i.e., they agree more on not having financial problems in the future, and they rate the financial education they receive from school and their parents higher.

Moreover, as presented in columns 1 and 2 of Table 3, the coefficient for self-assessed ability to resist temptations is positive and significant, which indicates that students with higher resistance against temptations have, on average, a brighter attitude about their financial future and the financial education in school. Strömbäck et al. (2017) studied the influence of psychological characteristics on positive measures for financial behavior and financial well-being. For a representative sample of the Swedish population, they found that people with higher levels of self-control feel safer about their current and future financial situation, and that they are less anxious about financial matters. Our evidence supports these findings and highlights further, that self-control or discipline contributes to positive financial attitudes.

Furthermore, as presented in columns 1 and 3 of Table 3, our newly introduced behavioral consistency score exhibits a positive and significant coefficient for measures of perceived future financial stability and financial education from parents, indicating that high school students with a higher behavioral consistency score, on average, believe they will have fewer financial problems in the future and value the financial education they receive from parents more highly. Hence, not only self-control but also consistency in one's own behavior is positively related to the perception of future financial well-being. Consequently, behavioral consistency is able to describe future financial satisfaction that goes beyond non-cognitive psychological traits such as self-control. Moreover, this result indicates that consistent behavior is closely related to the financial education provided by parents, which might be explained by parents giving their children practical advice on how to properly deal with money instead of explaining them financial concepts to them in more detail.

Taken together, this result implies that parents primarily educate their children in how to regularly save and how to be consistent in their behavior (i.e., not falling for behavioral biases like anchoring and framing in their everyday decision-making). Moreover, it indicates that financial education provided by parents is closely related to the confidence students

have regarding their financial situation in the future. This is also in line with the results of Amagir et al. (2020), showing that there is a positive relationship between adolescents' financial literacy and the discussion of financial matters with family and peers and, hence, highlights the importance of parental discussions about finance outside of schools.

Table 1: Financial knowledge, behavioral consistency, and economic preferences

	<i>Dependent variable:</i>			
	FINKNOW (1)	BEHCON (2)	RISK (3)	TIME (4)
SCHOOL GRADE	0.131 (0.085)	0.049 (0.041)	0.144 (0.082)	0.100 (0.091)
GENDER				
MALE	0.548** (0.088)	0.038 (0.071)	0.523** (0.125)	0.190 (0.167)
DIVERSE	-0.608 (0.350)	0.184 (0.204)	1.431** (0.467)	-0.166 (0.601)
RELIGION				
ISLAMIC	-0.374** (0.132)	-0.141 (0.142)	-0.121 (0.236)	-0.124 (0.275)
ORTHODOX	-0.306 (0.270)	-0.457* (0.191)	-0.168 (0.378)	-0.564 (0.494)
PROTESTANT	-0.122 (0.243)	-0.460* (0.209)	-0.452 (0.302)	0.313 (0.625)
OTHER	0.146 (0.214)	-0.066 (0.284)	0.105 (0.465)	-0.434 (0.376)
WITHOUT	0.060 (0.141)	0.022 (0.107)	0.062 (0.271)	-0.070 (0.293)
SCHOOL TYPE				
GENERAL	-0.161 (0.370)	0.007 (0.179)	0.321 (0.415)	1.020 (0.571)
ACADEMIC LOWER	-0.223 (0.426)	-0.019 (0.250)	0.267 (0.434)	0.924 (0.670)
PRE-VOCATIONAL	0.143 (0.276)	-0.114 (0.186)	-0.224 (0.413)	0.442 (0.503)
ACADEMIC UPPER	0.477* (0.232)	0.242 (0.136)	-0.205 (0.241)	1.136* (0.456)
COLLEGE	0.436 (0.234)	0.235* (0.115)	0.064 (0.276)	0.577 (0.422)
MATH SKILL	0.108 (0.056)	0.065 (0.035)	-0.107 (0.070)	0.186* (0.076)
GERMAN SKILL	-0.023 (0.052)	-0.057 (0.035)	-0.082 (0.079)	-0.072 (0.078)
EDUCATION MOTHER				
NONE	0.448 (0.289)	-0.335 (0.302)	0.117 (0.454)	0.442 (0.406)
COMPULSORY	0.350 (0.187)	-0.072 (0.135)	-0.054 (0.294)	0.517 (0.310)
ALEVELS	-0.072 (0.126)	-0.090 (0.107)	0.014 (0.230)	0.173 (0.213)
UNIVERSITY	-0.063 (0.145)	-0.033 (0.124)	0.019 (0.183)	0.109 (0.260)
DON'T KNOW	-0.262 (0.168)	-0.141 (0.168)	-0.226 (0.281)	-0.078 (0.324)
EDUCATION FATHER				
NONE	-0.373 (0.401)	-0.158 (0.266)	0.534 (0.605)	-0.003 (0.745)
COMPULSORY	-0.125 (0.245)	0.162 (0.156)	0.080 (0.326)	-0.489 (0.390)
ALEVELS	0.196 (0.121)	-0.009 (0.099)	-0.040 (0.253)	-0.247 (0.230)
UNIVERSITY	0.431** (0.123)	-0.120 (0.133)	-0.124 (0.208)	0.391 (0.272)
DON'T KNOW	-0.100 (0.175)	0.101 (0.147)	-0.070 (0.313)	-0.065 (0.300)
CONSTANT	0.391 (0.978)	2.764** (0.450)	1.732 (1.121)	-0.197 (1.319)
Observations	771	771	771	771
Adjusted R ²	0.272	0.044	0.030	0.045
F Statistic	12.530**	2.315**	1.948**	2.451**

Ordinary least squares regressions for the dependent variables (1) FINKNOW, (2) BEHCON, (3) RISK, and (4) TIME. FINKNOW represents the number of correct answers on the financial knowledge questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC UPPER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from the previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). NONE, COMPULSORY, ALEVELS, UNIVERSITY, and DON'T KNOW indicate the education levels of subjects' mothers and fathers, respectively, with the reference category being VOCATIONAL. Control for order effects is included in the regression (2) BEHCON, which shows no significant coefficients for two of three predetermined orders of tasks, with one being the reference category (Decoy, Anchoring, Framing, Mental Accounting, Conjunction Fallacy). Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

Table 2: Field behavior

	<i>Dependent variable:</i>			
	GAMBLING (1)	RISK GENERAL (2)	SAVING (3)	TEMPTATION (4)
SCHOOL GRADE	-0.020 (0.036)	0.104 (0.135)	-0.026 (0.055)	-0.030 (0.045)
GENDER				
MALE	0.218** (0.066)	1.156** (0.191)	-0.077 (0.091)	-0.0001 (0.082)
DIVERSE	0.536 (0.383)	1.366 (0.883)	-0.270 (0.337)	-0.517 (0.288)
RELIGION				
ISLAMIC	-0.273* (0.105)	-0.216 (0.313)	-0.256 (0.149)	0.058 (0.130)
ORTHODOX	-0.174 (0.162)	0.468 (0.425)	-0.275 (0.253)	0.090 (0.169)
PROTESTANT	0.254 (0.262)	-0.600 (0.470)	-0.168 (0.268)	0.130 (0.225)
OTHER	-0.226 (0.214)	-0.011 (0.479)	0.044 (0.268)	-0.181 (0.225)
WITHOUT	-0.153 (0.095)	-0.301 (0.270)	-0.213 (0.124)	0.136 (0.128)
SCHOOL TYPE				
GENERAL	0.020 (0.170)	0.136 (0.699)	-0.007 (0.268)	-0.172 (0.186)
ACADEMIC LOWER	-0.247 (0.188)	0.058 (0.698)	0.006 (0.324)	-0.207 (0.233)
PRE-VOCATIONAL	0.059 (0.112)	-0.723 (0.498)	-0.268 (0.223)	0.027 (0.176)
ACADEMIC UPPER	-0.041 (0.106)	0.012 (0.473)	0.138 (0.168)	0.037 (0.118)
COLLEGE	0.304* (0.110)	-0.089 (0.424)	-0.163 (0.175)	-0.066 (0.134)
MATH SKILL	0.027 (0.033)	-0.239* (0.116)	0.196** (0.061)	0.081* (0.039)
GERMAN SKILL	-0.039 (0.040)	0.065 (0.126)	0.115* (0.045)	0.020 (0.042)
EDUCATION MOTHER				
NONE	-0.016 (0.177)	-0.581 (0.637)	-0.134 (0.319)	-0.514 (0.414)
COMPULSORY	0.165 (0.156)	0.440 (0.370)	-0.036 (0.189)	0.004 (0.180)
ALEVELS	0.094 (0.078)	-0.009 (0.279)	-0.174 (0.164)	0.084 (0.122)
UNIVERSITY	0.212* (0.097)	0.155 (0.325)	0.030 (0.157)	0.065 (0.135)
DON'T KNOW	0.232* (0.115)	-0.012 (0.403)	-0.145 (0.182)	-0.125 (0.169)
EDUCATION FATHER				
NONE	-0.229 (0.158)	-0.499 (0.734)	0.495* (0.238)	0.156 (0.426)
COMPULSORY	-0.114 (0.138)	-0.285 (0.437)	-0.211 (0.239)	0.176 (0.211)
ALEVELS	-0.139 (0.114)	-0.096 (0.288)	-0.029 (0.128)	0.085 (0.149)
UNIVERSITY	-0.107 (0.087)	-0.378 (0.305)	-0.046 (0.152)	0.026 (0.134)
DON'T KNOW	-0.213* (0.100)	-0.670 (0.437)	0.048 (0.164)	0.197 (0.138)
CONSTANT	1.789** (0.487)	4.120* (1.655)	3.013** (0.683)	3.110** (0.525)
Observations	771	771	771	771
Adjusted R ²	0.039	0.053	0.084	0.004
F Statistic	2.237**	2.721**	3.841**	1.113

Ordinary least squares regressions for the dependent variables (1) GAMBLING, (2) RISK GENERAL, (3) SAVING, and (4) TEMPTATION. GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regular saving behavior (integers from 1 to 5). TEMPTATION denotes subjects' self-reported ability to resist temptations (integers from 1 to 5). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC UPPER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from the previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). NONE, COMPULSORY, ALEVELS, UNIVERSITY, and DON'T KNOW indicate the education levels of subjects' mothers and fathers, respectively, with the reference category being VOCATIONAL. Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

Table 3: Perceived preparedness on financial matters

	<i>Dependent variable:</i>		
	NO FINANCIAL PROBLEMS (1)	FINEDU SCHOOL (2)	FINEDU PARENTS (3)
SCHOOL GRADE	0.022 (0.056)	-0.240** (0.044)	-0.048 (0.046)
GENDER			
MALE	-0.136 (0.084)	0.021 (0.088)	-0.144 (0.085)
DIVERSE	-0.329 (0.264)	-0.323 (0.232)	-0.300 (0.266)
RELIGION			
ISLAMIC	-0.224 (0.131)	-0.138 (0.122)	-0.013 (0.132)
ORTHODOX	-0.186 (0.175)	0.261 (0.220)	0.225 (0.204)
PROTESTANT	0.654* (0.314)	-0.065 (0.258)	0.719** (0.166)
OTHER	-0.104 (0.283)	-0.189 (0.379)	0.119 (0.290)
WITHOUT	-0.058 (0.100)	-0.223 (0.135)	0.024 (0.148)
SCHOOL TYPE			
GENERAL	-0.029 (0.220)	-1.160** (0.192)	-0.143 (0.207)
ACADEMIC LOWER	0.149 (0.214)	-1.430** (0.225)	-0.205 (0.216)
PRE-VOCATIONAL	-0.051 (0.218)	-0.401* (0.187)	-0.212 (0.172)
ACADEMIC UPPER	0.046 (0.141)	-1.299** (0.145)	-0.349* (0.162)
COLLEGE	0.135 (0.179)	0.163 (0.125)	-0.050 (0.133)
MATH SKILL	0.063 (0.045)	0.026 (0.047)	0.055 (0.039)
GERMAN SKILL	0.0005 (0.045)	0.082 (0.047)	0.041 (0.059)
EDUCATION MOTHER			
NONE	-0.396 (0.250)	0.559** (0.184)	-0.272 (0.347)
COMPULSORY	-0.095 (0.195)	-0.234 (0.127)	-0.260 (0.160)
ALEVELS	0.116 (0.152)	-0.245 (0.128)	0.200 (0.132)
UNIVERSITY	0.129 (0.167)	-0.328* (0.138)	0.001 (0.125)
MISSING	-0.070 (0.164)	-0.042 (0.158)	-0.077 (0.186)
EDUCATION FATHER			
NONE	0.323 (0.349)	-0.219 (0.331)	0.101 (0.356)
COMPULSORY	0.266 (0.167)	0.216 (0.171)	-0.050 (0.199)
ALEVELS	-0.140 (0.114)	-0.084 (0.149)	-0.131 (0.125)
UNIVERSITY	-0.118 (0.140)	0.022 (0.133)	-0.109 (0.115)
MISSING	-0.067 (0.148)	-0.068 (0.164)	-0.087 (0.153)
FINKNOW	0.025 (0.037)	-0.014 (0.035)	0.038 (0.035)
BEHCON	0.144** (0.039)	0.027 (0.047)	0.160** (0.041)
RISK	0.028 (0.023)	0.005 (0.023)	0.005 (0.021)
TIME	0.033 (0.019)	-0.018 (0.021)	0.006 (0.018)
GAMBLING	-0.082 (0.058)	-0.001 (0.041)	0.101* (0.043)
GENERAL RISK	0.045* (0.018)	-0.011 (0.019)	0.010 (0.016)
SAVING	0.088* (0.038)	0.154** (0.036)	0.163** (0.038)
TEMPTATION	0.162** (0.049)	0.128** (0.041)	0.042 (0.040)
CONSTANT	1.679* (0.644)	4.516** (0.614)	2.578** (0.578)
Observations	771	771	771
Adjusted R ²	0.089	0.249	0.085
F Statistic	3.271**	8.754**	3.169**

Ordinary least squares regressions for the dependent variables (1) NO FINANCIAL PROBLEMS, (2) FINEDU SCHOOL, and (3) FINEDU PARENTS. NO FINANCIAL PROBLEMS denotes subjects' belief in not having financial problems in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). FINEDU SCHOOL and FINEDU PARENTS are subjects' beliefs about learning enough about finance in school or from their parents in order to make good financial decisions in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC UPPER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from the previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). NONE, COMPULSORY, ALEVELS, UNIVERSITY, and DON'T KNOW indicate the education levels of subjects' mothers and fathers, respectively, with the reference category being VOCATIONAL. FINKNOW is the number of correct answers on the financial knowledge questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regularly saving behavior (integers from 1 to 5). TEMPTATION denotes subjects' self-reported ability to resist temptations (integers from 1 to 5). Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

3.3 Exploratory Analysis

In this section, we outline an exploratory finding that is not part of the pre-registered analysis in our pre-analysis plan.

Students' self-assessed quality of financial education from school or from parents can also be used as a proxy for from where students believe to have received financial education in the first place. As indicated by the relative distribution of self-assessed financial education in school and parental financial education (Table C1 and Figure C1 in Appendix C), the self-assessed financial education received from parents ($M = 3.76$, $SD = 1.10$) is statistically different (paired t -test; $p < 0.001$) from the self-assessed financial education in school ($M = 2.74$, $SD = 1.23$). Therefore, according to the opinion of students, their parents are the primary source of financial education, which again underlines the importance of parents in the financial education of their children.

4 Conclusion

In this paper, we provide a comprehensive analysis on the determinants of adolescents' financial literacy in a comprehensive sense as understood by the OECD definition (Atkinson and Messy, 2012; OECD, 2018) using an online experiment in a well controlled environment in Austrian high schools. Each participant had to go through five experimental blocks where we elicited several measures alongside the three dimensions of financial literacy (i.e., knowledge, behavior, and attitude), including financial knowledge, susceptibility to behavioral biases, economic preferences, field behavior, and perception (attitude) on financial matters. In particular, we establish a new behavioral consistency score where subjects had to go through two slightly different versions of bias-inducing tasks.

First, we find, in line with previous literature, a significant gender effect on adolescents' financial knowledge (Andreoni et al., 2020; Razen et al., 2020) and financial behavior in terms of risk-taking (Eckel and Grossman, 2008), pointing toward males having a better understanding of financial concepts as well as a higher risk tolerance compared to females. Second, we provide evidence that skills in math are key for engagement in healthy financial behaviors, such as saving regularly and being patient. Third, we find some effects of religious affiliation on financial knowledge and financial behavior since Muslim students show, on average higher, levels of unawareness regarding financial concepts and lower levels of gambling behavior compared to Roman Catholics. Importantly, our results also indicate

that students' *perceived preparedness* for their financial future does not correlate with their financial literacy score, but with their ability to make consistent decisions. Fourth, we show that, as students reach higher school levels, they rate their financial education in school lower, and we also detect a perception issue among students who attend the upper cycle of academic secondary school regarding their superior financial knowledge. Fifth, we find evidence for a positive relationship between measures of financial behavior and financial attitude, including our newly developed behavioral consistency score. Lastly, we conclude that students primarily perceive their parents as the primary source of financial education.

Our results will help policy makers and scholars to identify which socio-economic and demographic variables are relevant for the various dimensions of financial literacy among adolescents. Moreover, our results show that the importance of mathematical abilities for developing a sustainable financial life cannot be overstated. In our sample, better math grades relate to more favorable results across almost all dimensions of financial literacy, with several effects being significant (arguably, the negative correlation with risk attitude could form the basis of a further discussion that goes beyond the scope of this paper). Our findings also support recent initiatives to strengthen the financial education provided in schools. Finally, we show that conventionally measured financial knowledge does not make students more confident about their financial future. However, they seem to have an understanding of the quality of their actual decisions. To support confidence, education programs should not only address knowledge but also practice the art of financial decision-making.

However, our study has some limitations. First, the time between the base version and the bias-inducing variant in the behavioral consistency block was short. The median time participants took for the three blocks placed in between was 7.75 minutes, hence indicating that recognition or memory effects might play a role in our behavioral consistency measure. Therefore, not only could the coefficients we find in our analysis be underestimated, but also potential interaction effects with other explanatory variables might be relevant. Future research could circumvent this issue by increasing the time between both versions of the bias-inducing tasks (i.e., splitting up the experiment over two separate sessions with days or weeks between them). Second, in our group of students attending a college of higher vocational education, the type of commercial college institution type is overrepresented among students. Hence, our sample is biased in this regard, which could lead to an overestimation of the coefficient indicating whether a student attends a college of higher vocational education or not. This issue particularly affects the coefficient for col-

leges of higher education regarding participants' behavioral consistency scores. Students, who attend such a commercial college have a higher number of business-related subjects, and especially, they also learn about concepts of marketing, which is not taught to such an extent in the other types of schools. Thus, these students are directly or indirectly familiar with concepts of anchoring or framing, which might explain why they achieve a higher number of consistent tasks on average. Future research could therefore investigate which content taught in school particularly fosters behavioral consistency in adolescence.

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Online Appendix

A Survey

A.1 Welcome

Welcome

Dear student!

Thank you for your participation. The following questionnaire consists of a series of decision games and questions on different topics. Please read the explanations and questions carefully and complete the whole questionnaire honestly and without help from others. Also, please do not use the internet to find answers. The questionnaire is of course anonymous.

Before you start with the questionnaire, please tell us which class you are in, which school you attend and whether you are at school or at home when you are answering the survey.

Class

Please enter the name of the class here and not the school level.

School

Please enter the full name of the school here.

- I am answering the survey in school.
 I am answering the survey at home.

Note: If you are using a smartphone, use it in landscape mode for an optimal presentation of the questionnaire.

Next



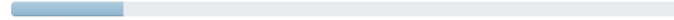
A.2 Behavioral consistency I

Time remaining until you are automatically forwarded: **0:15**

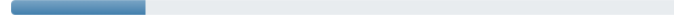
The following block consists of 5 questions about your assessment or what decisions you would make in certain situations.

Next

Block 1 of 6



Task 1 of 5



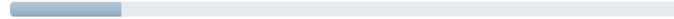
Question 1)

Imagine you want to subscribe to your favorite magazine. Which of the following two subscriptions would you choose?

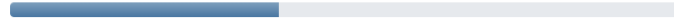
- Digital-only subscription (online access) - €29 per year
- Print and digital subscription (online access and printed magazine) - €62 per year

Next

Block 1 of 6



Task 2 of 5



Question 2)

Imagine you want to buy new headphones. You pass a shop and in the window you see a new model with Bluetooth (for connecting to your smartphone or tablet) that is very comfortable to wear and has a particularly long battery life.

How much would you pay for the headphones?

€

Next

Block 1 of 6

Task 3 of 5

Question 3)

Imagine you are playing the following game. At the beginning of the game you receive an endowment of €100 and then you have to choose between two alternatives:

- Alternative A: You lose either €0 or €100 with equal probability (50:50 chance).
- Alternative B: You lose €50 for sure.

Next

Block 1 of 6

Task 4 of 5

Question 4)

Imagine you are about to buy a jacket for €125 and a calculator for €15. The jacket salesman informs you that the jacket costs €120 in another branch of the shop. The other branch of the shop is about a 20-minute walk away.

Would you go to the other shop?

- Yes
- No

Next

Block 1 of 6

Task 5 of 5

Question 5)

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Which is more probable?

- Linda is a bank teller.
- Linda is a bank teller and in the climate protection movement.

Next

A.3 Financial literacy

Time remaining until you are automatically forwarded: 0:15

The following block consists of 5 general questions on the topic of finance.

Next

Please answer the following questions.

Question 1) Suppose you have €100 in your savings account and the interest rate is 2% per year. How much will you have in 5 years if you leave the money in the savings account?

- More than €102
- Exactly €102
- Less than €102
- Do not know

Question 2) Suppose the interest rate on your savings account is 1% per year and the inflation rate is 2% per year. If you leave the money in the savings account for one year, how much can you buy compared to today?

- More than today
- Exactly the same
- Less than today
- Do not know

Question 3) Buying a single stock usually offers safer profits than buying a stock mutual fund (a stock mutual fund consists of several different stocks)

- True
- False
- Do not know

Question 4) If interest rates rise, what typically happens to bond prices?

- They go up
- They fall
- They stay the same
- There is no relationship in bond prices and the interest rate
- Do not know

Question 5) A 15-year loan usually requires higher monthly payments than a 30-year loan. However, the total interest paid over the life of the loan is lower.

- True
- False
- Do not know

Next

A.4 Economic preferences

Time remaining until you are automatically forwarded: 0:15

The following block consists of 2 questions on how you would decide in different situations where you can get monetary payments.

Next

Block 3 of 6

Task 1 of 2

Decision game 1)

Imagine that you can choose between the following six games. The games are presented in the table below. In each game there are two possible outcomes, as a coin toss (head or tails) decides, whether you get the left or right amount of money. If you have decided for a game, the probability of getting the left or the right amount of money is equally high (50:50 chance).

Please choose now the game for which you would decide:

Game	Coin toss is ...		
	Heads		Tails
1 <input type="radio"/>	€10	or	€10
2 <input type="radio"/>	€8	or	€13
3 <input type="radio"/>	€6	or	€16
4 <input type="radio"/>	€4	or	€19
5 <input type="radio"/>	€2	or	€22
6 <input type="radio"/>	€0	or	€24

Quick-Check (for your preferred game):

If the coin shows heads, I get € .

If the coin shows tails, I get € .

Next

Decision game 2)

In the following table you can see two pay outs in each row: €10 today or a higher amount in 6 months. The amount in 6 months is rising from row to row by €1 (from €11 in the first row until €16 in sixth row).

Please indicate in each of the six rows, which option you prefer (A: €10 today, or B: the higher payment in 6 months). You can interpret the question also as following: From which amount on, would you accept to wait 6 months for your payment? To answer the question, click on 'B' in this row, where the amount is stated from which on you would wait. If you always prefer €10 today, click in the last row on 'A'. The remaining rows are filled out automatically.

Nr.	A: Amount today	A	B	B: Amount in 6 months
1	€10 today	<input type="radio"/>	<input type="radio"/>	€11 in 6 months
2	€10 today	<input type="radio"/>	<input type="radio"/>	€12 in 6 months
3	€10 today	<input type="radio"/>	<input type="radio"/>	€13 in 6 months
4	€10 today	<input type="radio"/>	<input type="radio"/>	€14 in 6 months
5	€10 today	<input type="radio"/>	<input type="radio"/>	€15 in 6 months
6	€10 today	<input type="radio"/>	<input type="radio"/>	€16 in 6 months

Quick-Check (according to your decision):

Beginning with an amount of € I would wait 6 months for my payment. For an amount below I would prefer to get €10 today.

If you selected 'A' for each line above, leave this field blank and click 'Next'.

Next

A.5 Field behavior and perceived preparedness on financial matters

Time remaining until you are automatically forwarded: 0:15

The following block consists of 7 questions on various personal assessments in financial matters and on behaviors in everyday life.

Next

Please state how the following sentences apply to you.

How often do you gamble?

- 1 2 3 4 5

never seldom occasionally often very often

Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

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

not at all willing to take risk very willing to take risk

I regularly save money.

- 1 2 3 4 5

strongly disagree disagree neither agree nor disagree agree strongly agree

I can easily resist temptations.

- 1 2 3 4 5

strongly disagree disagree neither agree nor disagree agree strongly agree

Next

Please state how the following sentences apply to you.

I believe that I will not have financial problems in the future.

1 2 3 4 5

strongly disagree disagree neither agree nor disagree agree strongly agree

I believe that I learn enough about finance at school to be able to make good financial decisions in the future.

1 2 3 4 5

strongly disagree disagree neither agree nor disagree agree strongly agree

I believe that I learn enough about finances from my parents to be able to make good financial decisions in the future.

1 2 3 4 5

strongly disagree disagree neither agree nor disagree agree strongly agree

Next

A.6 Behavioral consistency II

Time remaining until you are automatically forwarded: 0:15

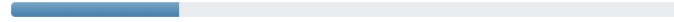
The following block consists of 4 questions about your assessment or what decisions you would make in a number of further situations.

Next

Block 5 of 6



Task 1 of 4



Question 1)

Imagine you want to subscribe to your favorite magazine. Which of the following three subscriptions would you choose?

- Digital-only subscription (online access) - €29 per year
- Print-only subscription (printed magazine) - €62 per year
- Print and digital subscription (online access and printed magazine) - €62 per year

Next

Block 5 of 6



Task 2 of 4



Question 2)

Imagine you want to buy new headphones. You pass a shop and in the window you see a new model with Bluetooth (for connecting to your smartphone or tablet) that is very comfortable to wear and has a particularly long battery life.

Would you pay more than €75 for the headphones?

- Yes
- No

How much would you pay for the headphones?

€

Next

Block 5 of 6

Task 3 of 4

Question 3)

Imagine you are playing the following game. At the beginning of the game you receive no endowment and then you have to choose between two alternatives:

- Alternative A: You win either €0 or €100 with equal probability (50:50 chance).
- Alternative B: You win €50 for sure.

Next

Block 5 of 6

Task 4 of 4

Question 4)

Imagine you are about to buy a jacket for €125 and a calculator for €15. The calculator salesman informs you that the calculator costs €10 in another branch of the shop. The other branch of the shop is about a 20-minute walk away.

Would you go to the other shop?

- Yes
- No

Next

A.7 Demographics

Block 6 of 6

Task 1 of 1

Please fill in the following fields.

Age:	<input type="text"/>	years
Gender:	Please select ▾	
Religion:	Please select ▾	
School type:	Please select ▾	
School grade:	Please select ▾	
Math grade in your last year's school report card:	Please select ▾	
German grade in your last year's school report card:	Please select ▾	
Highest education level of your mother:	Please select ▾	
Highest education level of your father:	Please select ▾	

Next

A.8 Closing

Done!

Dear student!

Thank you for taking part in our questionnaire. If you are interested in this kind of questionnaire and we could arouse your interest, you are welcome to leave your e-mail in the field below for future surveys. This will enable us to contact you in the future if a similar project to this one is carried out.

E-mail address for participation in further questionnaires (optional):

E-mail:

[Next](#)

Thank you! You can now close the browser tab.



B Information on the Austrian schooling system

After completing primary school, students in Austria generally attend either general (compulsory) secondary school (*Mittelschule*) or the lower cycle of academic secondary school (*Allgemeinbildende höhere Schule, Unterstufe*), both of which last four years and resemble the lower secondary level of the Austrian schooling system (BMBWF, 2021). These two types of schools mainly differ in their admission requirements: While for the former a positive completion of primary school is sufficient, the latter requires a successful completion (i.e., having good to very good grades in German, Reading and Mathematics). Following one of these two school types, Austrian students then have to decide between several different education paths in the upper secondary level of the Austrians education system (BMBWF, 2021). Among others, they can attend pre-vocational school (*Polytechnische Schule*) for an additional year of schooling with a subsequent dual training in form of an apprenticeship and a part-time vocational school (*Berufsschule*) for further three to five years, depending on the type of apprenticeship. Alternatively, students can also go to a school of intermediate vocational education (*Berufsbildende mittlere Schule*) for one to four years, graduating with a similar qualification compared to pre-vocational school with dual training. However, if students want to obtain a qualification for studying at a university, they have to attend either the upper cycle of academic secondary school (*Allgemeinbildende höhere Schule, Oberstufe*) or a college of higher vocational education (*Berufsbildende höhere Schule*). Compared to the upper cycle of academic secondary school which lasts four years, the college of higher vocational education takes five years to complete, but comes along with an specific vocational qualification in the fields of technology, engineering, commerce, fashion or tourism for example. For further information on the Austrian schooling system, please refer to BMBWF (2021).

C Supplementary data analysis and figures

Table C1: Descriptive statistics

	Relative distributions across categories
GENDER	Female: 0.49; Male: 0.49; Diverse: 0.02
RELIGION	Islam: 0.10; Orthodox: 0.03; Protestant: 0.02; Roman Catholic: 0.72; Other: 0.02; Without: 0.10
SCHOOL TYPE	General secondary: 0.22; Academic lower: 0.23; Pre-vocational: 0.08; Vocational: 0.11; Academic upper: 0.22; College: 0.14;
SCHOOL GRADE	5: 0.07; 6: 0.13; 7: 0.09; 8: 0.16; 9: 0.14; 10: 0.22; 11: 0.12; 12: 0.07;
MATH SKILL	1: 0.03; 2: 0.18; 3: 0.26; 4: 0.27; 5: 0.26;
GERMAN SKILL	1: 0.02; 2: 0.12; 3: 0.29; 4: 0.27; 5: 0.29;
EDUCATION MOTHER	None: 0.03; Compulsory school: 0.09; Vocational school: 0.22; A levels: 0.18; University: 0.24; Don't know: 0.25;
EDUCATION FATHER	None: 0.02; Compulsory school: 0.06; Vocational school: 0.26; A levels: 0.15; University: 0.25; Don't know: 0.26;
FINKNOW	0: 0.12; 1: 0.20; 2: 0.26; 3: 0.23; 4: 0.15; 5: 0.03; M: 2.18; SD: 1.32;
BEHCON	0: 0.01; 1: 0.05; 2: 0.17; 3: 0.37; 4: 0.37; 5: 0.04; M: 3.16; SD: 0.96;
RISK	Scale from 1 (less risk tolerant) to 6 (more risk tolerant): 1: 0.48; 2: 0.14; 3: 0.12; 4: 0.05; 5: 0.04; 6:0.17; M: 2.55; SD: 1.90;
TIME	Scale from 0 (less patient) to 6 (more patient): 0:0.34; 1: 0.17; 2: 0.11; 3: 0.14; 4: 0.07; 5: 0.05; 6:0.11; M: 2.02; SD: 2.05;
GAMBLING	Never: 0.54; Seldom: 0.33; Occasionally: 0.09; Often: 0.02; Very often: 0.02;
RISK GENERAL	M: 4.67; SD: 2.61 (0: not at all willing to take risks, 10: very willing to take risks);
SAVING	Scale from 1 (irregularly saving money) to 5 (regularly saving money): Strongly disagree: 0.07; Disagree: 0.09; Neither agree nor disagree: 0.24; Agree: 0.27; Strongly agree: 0.34;
TEMPTATION	Scale from 1 (difficult to resist temptation) to 5 (easy to resist temptation): Strongly disagree: 0.06; Disagree: 0.15; Neither agree nor disagree: 0.43; Agree: 0.24; Strongly agree: 0.12;
NO FINANCIAL PROBLEMS	Scale from 1 (believe to have financial problems in the future) to 5 (believe to not have financial problems in the future) Strongly disagree: 0.07; Disagree: 0.12; Neither agree nor disagree: 0.20; Agree: 0.41; Strongly agree: 0.21;
FINEDU SCHOOL	Scale from 1 (believe to not learn enough about finance at school) to 5 (believe to learn enough about finance at school): Strongly disagree: 0.20; Disagree: 0.22; Neither agree nor disagree: 0.28; Agree: 0.21; Strongly agree: 0.08;
FINEDU PARENTS	Scale from 1 (believe to not learn enough about finance from parents) to 5 (believe to learn enough about finance from parents): Strongly disagree: 0.04; Disagree: 0.10; Neither agree nor disagree: 0.21; Agree: 0.36; Strongly agree: 0.29;

This table shows descriptive statistics regarding subjects' GENDER, their RELIGION, SCHOOL TYPE, SCHOOL GRADE, MATH SKILL, and GERMAN SKILL (Austrian grades in reversed order; i.e. here, higher numbers indicate better grades), and the highest education level of their parents (EDUCATION MOTHER and EDUCATION FATHER, respectively). Financial literacy score and behavioral consistency score are represented by FINLIT and BEHCON, respectively. RISK is subjects' lottery choice in the risk preference experiment (integers from 1 to 6, higher values indicate a higher risk tolerance). TIME is based on the switching point (in reversed order) from the earlier to the later payment in the time preference experiment (integers from 0 to 6, higher values indicate higher patience). GAMBLING is elicited on a 5-point Likert scale and reports subjects' self-reported risky field behavior. RISK GENERAL indicates subjects' self-reported risk-taking in general and is elicited using a 11-point Likert scale. SAVING stands for subjects' self reported savings behavior using a 5-point Likert scale, and TEMPTATION represents subjects' ability to resist temptation on a 5-point Likert scale. Subjects' belief of having financial problems in the future on a 5-point Likert scale is denoted by NO FINANCIAL PROBLEMS. FINEDU SCHOOL and FINEDU PARENTS stand for subjects' perception of learning enough about finance, either at school or from their parents, on a 5-point Likert-scale (higher values indicate a more positive perception of learning enough about finance).

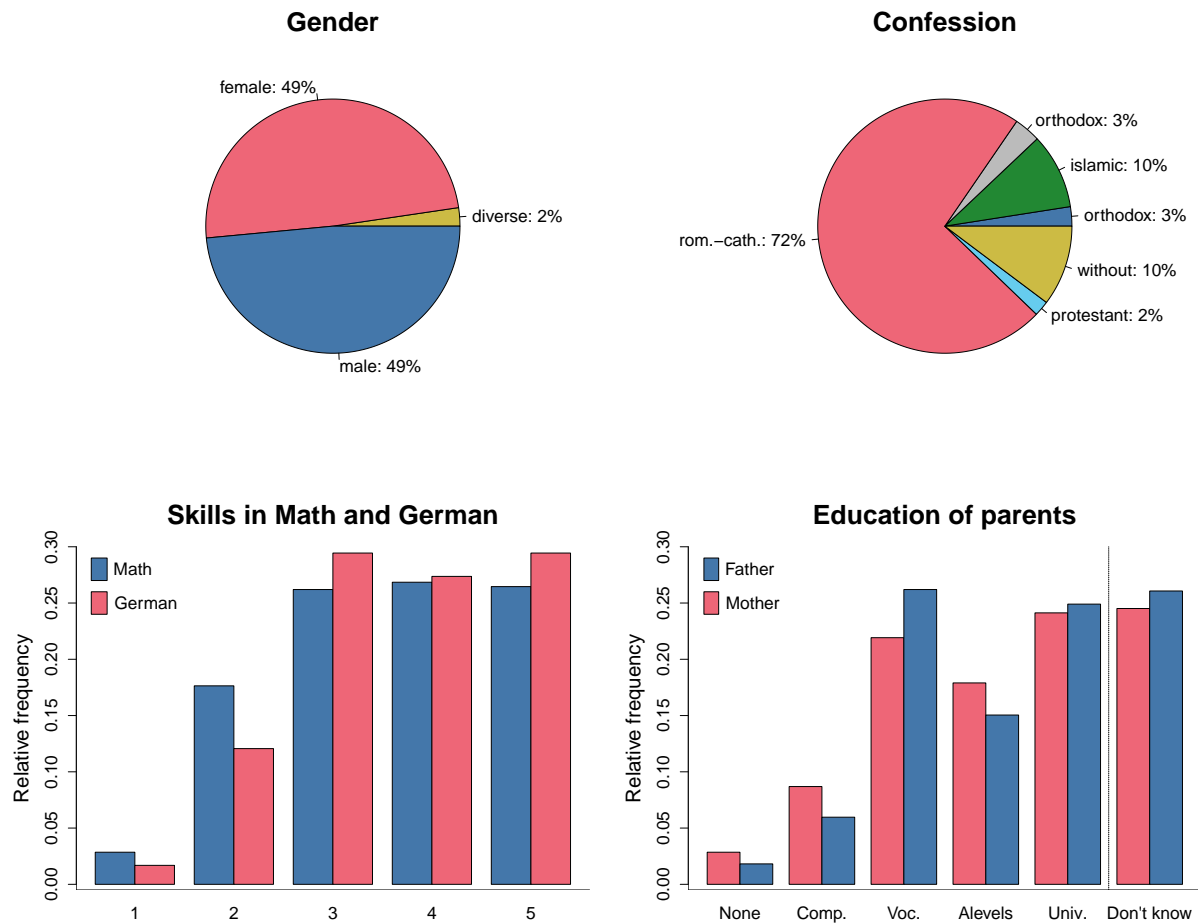


Figure C1: Distribution of sample characteristics. This figure shows the relative distribution of gender (male, female, or diverse), confession (roman-catholic, muslim, orthodox, other, or without), skills in math and german (Austrian grade in reversed order; i.e., here, higher numbers indicate better grades) and the educational levels of the mothers and fathers (none, compulsory, vocational, A-levels, university, and don't know).

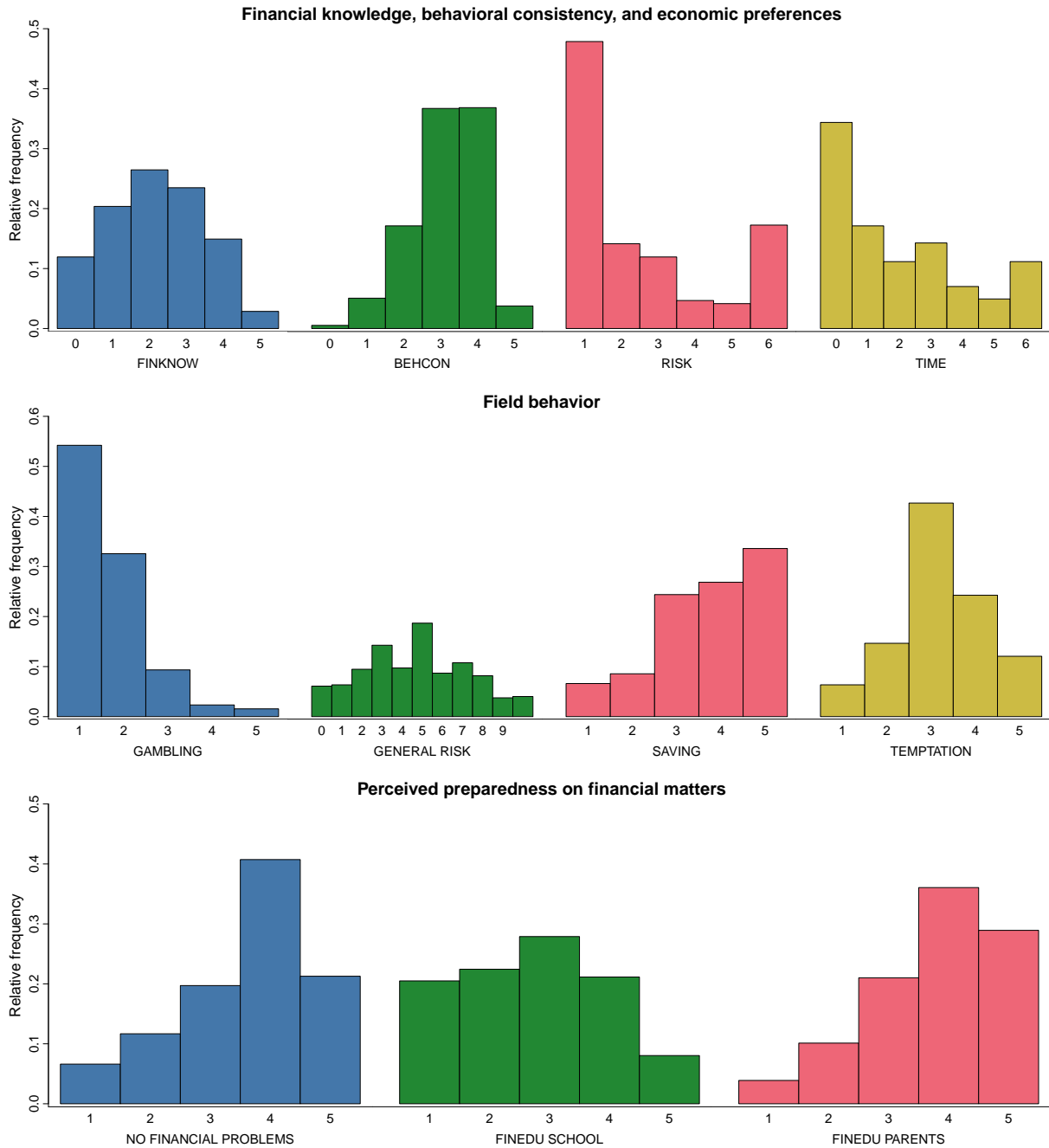


Figure C2: Distribution of the experimentally elicited variables. This figure illustrates the distribution of all experimentally elicited variables. FINKNOW is the number of correct answers on the financial knowledge questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regularly saving behavior (integers from 1 to 5). TEMPTATION denotes subject's self-reported ability to resist temptations (integers from 1 to 5). NO FINANCIAL PROBLEMS denotes subjects' belief in not having financial problems in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). FINEDU SCHOOL and FINEDU PARENTS are subjects' beliefs about learning enough about finance in school or from their parents in order to make good financial decisions in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5).

	(1)	(2)	(3)	(4)	(5)
(1) SCHOOL GRADE	1				
(2) MATH SKILL	-0.112**	1			
(3) GERMAN SKILL	-0.080*	0.534**	1		
(4) EDUCATION MOTHER	0.193**	0.145**	0.170**	1	
(5) EDUCATION FATHER	0.195**	0.073*	0.110	0.715**	1

Table C2: Correlation matrix of (quasi)-metric explanatory variables showing pairwise Pearson's correlation coefficient. SCHOOL GRADE is subjects' current school grade. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from the previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). EDUCATION MOTHER and EDUCATION FATHER indicate the education levels of subjects' mothers and fathers, respectively (Don't know: 0; None: 1; Compulsory: 2; Vocational: 3; Alevels: 4; University: 5). * and ** represent the 5% and 0.5% significance level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) FINKNOW	1										
(2) BEHCON	0.087*	1									
(3) RISK	0.073*	0.022	1								
(4) TIME	0.158**	0.008	-0.029	1							
(5) GAMBLING	0.104**	0.014	0.198*	-0.001	1						
(6) GENERAL RISK	0.086*	-0.039	0.253**	-0.014	0.312**	1					
(7) SAVING	0.014	0.013	-0.080*	0.113**	-0.043	-0.137**	1				
(8) TEMPTATION	0.063	0.014	-0.073*	0.068	-0.106**	-0.112**	0.329**	1			
(9) NO FINANCIAL PROBLEMS	0.092*	0.138**	0.030	0.099*	-0.033	0.054	0.171**	0.196**	1		
(10) FINEDU SCHOOL	-0.105**	-0.015	-0.034	-0.093*	-0.010	-0.091*	0.177**	0.141**	0.125**	1	
(11) FINEDU PARENTS	0.024	0.122**	-0.009	0.026	0.077*	-0.004	0.223**	0.105**	0.322**	0.281**	1

Table C3: Correlation matrix of dependent variables showing pairwise Pearson's correlation coefficient. FINKNOW is the number of correct answers on the financial knowledge questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regularly saving behavior (integers from 1 to 5). TEMPTATION denotes subject's self-reported ability to resist temptations (integers from 1 to 5). NO FINANCIAL PROBLEMS denotes subjects' belief in not having financial problems in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). FINEDU SCHOOL and FINEDU PARENTS are subjects' beliefs about learning enough about finance in school or from their parents in order to make good financial decisions in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). * and ** represent the 5% and 0.5% significance level, respectively.

Table C4: Robustness check financial knowledge, behavioral consistency, and economic preferences (median imputation)

	<i>Dependent variable:</i>			
	FINKNOW (1)	BEHCON (2)	RISK (3)	TIME (4)
SCHOOL GRADE	0.171* (0.083)	0.053 (0.041)	0.170* (0.081)	0.112 (0.084)
GENDER				
MALE	0.518** (0.085)	0.029 (0.069)	0.514** (0.124)	0.159 (0.164)
DIVERSE	-0.654 (0.357)	0.138 (0.197)	1.417** (0.475)	-0.152 (0.613)
RELIGION				
ISLAMIC	-0.294* (0.134)	-0.173 (0.131)	-0.074 (0.243)	-0.032 (0.268)
ORTHODOX	-0.302 (0.265)	-0.443* (0.189)	-0.187 (0.363)	-0.560 (0.499)
PROTESTANT	-0.120 (0.257)	-0.458* (0.202)	-0.468 (0.301)	0.334 (0.617)
OTHER	0.255 (0.213)	-0.060 (0.282)	0.122 (0.472)	-0.313 (0.372)
WITHOUT	0.054 (0.131)	0.023 (0.113)	0.053 (0.271)	-0.081 (0.286)
SCHOOL TYPE				
GENERAL	-0.125 (0.387)	0.001 (0.180)	0.364 (0.415)	0.994 (0.582)
ACADEMIC LOWER	-0.104 (0.432)	-0.052 (0.251)	0.366 (0.442)	0.964 (0.673)
PRE-VOCATIONAL	0.179 (0.293)	-0.150 (0.197)	-0.161 (0.396)	0.468 (0.528)
ACADEMIC UPPER	0.517* (0.257)	0.208 (0.140)	-0.156 (0.245)	1.189* (0.473)
COLLEGE	0.447 (0.257)	0.225 (0.117)	0.084 (0.278)	0.592 (0.431)
MATH SKILL	0.107 (0.056)	0.070* (0.035)	-0.112 (0.068)	0.189* (0.076)
GERMAN SKILL	-0.012 (0.053)	-0.057 (0.035)	-0.069 (0.080)	-0.076 (0.077)
EDUCATION MOTHER	-0.080 (0.054)	0.030 (0.050)	0.023 (0.067)	-0.051 (0.100)
EDUCATION FATHER	0.232** (0.050)	-0.066 (0.056)	-0.064 (0.079)	0.205 (0.121)
CONSTANT	-0.525 (0.926)	2.790** (0.424)	1.484 (1.055)	-0.758 (1.204)
Observations	771	771	771	771
Adjusted R ²	0.258	0.048	0.035	0.043
F Statistic	16.790**	3.032**	2.633**	3.044**

Ordinary least squares regressions for the dependent variables (1) FINKNOW, (2) BEHCON, (3) RISK, and (4) TIME. FINKNOW represents the number of correct answers on the financial literacy questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC HIGHER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). EDUCATION MOTHER and EDUCATION FATHER represent the highest education level of subjects' parents (1: None, 2: Compulsory school, 3: Vocational school, 4: A-Levels, 5: University), where the highest education level of parents with subjects don't knowing that are imputed using the median (i.e., 3: Vocational School for EDUCATION MOTHER, and 3: Vocational school for EDUCATION FATHER). Control for order effects is included in the regression (2) BEHCON, which shows no significant coefficients for two of three predetermined orders of tasks, with one being the reference category (Decoy, Anchoring, Framing, Mental Accounting, Conjunction Fallacy). Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

Table C5: Robustness check field behavior (median imputation)

	<i>Dependent variable:</i>			
	GAMBLING (1)	RISK GENERAL (2)	SAVING (3)	TEMPTATION (4)
SCHOOL GRADE	-0.021 (0.036)	0.173 (0.135)	-0.023 (0.055)	-0.028 (0.044)
GENDER				
MALE	0.209** (0.064)	1.110** (0.182)	-0.085 (0.090)	0.003 (0.079)
DIVERSE	0.503 (0.386)	1.051 (0.846)	-0.290 (0.348)	-0.543* (0.275)
RELIGION				
ISLAMIC	-0.273* (0.104)	-0.239 (0.281)	-0.224 (0.147)	0.058 (0.130)
ORTHODOX	-0.163 (0.163)	0.501 (0.434)	-0.279 (0.253)	0.121 (0.159)
PROTESTANT	0.272 (0.270)	-0.607 (0.452)	-0.139 (0.267)	0.125 (0.224)
OTHER	-0.169 (0.217)	0.177 (0.500)	0.033 (0.260)	-0.193 (0.205)
WITHOUT	-0.160 (0.092)	-0.372 (0.258)	-0.193 (0.120)	0.131 (0.126)
SCHOOL TYPE				
GENERAL	0.012 (0.167)	0.221 (0.713)	-0.003 (0.271)	-0.178 (0.193)
ACADEMIC LOWER	-0.256 (0.182)	0.164 (0.688)	0.019 (0.322)	-0.228 (0.239)
PRE-VOCATIONAL	0.034 (0.109)	-0.764 (0.544)	-0.205 (0.224)	0.001 (0.180)
ACADEMIC UPPER	-0.059 (0.101)	-0.042 (0.506)	0.153 (0.171)	0.026 (0.112)
COLLEGE	0.309** (0.109)	-0.035 (0.458)	-0.147 (0.176)	-0.079 (0.136)
MATH SKILL	0.025 (0.034)	-0.239* (0.114)	0.198** (0.059)	0.090* (0.039)
GERMAN SKILL	-0.046 (0.040)	0.074 (0.126)	0.115* (0.045)	0.022 (0.042)
EDUCATION MOTHER	0.043 (0.042)	0.061 (0.119)	0.018 (0.054)	0.068 (0.055)
EDUCATION FATHER	-0.004 (0.038)	-0.009 (0.108)	-0.020 (0.060)	-0.031 (0.050)
CONSTANT	1.722** (0.449)	3.053 (1.604)	2.896** (0.711)	3.004** (0.521)
Observations	771	771	771	771
Adjusted R ²	0.040	0.049	0.086	0.008
F Statistic	2.866**	3.332**	5.264**	1.348

Ordinary least squares regressions for the dependent variables (1) GAMBLING, (2) RISK GENERAL, (3) SAVING, and (4) TEMPTATION. GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regular saving behavior (integers from 1 to 5). TEMPTATION denotes subjects' self-reported ability to resist temptations (integers from 1 to 5). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC UPPER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). EDUCATION MOTHER and EDUCATION FATHER represent the highest education level of subjects' parents (1: None, 2: Compulsory school, 3: Vocational school, 4: A-Levels, 5: University), where the highest education level of parents with subjects don't knowing that are imputed using the median (i.e. 3: Vocational School for EDUCATION MOTHER, and 3: Vocational school for EDUCATION FATHER). Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

Table C6: Robustness check perceived preparedness on financial matters (median imputation)

	<i>Dependent variable:</i>		
	NO FINANCIAL PROBLEMS (1)	FINEDU SCHOOL (2)	FINEDU PARENTS (3)
SCHOOL GRADE	0.035 (0.054)	-0.241** (0.043)	-0.041 (0.044)
GENDER			
MALE	-0.158 (0.082)	0.012 (0.084)	-0.138 (0.079)
DIVERSE	-0.366 (0.266)	-0.271 (0.238)	-0.322 (0.263)
RELIGION			
ISLAMIC	-0.214 (0.122)	-0.161 (0.111)	-0.067 (0.128)
ORTHODOX	-0.169 (0.172)	0.229 (0.219)	0.197 (0.187)
PROTESTANT	0.645* (0.296)	-0.071 (0.271)	0.670** (0.157)
OTHER	-0.077 (0.278)	-0.202 (0.376)	0.093 (0.285)
WITHOUT	-0.078 (0.103)	-0.213 (0.134)	-0.018 (0.147)
SCHOOL TYPE			
GENERAL	-0.014 (0.217)	-1.155** (0.188)	-0.122 (0.203)
ACADEMIC LOWER	0.170 (0.216)	-1.425** (0.229)	-0.203 (0.214)
PRE-VOCATIONAL	-0.062 (0.228)	-0.395* (0.175)	-0.226 (0.181)
ACADEMIC UPPER	0.052 (0.149)	-1.286** (0.145)	-0.344* (0.163)
COLLEGE	0.129 (0.186)	0.154 (0.121)	-0.033 (0.141)
MATH SKILL	0.063 (0.043)	0.016 (0.045)	0.054 (0.038)
GERMAN SKILL	0.006 (0.044)	0.084 (0.048)	0.048 (0.059)
EDUCATION MOTHER	0.097 (0.054)	-0.126* (0.054)	0.077 (0.051)
EDUCATION FATHER	-0.087 (0.055)	-0.005 (0.048)	-0.042 (0.044)
FINKNOW	0.032 (0.037)	-0.013 (0.035)	0.037 (0.035)
BEHCON	0.145** (0.039)	0.027 (0.047)	0.158** (0.041)
RISK	0.029 (0.022)	0.007 (0.022)	0.006 (0.021)
TIME	0.034 (0.019)	-0.019 (0.021)	0.006 (0.018)
GAMBLING	-0.084 (0.059)	-0.004 (0.041)	0.096* (0.044)
GENERAL RISK	0.046* (0.018)	-0.013 (0.019)	0.011 (0.016)
SAVING	0.086* (0.037)	0.155** (0.036)	0.161** (0.038)
TEMPTATION	0.164** (0.049)	0.122** (0.040)	0.042 (0.042)
CONSTANT	1.456* (0.587)	4.895** (0.569)	2.309** (0.519)
Observations	771	771	771
Adjusted R ²	0.094	0.248	0.085
F Statistic	4.181**	11.130**	3.869**

Ordinary least squares regressions for the dependent variables (1) NO FINANCIAL PROBLEMS, (2) FINEDU SCHOOL, and (3) FINEDU PARENTS. NO FINANCIAL PROBLEMS denotes subjects' belief in not having financial problems in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). FINEDU SCHOOL and FINEDU PARENTS are subjects' beliefs about learning enough about finance in school or from their parents in order to make good financial decisions in the future, with higher values indicating stronger agreement and lower values indicating stronger disagreement (integers from 1 to 5). SCHOOL GRADE is subjects' current school grade. MALE and DIVERSE are binary dummies indicating gender, with the reference category being FEMALE. ISLAM, ORTHODOX, PROTESTANT, OTHER, and WITHOUT are indicator variables for subjects' confession, with the reference category being ROMAN CATHOLIC. GENERAL, ACADEMIC LOWER, PRE-VOCATIONAL, ACADEMIC UPPER, and COLLEGE are indicators for subjects' school type, with the reference category being VOCATIONAL SCHOOL. MATH SKILL and GERMAN SKILL denote subjects' grades in math and German from previous year's school report card, with higher numbers indicating better grades (in order to make the interpretation of coefficients more intuitive, we reversed the Austrian grade scale). EDUCATION MOTHER and EDUCATION FATHER represent the highest education level of subjects' parents (1: None, 2: Compulsory school, 3: Vocational school, 4: A-Levels, 5: University), where the highest education level of parents with subjects don't knowing that are imputed using the median (i.e. 3: Vocational School for EDUCATION MOTHER, and 3: Vocational school for EDUCATION FATHER). FINKNOW is the number of correct answers on the financial knowledge questions (integers from 0 to 5). BEHCON is the number of consistent tasks in the behavioral consistency blocks (integers from 0 to 5). RISK measures experimentally elicited risk attitudes (integers from 1 to 6), and TIME measures experimentally elicited time preferences (integers from 0 to 6). GAMBLING represents subjects' engagement in gambling, with higher values indicating more frequent engagement (integers from 1 to 5). RISK GENERAL denotes subjects' self-reported willingness to take risks in general, with higher values indicating higher willingness to take risks (integers from 0 to 10). SAVING represents subjects' self-reported saving behavior, with higher values referring to more regularly saving behavior (integers from 1 to 5). TEMPTATION denotes subject's self-reported ability to resist temptations (integers from 1 to 5). Standard errors, clustered on school class level, are in parentheses. * and ** represent the 5% and 0.5% significance level, respectively.

D Raw data preparation

Before analyzing the data, we examined the demographics of our subjects for any structural errors which might occur because of their age (M : 14.66 years, SD : 2.28 years) and the fact that the experiment was held using a computer. As it turned out, some subjects had problems in correctly declaring their school related variables (i.e., school and class identifiers, school type and school grade). Specifically, typing errors were present in school and class names, and false assignments of school types appeared. In order to maximize the number of observations in our dataset, we corrected the data in cases where the structural error was evident. If that has not been the case, the corresponding observation has been deleted for the subsequent analysis. In more detail, the raw data preparation procedure was as follows. First, we harmonized the school and class identifiers by removing any typing error by hand. We then removed implausible observations including tests, and single logins at separate times and schools appearing only once in the data. Then we assigned students with a typing error in their class identifier to corresponding classes that are in the same school and started the questionnaire at the same time. After that, we summarized three classes of one participating school to one class as all participants had the same login time, which is most likely due to the fact that these participants filled out the survey in an inter-class subject in school, which is also common among some school subjects in Austria. Next, we corrected school type and school grade errors by harmonizing participants' school type to the school type the school was belonging to, and by adjusting the school grade via the particular school and the class identifier (e.g., middle schools in Austria are general secondary schools, and a participant who declares to be in 4th grade in middle school is on school grade 8.). Moreover, we hand corrected one typo in one participant's class identifier as he/she logged in with another class at the same time, and we imputed the median class age for three participants as they stated to be too young to be in the class and school they declared to be. However, the latter is not relevant for the analysis since we use the school grade as a proxy for age difference. Lastly, we computed the group identifier by connecting the school identifier (i.e., school name) and the class identifier of subjects, yielding us group variables for clustering.

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Determinants of Financial Literacy and Behavioral Bias among Adolescents

Abstract

Building on cross-sectional data for Austrian high school students from fifth to twelfth grade, we investigate the correlations between socio-economic background variables and a comprehensive set of variables related to financial decision-making (i.e., financial knowledge, behavioral consistency, economic preferences, field behavior, and perception of financial matters). We confirm the findings of previous literature that the male gender is positively associated with financial knowledge and risk-taking and that there is a strong and beneficial correlation between math grades and healthy financial behavior (e.g., saving). Moreover, we find that students' behavioral consistency is positively correlated with measures of financial attitude (e.g., self-assessed future financial well-being and financial education received from parents). Finally, our results indicate that financial education, as perceived by the students, is primarily provided by parents.

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