# Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior

Matthias Sutter
Martin G. Kocher
Daniela Rützler
Stefan T. Trautmann

# Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior

## Abstract

We study risk attitudes, ambiguity attitudes, and time preferences of 661 children and adolescents, aged ten to eighteen years, in an incentivized experiment and relate experimental choices to field behavior. Experimental measures of impatience are found to be significant predictors of health-related field behavior, saving decisions and conduct at school. In particular, more impatient children and adolescents are more likely to spend money on alcohol and cigarettes, have a higher body mass index, are less likely to save money and show worse conduct at school. Experimental measures for risk and ambiguity attitudes are only weak predictors of field behavior.

JEL-Code: C910, C930, D810, D900.

Keywords: experiments with children and adolescents, risk, ambiguity, time preferences, health status, savings, conduct at school, external validity.

*Matthias Sutter*
*Department of Public Finance*
*University of Innsbruck*
*Universitaetsstrasse 15*
*Austria – 6020 Innsbruck*
*matthias.sutter@uibk.ac.at*

*Martin G. Kocher*
*Department of Economics*
*University of Munich*
*Munich / Germany*
*martin.kocher@lrz.uni-muenchen.de*

*Daniela Rützler*
*University of Innsbruck*
*Innsbruck / Austria*
*daniela.ruetzler@uibk.ac.at*

*Stefan T. Trautmann*
*University of Tilburg*
*Tilburg / The Netherlands*
*s.t.trautmann@uva.nl*

Recent research has shown that experimental data on risk and time preferences serve as a good predictor for field behavior concerning, for instance, occupational choices (Holger Bonin et al., 2007; Stephen V. Burks et al., 2009), financial literacy and credit card borrowing (Stephan Meier and Charles Sprenger, 2008, 2010), smoking and alcohol consumption (Ahmed Khwaja, Frank Sloan and Martin Salm, 2006; Christopher F. Chabris et al., 2008), or nutrition intake (Chabris et al., 2008; Rosalyn E. Weller et al., 2008). For example, Chabris et al. (2008) find that experimentally elicited discount rates can explain inter-individual variation in the BMI (body mass index) or the intensity of physical exercise and smoking in a sample of 555 adults. Burks et al. (2009) present data from 1,000 trainee truck drivers and show how experimentally elicited risk and time preferences are related to job attachment and the duration of staying in a job, due to a correlation of these preference parameters with cognitive skills (see also Thomas Dohmen et al., 2010).

So far, research that relates experimental choices to field behavior has only considered adult decision makers. In this paper, we elicit time preferences, risk attitudes, and ambiguity attitudes of 661 children and adolescents, aged ten to eighteen years. We then relate individual experimental choices to behavior in the field, in particular to smoking, drinking, the body mass index (BMI), savings, and conduct at school. We find that experimental measures of time preferences are significant predictors of field behavior *already at an early stage in life*. In particular, more impatient children and adolescents are more likely to spend money on alcohol and cigarettes, have a higher BMI, are less likely to save money, and commit more violations of the school's code of conduct. Taken together, more impatient children and adolescents have a considerably worse health and economic outlook. In contrast to our experimental measures of time preferences, the experimental measures for risk and ambiguity attitudes are at best weak predictors of field behavior for the age groups we study. Risk aversion is only related to the BMI, with more risk averse subjects having a lower BMI. Moreover, subjects who are more ambiguity averse are less likely to smoke.

Measuring children's and adolescents' attitudes towards delay and uncertainty and assessing the external validity of the experimental measurements is relevant because it provides an important input for the optimal design of policy interventions that target children's and adolescents' behavior. In their transition from childhood to adulthood, children and adolescents experience an increasing number of decisions involving uncertainty and long-term consequences. In many circumstances these decisions do not involve *risk* – where probabilities are known – but rather *ambiguity*, where probabilities are unknown or vague (Daniel Ellsberg, 1961; Yoram Halevy, 2007; Mohammed Abdellaoui et al., 2011). Important examples include the uncertainties

involved in drug intake, the practicing of unprotected sex, or investments for the future through saving or education. Therefore, we investigate not only risk but also ambiguity attitudes, alongside time preferences.

So far, the evidence on children's risk taking, ambiguity attitudes, and time preferences is still scarce. The existing literature suggests that children are relatively more risk seeking and delay averse, i.e., impatient, than adults (see, for example, Wiliam T. Harbaugh, Kate Krause and Lise Vesterlund, 2002; Irwin P. Levin and Stephanie S. Hart, 2003; Eric Bettinger and Robert Slonim, 2007; Levin et al., 2007). Although many decisions of children and adolescents involve both uncertainty and delay, to the best of our knowledge no empirical study has integrated both aspects in a single, unifying research design. Furthermore, none of the previously mentioned studies has examined the predictive power of experimentally elicited attitudes towards uncertainty or delay for the field behavior of children and adolescents.

The first contribution of this paper is, therefore, to provide a unified experimental framework to measure delay and uncertainty attitudes for a large sample of children and adolescents. If uncertainty and time preferences are correlated, as often conjectured, omitting one of them might lead to a wrong attribution of behavioral effects and consequences to the included one (Halevy, 2008).

The second contribution of this paper is to link elicited attitudes of children and adolescents from the fully incentivized experiment to their field behavior, in particular to health-related behavior, as well as saving decisions and conduct at school. In other words, we assess the external validity of experimental measures for children and adolescents. A recent study by Marco Castillo et al. (2011) is related to this aspect of our approach. They study the link between experimentally elicited time preferences of thirteen- to fifteen-year old children to their disciplinary referrals in school, finding that less patient children have a less favorable outlook for school performance. However, Castillo et al. (2011) do not consider a potentially simultaneous influence of time preferences and attitudes towards uncertainty on behavior. Furthermore, we consider a larger age spectrum and a broader array of indicators, including also health-related behavior and saving decisions. Putting particular emphasis on health-related behavior (smoking, drinking, and the BMI) of children and adolescents is relevant for the development of policy interventions that are able to avoid negative long-term health consequences, which ultimately also have an impact on labor market success and economic prosperity (Anne Case, Darren Lubotsky and Christina Paxson, 2002).

In our experiment, we elicit risk, ambiguity and delay attitudes using simple versions of standard choice list tasks that are well-established and widely used in the economics literature.

All decisions are incentivized, with cash as the reward medium, paid according to the choices made.[1] In addition to eliciting preferences, we use a questionnaire, as well as data obtained directly from the schools, to relate demographic variables and information about subjects' field behavior to attitudes towards delay and uncertainty. Our experiment has another noteworthy feature: in contrast to all previous studies, our experiment was conducted during regular school hours. That is, we had virtually no drop-outs and, thus, no self-selection into the experiment. Recent papers by Gal Zauberman and John G. Lynch Jr. (2005) and Jawwad Noor (2009) provide theoretical arguments and empirical evidence that self-selected participants in experiments may be those most in need of immediate cash, thus potentially biasing experimental results in favor of detecting a present-bias. Avoiding self-selection minimizes the possibility of such a bias.

Our experimental results confirm the typical patterns of preferences regarding risk, ambiguity, and impatience, that are also observed with adult experimental participants (Shane Frederick, George Loewenstein and Ted O'Donoghue, 2002; Dohmen et al., 2011). On average, children and adolescents are risk averse, ambiguity averse and impatient. Interestingly, we find hardly any age effect within each dimension (of risk, ambiguity and patience), indicating that these preferences are stable in the age group of ten- to eighteen-year olds. As is standard in the literature on adults' risk aversion (Rachel Croson and Gneezy, 2009), we also find a strong gender difference such that girls are more risk averse than boys. High ability students measured by their math grades are more patient. Importantly, there is a significant relation between risk aversion and time preferences, with more risk averse subjects being more patient. Looking at the predictive power of experimental decisions for behavior in the field, we observe that for children and adolescents time preferences are a strong predictor of health-related field behavior, saving decisions, and conduct at school, as already indicated above. However, the link between laboratory decisions and supposedly related behavior in the field is only weak for risk and ambiguity attitudes.

The rest of the paper is organized as follows. In section I we describe the data set and the general features of the experimental study. Sections II and III present the specific designs and results of the uncertainty and delay attitude elicitation as well as the effects of individual

---

[1] Note that Harbaugh et al. (2002), Bettinger and Slonim (2007) and Castillo et al. (2011) use vouchers or small gifts as rewards. However, gift certificates may carry more uncertainty than cash, thus causing an interaction of both time and risk preferences in the delay task (see Uri Gneezy, John A. List and George Wu, 2006). For this reason, and given the permission of all involved parties, including parents and school principals, we have decided to use cash in our experiment.

background variables on these measures. We also discuss aspects of our results that replicate existing findings in the literature and those that deviate from them. Following previous papers (Gideon Keren and Peter Roelofsma, 1995; Bettinger and Slonim, 2007; Halevy, 2008), we assume that delay often implies uncertainty, and we use uncertainty attitudes elicited in section II as explanatory variables in the analysis of time preferences in section III. In section IV, we study how our experimental measures relate to field behavior with respect to smoking, drinking, the BMI, saving, and conduct at school. Section V discusses our main findings and concludes the paper.

# I.     Subject Pool and General Experimental Setup

## A.     Subject Pool

We conducted experiments with a total of 661 children and adolescents, aged ten to eighteen years. The experiments were run in three Austrian schools, comparable to US high schools, in Innsbruck and Schwaz, two cities in the Federal State of Tyrol, between November 2007 and May 2008. We randomly selected 28 classes in $5^{th}$, $7^{th}$, $9^{th}$, and $11^{th}$ grade. The youngest participants were ten years old, the oldest ones eighteen years. The distribution of students across grades and gender is shown in Table 1. The study was approved by the central school administration board of Tyrol, and the principals and teachers of the participating schools gave permission to conduct the experiments in class during regular school hours. Parents were informed about the experiment and the collection of survey data. All children got their parent's permission to participate. Besides asking parents for consent, we also asked all students whether they would be willing to participate in the experiments. No student opted out.

*Table 1 about here*

## B.     General Experimental Setup

The experiments involved real monetary payoffs, and each subject got paid according to his or her choices. Payoffs used were between €4 and €4 (see sections II and III as well as the experimental procedure documented in online Appendix A1). All students faced exactly the same decision tasks, instructions and payoffs (except for a variation in reward levels in a subset of students to test for payoff effects, see section II). Students were aware that they could earn

money in the experiments and that their payoffs would depend on their choices. Payoffs were determined and paid in cash immediately, except for future payoffs in the time preference experiment, which were paid (during school hours at the same school) on a predetermined date in the future (see section III).

All experimental sessions were run jointly by the first author (male) and the third author (female) of this study in the students' classrooms during regular school hours. At the end of the experimental sessions, demographic background variables and additional survey data were collected through self-reports (see Appendix A2 for the questionnaire). Additional data on students' grades and conduct at school were obtained directly from the schools.

We elicited risk and ambiguity attitudes as well as time preferences through choice lists. Each subject faced a number of ordered choices where a gamble (or an immediate payoff) was compared to an increasingly attractive sure (or future) payoff. Choice lists have been widely used in the economics literature (see, for example, Charles A. Holt and Susan K. Laury, 2002; Dohmen et al., 2010). They allow conditioning real payoffs on actual choices in an incentive compatible way.

Despite their simplicity, choice list elicitations sometimes yield inconsistent choice patterns when subjects switch repeatedly between early and delayed payments (or the sure payoffs and the gamble) and sometimes choose the gamble over a sure payoff that is identical to the gamble's largest prize (Holt and Laury, 2002; Bettinger and Slonim, 2007). Although some authors have tried to recover consistent preferences from inconsistent choice lists (e.g., Bettinger and Slonim, 2007; Judith Lammers and Sweder van Wijnbergen, 2008), we believe that most of the inconsistencies we observe are actually due to mistakes or misunderstandings and that no consistent preferences can be recovered from the lists involving inconsistent choices. We have therefore eliminated all subjects with inconsistent choices (either in the uncertainty or the time preference experiment; see right-hand side of Table 1) from the analysis.[2] This leaves us with 639 (out of 661) subjects with complete and consistent data. The relatively high proportion of consistent choices is probably a consequence of putting a lot of effort in explaining the choice lists to our participants, going through many examples and answering any remaining questions after carefully explaining the experiment. Note that the instructions carefully avoided any suggestions that choosing either safe (or risky), respectively earlier (or later) payment, is

---

[2] If we recover switching points from inconsistent subjects by assuming that repeatedly switching between the two options indicates near indifference (Lammers and van Wijnbergen, 2008), all our results remain qualitatively unchanged.

normative or rational. It is also important to note that our choice lists for eliciting uncertainty attitudes were significantly easier than the choice lists based on Holt and Laury (2002), which are often used in the literature. In contrast to Holt and Laury (2002), our subjects did not compare two different gambles with changing probability distributions along the list. Rather, they had to compare one (fixed) gamble to a sure amount that increased monotonically. Violations of monotonicity through multiple switching as, e.g., in the preference €4 ≻ gamble ≻ €5 are more likely to become obvious.

In principle, utility models for risk and ambiguity can be calibrated from the observed switching points (as in Holt and Laury, 2002, for instance). Similarly, discounting models for time preferences can be estimated from the choice lists for delay (Han Bleichrodt, Kirsten Rohde and Peter P. Wakker, 2009; Arthur E. Attema et al., 2010). However, we decided to study preferences and their effects on field behavior in terms of the raw switching points to avoid any confounding effects due to (arbitrary) parametric assumptions. That is, we will define certainty equivalents for uncertainty tasks, and future equivalents for delay tasks, and relate them to demographics and field behavior directly, i.e., in a model-free way.

# II. Risk and Ambiguity Attitudes

## A. Method

We elicited risk and ambiguity attitudes within the framework of the Ellsberg two-color choice task (Ellsberg, 1961). Subjects were presented with two bags with twenty balls each. The balls were either white or orange. Subjects could win a fixed amount of money (see below) by betting on the color of their choice to be blindly drawn from a bag by themselves. One of the bags, the *risky prospect*, contained exactly ten white and ten orange balls, the distribution being known (and shown) to the subjects. The other bag, the *ambiguous prospect*, contained twenty balls that were either white or orange. The exact numbers of either color were unknown to the subjects. Note that no reference was given to probabilities for either bag. Rather, both prospects were described and actually played in terms of balls drawn from bags.

For each prospect we presented subjects with a series of choices between playing the aforementioned bet or taking a sure payoff instead. The choices for each prospect were arranged in a list that offered the choice between increasing sure amounts and the gamble. An excerpt from the list that has been used in the experiment is shown in Figure 1.

*Figure 1 and Figure 2 about here*

Subjects made twenty ordered choices for the risky prospect and twenty choices for the ambiguous prospect, with changing orders between subjects. All choices were numbered, and one of the choices was randomly determined by lot to be played for real payoffs. Depending on the subject's decision in the selected choice problem she would either play the gamble by betting on a color and drawing one ball from the bag, or receive the sure payoff instead.

From the two choice lists we calculated the subject's *certainty equivalents* for the prospects as the midpoint between the two sure payoffs where the subject switched from the gamble to the sure payoff. In the example in Figure 2, the certainty equivalent is calculated as €3.75.[3]

## B.    Payoffs

If subjects chose to play the gamble, they chose a color first and then blindly drew a ball from the bag. If the color drawn matched the color chosen before, they received a prize. Otherwise they received nothing. The prize was fixed at €10 for 471 out of 639 subjects, irrespective of their age. Keeping the prize constant allowed us to have exactly the same design for all age groups. Of course, the €10 prize might have been perceived differently by the younger cohorts than by the older cohorts in our experiment. To control for stake size effects we introduced a prize variation in part of the sample (for 168 out of the 639 subjects with consistent choices), increasing the prize from €6 for 5th graders in steps of €2 up to €12 for 11th graders. In addition to the payoffs from the experiment, each participant received a show-up fee of €2.

Denote the prize in the gamble with $\pi$. The sure payoffs in the choice lists always varied from $\pi/20$ to $\pi$ in twenty evenly spaced steps. For instance, in the €10-prize group the smallest sure amount was €0.50, and each step added €0.50 to the sure amount. As a consequence, we kept the number of items in the choice list constant across payoff variation groups, eliminating possibly confounding list structure effects.

---

[3] One subject always chose the gamble and was thus excluded from the analysis. Subjects who always chose the sure amount were classified as having a certainty equivalent that is halfway in between zero and the sure amount in the first row. Thirty eight subjects choose always the sure amount both in the risky and ambiguous prospect, five subjects only for the risky prospect, and thirty six subjects only for the ambiguous prospect.

## C.    Attitude Measures

We define measures of risk and ambiguity attitudes based on certainty equivalents (Wakker 2010, chapter 11). As a measure of individual risk attitude $r$ we use

$$r = 1 - CE_R / \pi , \tag{1}$$

where $CE_R$ denotes the certainty equivalent of the risky prospect, and individual subscripts are omitted. Values of $r$ larger (smaller) than 0.5 indicate risk aversion (risk loving), with risk neutrality for $r = 0.5$. As a measure of ambiguity attitude we employ the value $a$,

$$a = (CE_R - CE_A)/(CE_R + CE_A) , \tag{2}$$

with $CE_A$ being the certainty equivalent of the ambiguous prospect. This measure ranges from –1 (extreme ambiguity loving) over 0 (ambiguity neutrality) to 1 (extreme ambiguity aversion). The larger the difference between the two certainty equivalents, the stronger is the ambiguity attitude, controlling for the absolute level of risk and ambiguity attitude. The normalization controls for the fact that, for example, a €2-difference weighs more heavily for a relatively risk averse subject than for a relatively risk neutral subject.


## D.    Results

*Risk aversion*. In the aggregate, we find significant risk aversion in our sample, with a mean (median) measure of risk aversion of $r = 0.57$ (0.53) ($p < 0.001$, Wilcoxon signed-ranks test,[4] testing whether $r$ is different from 0.5). A regression including demographic background variables is shown in Table 2. It reveals first and foremost a clear gender effect: girls are significantly more risk averse than boys. Age does not have a significant effect. All other independent variables are not significant, either. Among them are the grades for math and German, which were obtained directly from the teachers. They are coded as relative grades in comparison to a class's average grade, and larger values indicate better performance.

*Table 2 about here*

*Ambiguity aversion*. A clear majority of our sample is ambiguity averse. The mean (median) ambiguity aversion for the whole sample yields $a = 0.13$ (0.07) ($p < 0.001$, Wilcoxon signed-ranks test, testing whether $a$ is different from 0). The regression in Table 2 shows that

---

[4] All tests reported in this paper are two-sided.

there are neither gender effects nor age effects for ambiguity preferences. The number of siblings as well as better German grades increase the level of ambiguity aversion weakly significantly. Other background variables are not significant.

## E.     Discussion

Overall, we find a considerable degree of risk and ambiguity aversion in our sample of children and adolescents. Interestingly, there are no age effects on risk and ambiguity aversion, contrary to an earlier study by Harbaugh et al. (2002), for instance. The practical absence of self-selection of participants into our experiments might be responsible for the disparity. The stronger risk aversion of girls found here mirrors a standard result for adults (Croson and Gneezy, 2009).

In our study, ambiguity aversion does not change with age, but it is prevalent in all age groups, and ambiguity attitudes seem to be influenced by different factors than risk attitudes. There is no overlap between the factors affecting risk and ambiguity preferences. Most strikingly, while gender has a strong influence on risk attitudes, no effect is found for ambiguity attitudes. These results are in line with findings in Lex Borghans et al. (2009) for a sample of fifteen and sixteen year old high school students. Ambiguity is influenced by social factors, though, such as the number of siblings. This result is consistent with social explanations of ambiguity attitudes proposed, e.g., by Shawn P. Curley, Frank Yates and Richard A. Abrams (1986), Stephen Morris (1997), or Stefan Trautmann, Ferdinand Vieider and Wakker (2008).

# III.  Attitudes Toward Delayed Payoffs – Measuring Impatience

## A.     Method, Payoffs, and Attitude Measures

Attitudes toward delay – or a subject's impatience – were elicited by letting subjects choose between sure payoffs at two different points in time. We used choice lists where the early payoff remained fixed, and the later payoff was increased monotonically along the list, starting with the payoff at the earlier time point (see Figure 3 for an example and Appendix A1).

*Figure 3 and Figure 4 about here*

From the lists we calculated the *future equivalent* of the fixed payoff at the earlier point in time as the midpoint between the two later payoffs where a subject switches from the earlier to

the later payment. In Figure 4, for example, the future equivalent equals €11.40. A larger future equivalent indicates stronger delay aversion, i.e., impatience.

We presented to each subject eight different choice lists. The lists differed in the stake size of the early payoff (either €4.05 or €10.10) and in the timing of the early and/or late payoffs. The amounts in the lists increased in steps of €0.10 (€0.20) from €4.05 (€10.10) to €5.95 (€13.90). For each stake size we elicited preferences for four different timing combinations of payoffs, summarized in Figure 5. In the first list subjects made choices between receiving a payoff today (*upfront-delay* of zero) versus receiving a payoff in three weeks (*delay* of three weeks). The second list maintained the three weeks delay, but shifted it into the future by having the early payment only in three weeks (i.e., the upfront-delay was three weeks). List 3 required choices between a payoff today and a payoff in one year, and list 4 shifted the latter list into the future by an upfront-delay of three weeks again.

*Figure 5 about here*

Note that choice lists 1 and 2, respectively 3 and 4, measure the attitude toward an identical delay (of three weeks, respectively on year) with and without an upfront-delay. A comparison of future equivalents between pairwise lists allows us to test for constant versus hyperbolic discounting/present bias (David Laibson, 1997; Drazen Prelec, 2004; Bleichrodt et al., 2009). If future equivalents are higher for list 1 (3) than for list 2 (4), the immediate payment receives more weight than the early payment in three weeks time, indicating present-biased discounting. Recall that the four timing combinations were used both with high and low stakes to control for stake-size effects.

Subjects filled out the eight choice lists in a random order. One list and one item on the chosen list were randomly selected after all choices had been made. Payoffs were paid out at the date chosen by the subject in the selected choice problem.

## B. Payment Procedures for Delayed Payoffs

A potential problem in time preference experiments with real payoffs concerns transaction costs and uncertainty regarding the delivery of the payment. Both might be different at different points in time. As a remedy, some researchers have argued in favor of using hypothetical payoffs in such tasks (Daniel Read, 2005), others have used dated checks or vouchers (e.g., Vital Anderhub et al., 2001; Samuel McClure et al., 2004) or delivered the money in person to each single

participant on the relevant day (Konstanze Albrecht et al., 2011). In general, researchers acknowledge the empirical problems and try to minimize confounds through uncertainty and transaction costs, an approach also taken here.

*Transaction costs.* The experiment was part of a larger series of experiments conducted at all participating schools, with researchers coming to the schools on a regular basis over a period of two years. The time frame involved in the delay task (with payments up to one year and three weeks in the future) was completely covered by the two-year period, implying practically no additional transaction costs of future payments. For those who changed to another school, it was announced and guaranteed through the principal's office that they would receive their payment by mail. In fact, no students left school for the three-week and six-week periods. During the one year and three weeks period, seven students (1%) left their school and received their payments by mail.[5]

*Uncertainty of future payment*. The time preference experiment was preceded at earlier dates by other experiments in which the students earned money exactly as described in the provided instructions, building up students' trust in our experimental procedure and credibility.[6] Furthermore, parents, principals and teachers had consented to this long-term project, adding to the trustworthiness of the researchers and reducing the possible uncertainty surrounding future payments.

## C.    Results

In Table 3 we analyze the determinants of subjects' impatience. We run separate regressions for the three-weeks and the one-year delay.[7] We define the *normalized future equivalent* as a subject's future equivalent divided by the size of the early payoff, and take it as the dependent variable in the regressions that are based on the eight choice lists (clustering on single subjects).

---

[5] Mobility is very low in Austria – compared to the U.S., for instance – and is most probably not a factor in children's decisions.

[6] For instance, in Peter Martinsson et al. (2011) we studied social preferences.

[7] Note that because of the fixed choice list design, the step size (e.g., €0.20 in the high stakes condtions) implies – by design – a larger discount rate if calculated with respect to a three-week delay compared to a one-year delay. Therefore, a subject may have a higher future equivalent in a one-year delay choice list compared to the equivalent 3 week-list, but a lower discount rate in the one year-list. We therefore run separate regressions for the three-weeks and one-year delay and mostly avoid interpretation of comparisons across delay conditions, noting that they should be treated with care.

As independent variables, we include dummies to account for the presence of an upfront-delay (=1), for high stakes (=1), and the interaction of these two dummies. Gender is also interacted with these dummies because gender differences in impatience might be related to the details of intertemporal choice. Finally we add our measures for risk attitude and ambiguity attitude as explanatory variables, and include all background variables used earlier.

*Table 3 about here*

We observe a negative effect of the high stakes conditions, that is, subjects become more patient if stakes are higher, in both the three-weeks and the one-year delay condition. However, we do not observe an effect of the upfront-delay in the three weeks condition. Only in the cases where an upfront delay is combined with high stakes and a one-year delay period, there is evidence of hyperbolic discounting such that both girls and boys become more patient if payments are shifted into the future (see the Wald tests below Table 3 for details).

More risk averse subjects are more patient, i.e., have smaller normalized future equivalents, in both delay conditions. The same holds true for subjects with better math skills (relative to the class average). Ambiguity aversion has no effect, nor has age. Gender is not clearly correlated with patience, except for women being weakly significantly more patient in the condition with high stakes, no upfront-delay, and a three-weeks delay period. Students who receive more weekly pocket money are less patient for both delay periods. This might seem surprising at first sight because one could presume that children receiving small amounts of pocket money are more liquidity constrained and therefore less patient. A conceivable explanation for our finding could be that children receiving more pocket money are less used to exert financial self-constraint and are therefore less able to do so in the experiment.

*Table 4 about here*

The future equivalents observed in the eight choice lists can be used to calculate implicit annual discount rates.[8] Table 4 presents the median annual discount rates. Not surprisingly, they are considerably larger for the short delay (of three weeks) than the long delay (of one year) and

---

[8] Using continuous discounting we calculate the discount rates with i=*ln*(future equivalent/early payoff) in case of a one year delay and with i=*ln*(future equivalent/early payoff)*52/3 in case of a three weeks delay.

also higher for low stakes than for high stakes.[9] Interestingly, the median annual discount rates are practically identical for choice lists with and without an upfront delay of three weeks.

## D.    Discussion

In contrast to other studies (see Frederick et al., 2002) we find no strong evidence for hyperbolic or present-biased discounting. Testing whether an upfront delay reduces impatience, we find evidence of a present bias only with the long delay period (of one year) and high stakes, indicating that hyperbolic discounting does not play a strong role in the current data set.

As we have argued, uncertainty and transaction costs involved in the future payoffs were comparatively low in our study. Since other studies have also controlled for these factors, they are unlikely to fully account for the weak evidence of a present bias. Perhaps more relevant as an explanation for our results is the fact that all students of the recruited classes did actually participate in the experiments. That is, in contrast to other studies, there was no self-selection of participants into the experiment. Recent papers by Zauberman and Lynch (2005) and Noor (2009) present theoretical arguments and empirical evidence that self-selected participants in experiments may be those most in need for immediate cash, i.e., those with present-biased preferences. Hence, self-selection into an experiment could have biased estimation results towards finding present-biased discounting in other studies. The absence of self-selection in our experiment is therefore a promising potential explanation for the weak evidence for hyperbolic discounting in our study. In general, however, the annual discount rates and the variation in these rates across time ranges and stake sizes that we report are similar to those described in other studies (see Frederick et al., 2002). We also find that subjects are more patient for the larger stake size, replicating the widely discussed magnitude effect (e.g., Noor, 2010) with real payoffs, and extending the evidence to a subject pool of children and adolescents.

Interestingly, higher individual levels of risk aversion as measured in the first experiment predict more patience. There are no robust age effects and we find no relationship between ambiguity attitudes andn patience, however. Concerning the relation of risk attitudes and patience, we note that impatience has been related to low self-control and impulsivity (Walter Mischel, Yuichi Shoda and Monica L. Rodriguez, 1989; Brady Reynolds et al., 2006). Risk

---

[9] Because of the list design, the discount rates calculated from the future equivalents cannot easily be compared across long and short delay periods (see footnote 7). However, comparisons across upfront-delay and stake-size conditions can readily be made in Table 4.

tolerance has similarly been related to impulsivity (Rudy E. Vuchinich and Maria L. Calamas, 1997; Tomasz Zaleskiewicz, 2001; Levin and Hart, 2003; Borghans et al., 2009). While these studies show a relationship between impatience and risk tolerance for adults, our results extend these findings to decision making of children and adolescents. A lower level of risk tolerance is associated with less delay aversion, or put the other way, more risk averse students are more patient.

High ability students (with respect to math grades) are also more patient. This effect is consistent with findings in Laurence Steinberg et al. (2009) and Castillo et al. (2011), and it shows an important association between intellectual capacity and the self-control necessary to overcome the temptations of immediate gratification. Finally, while Bettinger and Slonim (2007) and Castillo et al. (2011) have found girls to be more patient in intertemporal choice, we have found no unambiguous evidence for gender effects.

# IV.    Experimental Measures and Field Behavior

All previous studies relating field behavior to experimental measures of impatience or uncertainty attitudes consider only either time preferences or uncertainty attitudes as explanatory variables. In the present study we use experimental measures of risk, ambiguity, and delay attitudes to explain field behavior of children and adolescents. We put particular emphasis on the relation of experimental measures to health-related behavior, a relation that has, so far, only been studied for adults (Chabris et al., 2008; Weller et al., 2008).

We have collected data on five dependent variables. Information on saving, smoking, drinking and the BMI was collected through self-reports (see Appendix A2). We obtained data on these variables for all 661 subjects. Data on pupils' conduct at school were obtained directly from the principals' offices, but only for a subsample of 389 students, because we were not able to obtain approval from all school boards for using this information.

The variable "*body mass index*" (BMI) is a continuous variable, allowing us to use least squares regressions.[10] Conduct at school is measured as an ordered grade ranging from 1 (no

---

[10] We computed a specific measure by dividing the child's body mass index by the median body mass index for each age cohort, controlling for gender. The median body mass index for girls and boys in each age group was taken from a dataset of the World Health Organization in 2007 (at http://www.who.int/growthref/bmifa_girls_5_19years_z.pdf, and http://www.who.int/growthref/bmifa_boys_5_19years_z.pdf). We were able to validate the BMI that relied on self-reports of weight and height for a subset of 87 subjects (7th and 11th grade of one school) who underwent a medical check-up in school in the very same month of running the time preference experiment. In this check-up, a

misbehavior) to 4 (serious misbehavior), and we employ ordered probit regressions for this variable. The other three variables are constructed as binary variables, indicating the use of probit regressions. The variables "*smoking*" and "*alcohol consumption*" are coded as one if subjects indicated in the questionnaire that they spend money on cigarettes and alcohol respectively.[11] Likewise, "*saving*" is coded one if subjects indicated to save money. A look at the raw data shows that these questions elicited reasonable answers. For instance, according to our data the proportion of students that spend pocket money on alcohol rises monotonically from 2.4% at an age of twelve years to 55.3% at an age of seventeen years.[12]

Table 5 presents the regression results in a condensed form (while the single regressions underlying Table 5 are presented separately in Table A in Appendix A3). With each of the eight measures of impatience (i.e., for the normalized future equivalent in each single choice list) we have run one regression for each of our five dependent variables. This is a conservative approach that allows for different choice lists for time preferences to yield a different relationship between future equivalents and the dependent variables. Only if the data from all eight choice lists support basically the same conclusion, we can confidently know that impatience has a robust influence on a certain dependent variable. Table 5 also reports for each of the dependent variables results of an F-test over all eight measures of time preference, thus testing for joint significance to control for the effect of multiple testing.


*Table 5 about here*

---

subject's height and weight was recorded by a medical doctor, and we got data on the resulting BMI. The correlation of the BMI based on self-reports and the one based on medical reports is 0.92 ($p < 0.001$). A t-test shows that both measures are not significantly different (actual BMI = 20.28; self-reported BMI = 20.26; $p = 0.85$). Testing separately for boys and girls does not yield any significant differences between actual and self-reported BMI either.

[11] About 6 months after the time preference experiment, for control reasons, we administered a questionnaire concerning the frequency of smoking ("never", "sometimes", or "regularly") and drinking ("never", "rarely", "sometimes", or "regularly"). If we use the answers to these questions instead of the binary questions (that we chose because we considered them less intrusive and more likely to elicit honest answers than a finer-grained question), the results for both smoking and drinking remain qualitatively unchanged. The only difference concerns the effect of ambiguity attitude on smoking shown below, which becomes insignificant. Note that the binary variables used in Table 5 capture whether or not children and teenagers have actively consumed alcohol and tobacco. Christine Jackson et al. (1997) show that early age usage, irrespective of its extent, decreases children's competence in academic and social skills and in self-confidence.

[12] Note that the legal drinking age in Austria for beer and wine is sixteen years and enforcement is much less strict than in the US, for instance.

To simplify the presentation of the results in Table 5 we, first, show the significant signs of the coefficients that capture the effects on behavior. In fact, the signs of significant coefficients are always identical for all eight regressions for each of the five dependent variables, providing a first indication that the eight different regressions produce a consistent pattern. In columns [A1] to [A5] of Table 5, we report the number of times (x y z) an independent variable is significant at the 1 (= x), 5 (= y), and 10 (= z) percent level. For instance, "– (8 0 0)" means that a certain independent variable is significantly negative in all eight regressions on the 1-percent level. The stars next to (x y z) indicate the results from F-tests that control for multiple testing. In columns [B1] to [B5] of Table 5, we provide, first, the average marginal effects/coefficients in the eight regressions, provided an independent variable is significant. For binary independent variables we report the effect of switching from zero to one. In squared brackets we report the effect of a one-standard-deviation increase in an independent variable. These latter effects can thus directly be compared across variables, e.g., by comparing the effects of the experimental preference measures to those of ability measures.

Our measure for impatience predicts most field behavior strongly and significantly. More impatient students are persistently more likely to spend money for smoking and alcohol consumption, less likely to save, and show worse conduct at school. For the body mass index our measure of impatience yields significant results only for two out of eight regressions, such that in these cases more impatient students have a higher BMI, but the F-test fails to support a joint significance of the impatience measure on the BMI ($p = 0.16$). The BMI is strongly associated with risk aversion, however. More risk averse students have a lower BMI. For the other four dependent variables risk aversion has no significant impact. Ambiguity is only significant for smoking habits. Students who are more ambiguity averse are less likely to spend money for smoking.

In general, we find that adding impatience, risk averion, and ambiguity aversion as explanatory variables explains a significant amount of variation. The inclusion of these variables improves the explained variance by 0.03 for saving and smoking, 0.02 for the body mass index as well as the grade for behavior at school, and 0.01 for drinking. The lower panel of Table 5 presents results for regressions that include each experimental measure (risk, ambiguity, patience) separately. The results show that the effects remain very robust.

We find a few interesting effects of demographic background variables. Smoking and drinking increase significantly with age, while saving goes down. Girls have a lower BMI and show better conduct across all regressions. Intellectual capacity as measured by math grades is

important. Students with better math grades are more likely to save money, less likely to smoke, and show better behavior at school. Having more pocket money increases the likelihood of alcohol consumption, and it is also associated with a higher BMI.

The general picture emerging from Table 5 suggests that impatience is more important than uncertainty attitudes in shaping the field behavior that we were interested in here and that especially time preferences are a more consistent predictor than any of the background variables. We find evidence that only for the BMI and smoking both impatience and uncertainty attitudes have a joint influence. This provides evidence for the presumption that especially delay aversion and, to a lesser extent, low levels of risk aversion and ambiguity aversion are related to low inhabitation levels of impulse-driven behavior. The size of the observed effects for preference measures is similar to those of cognitive ability: the effect of a one-standard-deviation increase in the preference measures is about the same size as a one-standard-deviation increase in the math grade, when both are significant predictors.

Overall, our results on field behavior involving delay and uncertainty are broadly consistent with the findings for adults. In particular, our study of school children replicates the effects of impatience on health and financial behaviors shown for adults. The magnitudes of the effects are similar to those reported in Chabris et al. (2008), for instance. They point out that the relatively small effects of delay aversion on single activities may accumulate to substantial effects in total. The same holds true for our study. We find that more impatient children are more likely to smoke, drink alcohol and have a higher BMI, leading to an overall far less favorable health outlook compared to more patient children.

# V. Conclusion

In this paper, we have analyzed how experimentally elicited risk and ambiguity attitudes as well as time preferences of children and adolescents relate to field behavior concerning decisions with delayed and uncertain outcomes such as health-related behavior, saving, or conduct at school. Our experiment has been run in three different schools by randomly selecting 28 classes from 5th, 7th, 9th, and 11th grade, including in total 661 students, aged ten to eighteen years. A particularly noteworthy feature of our experiment is the absence of selection effects of students. Since the experiments were run during regular school hours there were no drop outs. Hence, our results cannot be biased from self-selection into experimental participation.

In the experiment, we have found clear evidence for delay, risk and ambiguity aversion in the aggregate. Our findings for children and adolescents are largely in line with adult populations

(Frederick et al., 2002; Croson and Gneezy, 2009; Dohmen et al., 2010; Wakker, 2010). Considering the effects of demographics on attitudes, it seems interesting to note that for our sample of ten- to eighteen-year olds we have found no significant age effects in any dimension (risk, ambiguity, impatience). The results in Harbaugh et al. (2002) suggest that noteworthy age effects might occur before the age of ten, which could explain our findings. We have been able to replicate the standard result that women are more risk averse than men (Croson and Gneezy, 2009). Similarly, women have been found to be somewhat more patient, like in Bettinger and Slonim (2007) and Castillo et al. (2011). However, the latter finding is restricted to the time preference tasks with high stakes and a waiting period of three weeks only. Concerning cognitive abilities, better math grades are associated with more patience.

Turning to the relation of risk and ambiguity attitudes with time preferences, we have found that more risk averse subjects are more patient. Ambiguity attitudes, however, are not systematically related to time preferences. Interestingly, in our subject pool we have seen little evidence for present-biased preferences. Only with high stakes and a one-year delay we find some evidence for decreasing impatience, both for boys and girls. If present-biasedness is affected by the self-selection of subjects into experiments (Zauberman and Lynch, 2005; Noor, 2009), our findings might be explained by the lack of self-selection into the experiment.

The key finding of this paper, however, concerns the relationship of experimental measures and field behavior. Most importantly, we have found that students who are more impatient in the time preference experiment are less likely to save money, more likely to smoke, more likely to consume alcohol, have a higher body mass index, and misbehave more often at school. Taken together, these effects lead in particular to an overall far less favorable health and economic outlook for impatient students than for more patient ones. In contrast to our experimental measures of impatience, the elicited risk and ambiguity attitudes are worse predictors of field behavior. Risk aversion is only related to the for body mass index, indicating that more risk averse students have a lower BMI. A higher level of ambiguity aversion is associated with a lower likelihood of spending money for smoking.

Low predictive power of experimentally elicited risk attitudes for field behavior has been found for adults before (e.g., Dohmen et al., 2011). Risk attitudes have been shown to have a strong domain-specific component and to depend on risk perceptions, thus making the link to field behavior rather weak (Elke U. Weber, Ann-Renee Blais and Nancy Betz, 2002; Khwaja et al., 2006; Katherine G. Carman and Peter Kooreman, 2010). Our study corroborates these findings for a large sample of children and adolescents. Experimental time preference measures, however, seem more directly related to self-control problems, for instance with respect to health-

related behavior or procrastination. Children may perceive some activities that require self-control to abstain from, for instance smoking, as unhealthy or unproductive, but not necessarily as *risky*. If this is the case, then experimentally measured risk attitudes will not identify such behavior in the field. However, time preferences that are clearly related to self-control may still successfully predict such activities, although they are typically interpreted as "risky behavior" by researchers. In general, we consider the fact that field behavior of children and adolescents is predictable by some meaningful experimental preference measures an important result, because our results concern a period in life where, following the "diagnosis", policy interventions might most easily be implemented.

Given our findings on the negative effects of impatience on saving decisions, good conduct at school, and health-related behavior already for children and adolescents, it seems an important avenue for future research to address possible policy interventions. Early identification of at-risk children is an obvious first step. Moreover, as the work by Walter Mischel and collaborators has shown, children need to develop and train strategies to successfully exert self-control (e.g., Mischel et al., 1989). Our observation that the effects of time preferences and cognitive skills on behavior are comparable in size, suggests emphasizing these self-control skills at preschool and elementary school. The research on active decision making and optimal defaults to help overcome working professionals' myopia in saving for retirement (see, e.g., Gabriel D. Carroll et al., 2009) has not yet been extended to children's and adolescents' decisions. It seems plausible that active decision making (for choosing healthier food or exercising more frequently, for instance) and defaults (regular weight controls in schools, for example) might similarly contribute to overcome the negative effects of impatience in children and adolescents. Finally, because our study suggests that preferences concerning the timing and the uncertainty of payoffs form early in childhood, with no clear age effects between the age of ten and eighteen, early identification and targeted intervention in children that are at risk is important in order to be able to maximize the potential benefits of such interventions.

# References

**Abdellaoui, Mohammed, Aurelien Baillon, Laetitia Placido, and Peter P. Wakker.** 2011. "The Rich Domain of Uncertainty." *American Economic Review*, 101(2): 695–723.

**Albrecht, Konstanze, Kirsten Volz, Matthias Sutter, David Laibson, and Yves von Cramon**. 2011. "What is for Me is not for You: Brain Correlates of Intertemporal Choice for Self and Other." *SCAN – Social Cognitive and Affective Neuroscience*, 6(2): 218–25.

**Anderhub, Vital, Werner Güth, Uri Gneezy, and Doron Sonsino.** 2001. "On the Interaction of Risk and Time Preferences: An Experimental Study." *German Economic Review,* 2(3): 239–53.

**Attema, Arthur E., Han Bleichrodt, Kirsten I.M. Rohde, and Peter P. Wakker**. 2010. "Time-Tradeoff Sequences for Analyzing Discounting and Time Inconsistency." *Management Science,* 56(11): 2015–30.

**Bettinger, Eric, and Robert Slonim.** 2007. "Patience Among Children." *Journal of Public Economics,* 91(1-2): 343–63.

**Bleichrodt, Han, Kirsten I.M. Rohde, and Peter P. Wakker.** 2009. "Non-Hyperbolic Time Inconsistency." *Games and Economic Behavior,* 66(1): 27–38.

**Bonin, Holger, Thomas Dohmen, Armin Falk, David Huffman, and Uwe Sunde**. 2007. "Cross-Sectional Earnings Risk and Occupational Sorting: The Role of Risk Attitudes." *Labour Economics,* 14(6): 926–37.

**Borghans, Lex, Bart H. H. Golsteyn, James J. Heckman, and Hub Meijers.** 2009. "Gender Differences in Risk Aversion and Ambiguity Aversion." *Journal of European Economic Association* 7(2-3): 649–58.

**Burks, Stephen V., Jeffrey P. Carpenter, Lorenz Goette, and Aldo Rustichini.** 2009. "Cognitive skills affect economic preferences, strategic behavior, and job attachment." *Proceedings of the National Academy of Sciences*, 106(19): 7745–50.

**Carman, Katherine G., and Peter Kooreman**. 2010. Flu Shots, Mammogram, and the Perception of Probabilities. Netspar Discussion paper 03/2010-014.

**Carroll, Gabriel D., James J. Choi, David Laibson, Brigitte C. Madrian, and Andrew Metrick.** 2009. "Optimal Defaults and Active Decisions." *Quarterly Journal of Economics,* 124(4): 1639–74.

**Case, Anne, Darren Lubotsky, and Christina Paxson.** 2002. "Economic Status and Health in Childhood: The Origins of the Gradient." *American Economic Review*, 92(5): 1308–34.

**Castillo, Marco, Paul Ferraro, Jeff Jordan, and Ragan Petrie.** 2011. "The Today and Tomorrow of Kids." *Journal of Public Economics*, forthcoming.

**Chabris, Christopher F., David Laibson, Carrie L. Morris, Jonathon P. Schuldt, and Dmitry Taubinsky.** 2008. "Individual Laboratory-Measured Discount Rates Predict Field Behavior." *Journal of Risk and Uncertainty,* 37(2-3): 237–69.

**Croson, Rachel, and Uri Gneezy.** 2009. "Gender Differences in Preferences." *Journal of Economic Literature,* 47(2): 448–74.

**Curley, Shawn P., J. Frank Yates, and Richard A. Abrams.** 1986. "Psychological Sources of Ambiguity Avoidance." *Organizational Behavior and Human Decision Processes,* 38(2): 230–56.

**Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde.** 2010. "Are Risk Aversion and Impatience Related to Cognitive Ability?" *American Economic Review,* 100(3): 1238–60.

**Dohmen, Thomas, Armin Falk, David Huffman, Uwe Sunde, Jürgen Schupp, and Gert G. Wagner.** 2011. "Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences." *Journal of the European Economic Association*, 9(3): 522–50.

**Ellsberg, Daniel.** 1961. "Risk, Ambiguity and the Savage Axioms." *Quarterly Journal of Economics,* 75(4): 643–69.

**Frederick, Shane, George Loewenstein, and Ted O'Donoghue.** 2002. "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature,* 40(2): 351–401.

**Gneezy, Uri, John A. List, and George Wu.** 2006. "The Uncertainty Effect: When a Risky Prospect Is Valued Less Than its Worst Possible Outcome." *Quarterly Journal of Economics,* 121(4): 1283–1309.

**Halevy, Yoram.** 2007. "Ellsberg Revisited: An Experimental Study." *Econometrica,* 75(2): 503–36.

**Halevy, Yoram**. 2008. "Strotz Meets Allais: Diminishing Impatience and the Certainty Effect." *American Economic Review,* 98(3): 1145–62.

**Harbaugh, William T., Kate Krause, and Lise Vesterlund.** 2002. "Risk Attitudes of Children and Adults: Choices Over Small and Large Probability Gains and Losses." *Experimental Economics,* 5(1): 53–84.

**Holt, Charles A., and Susan K. Laury.** 2002. "Risk Aversion and Incentive Effects." *American Economic Review,* 92(5): 1644–55.

**Jackson, Christine, Lisa Henriksen, Denise Dickinson, and Douglas W. Levine**. 1997. "The Early Use of Alcohol and Tobacco: Its Relation to Children's Competence and Parents' Behavior." *American Journal of Public Health*, 87(3): 359–64.

**Keren, Gideon, and Peter Roelofsma.** 1995. "Immediacy and Certainty in Intertemporal Choice." *Organizational Behavior and Human Decision Processes,* 63(3): 287–97.

**Khwaja, Ahmed, Frank Sloan, and Martin Salm.** 2006. "Evidence on Preferences and Subjective Beliefs of Risk Takers: The Case of Smokers." *International Journal of Industrial Organization*, 24(4): 667–82.

**Laibson, David.** 1997. "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics,* 112(2): 443–77.

**Lammers, Judith, and Sweder van Wijnbergen.** 2008. "HIV/AIDS, Risk Aversion and Intertemporal Choice." Tinbergen Institute Discussion Paper 2007-098/1.

**Levin, Irwin P., and Stephanie S. Hart.** 2003. "Risk Preferences in Young Children: Early Evidence of Individual Differences in Reaction to Potential Gains and Losses." *Journal of Behavioral Decision Making,* 16(5): 397–413.

**Levin, Irwin P., Stephanie S. Hart, Joshua A. Weller, and Lyndsay A. Harshman.** 2007. "Stability of Choices in a Risky Decision-Making Task: A 3-Year Longitudinal Study with Children and Adults." *Journal of Behavioral Decision Making,* 20(3): 241–52.

**Martinsson, Peter, Katarina Nordblom, Daniela Rützler, and Matthias Sutter.** 2011. "Social Preferences During Childhood and the Role of Gender and Age – An Experiment in Austria and Sweden." *Economics Letters*, 110(3): 248–51.

**McClure, Samuel M., David I. Laibson, George Loewenstein, and Jonathan D. Cohen.** 2004. "Separate Neural Systems Value Immediate and Delayed Monetary Rewards." *Science,* 306(5695): 503–7.

**Meier, Stephan, and Charles Sprenger.** 2008. "Discounting Financial Literacy: Time Preferences and Participation in Financial Education Programs." IZA DP 3507.

**Meier, Stephan, and Charles Sprenger.** 2010. "Present-Biased Preferences and Credit Card Borrowing." *American Economic Journal: Applied Economics*, 2(1): 193–210.

**Mischel, Walter, Yuichi Shoda, and Monica L. Rodriguez.** 1989. "Delay of Gratification in Children." *Science,* 244(4907): 933–8.

**Moreira, Bruno, Raul Matsushita, and Sergio Da Silva.** 2010. "Risk Seeking Behavior of Preschool Children in a Gambling Task." *Journal of Economic Psychology*, 31(5): 794–801.

**Morris, Stephen.** 1997. "Risk, Uncertainty and Hidden Information." *Theory and Decision,* 42(3): 235–70.

**Noor, Jawwad.** 2009. "Hyperbolic Discounting and the Standard Model: Eliciting Discount Functions." *Journal of Economic Theory,* 144(5): 2077–83.

**Noor, Jawwad.** 2010. "Intertemporal Choice and the Magnitude Effect." *Games and Economic Behavior,* 72(1): 255–70.

**Prelec, Drazen.** 2004. "Decreasing Impatience: A Criterion for Non-Stationary Time Preference and 'Hyperbolic' Discounting." *Scandinavian Journal of Economics,* 106(3): 511–32.

**Read, Daniel.** 2005. "Monetary Incentives, What Are They Good for?" *Journal of Economic Methodology,* 12(2): 265–76.

**Reynolds, Brady, Amanda Ortengren, Jerry B. Richards, and Harriet de Wit.** 2006. "Dimensions of Impulsive Behavior: Personality and Behavioral Measures." *Personality and Individual Differences,* 40(2): 305–15.

**Steinberg, Laurence, Sandra Graham, Lia O'Brian, Jennifer Woolard, Elizabeth Cauffman, and Marie Banich.** 2009. "Age Differences in Future Orientation and Delay Discounting." *Child Development,* 80(1): 28–44.

**Trautmann, Stefan T., Ferdinand M. Vieider, and Peter P. Wakker.** 2008. "Causes of Ambiguity Aversion: Known Versus Unknown Preferences." *Journal of Risk and Uncertainty,* 36(3): 225–43.

**Vuchinich, Rudy E., and Maria L. Calamas.** 1997. "Does the Repeated Gambles Procedure Measure Impulsivity in Social Drinkers?" *Experimental and Clinical Psychopharmacology,* 5(2): 157–62.

**Wakker, Peter P.** 2010. *Prospect Theory for Risk and Ambiguity.* Cambridge, UK: Cambridge University Press.

**Weber, Elke U., Ann-Renee Blais, and Nancy Betz.** 2002. "A Domain-Specific Risk-Attitude Scale: Measuring Risk Perceptions and Risk Behaviors." *Journal of Behavioral Decision Making*, 15(4): 263–90.

**Weller, Rosalyn E., Edwin W. Cook III, Kathy B. Avsar, and James E. Cox.** 2008. "Obese Women Show Greater Delay Discounting than Healthy-Weight Women." *Appetite,* 51(3): 563–9.

**Zaleskiewicz, Tomasz.** 2001. "Beyond Risk Seeking and Risk Aversion: Personality and the Dual Nature of Economic Risk Taking." *European Journal of Personality,* 15(S1): 105–22.

**Zauberman, Gal, and John G. Lynch, Jr.** 2005. "Resource Slack and Propensity to Discount Delayed Investments of Time Versus Money." *Journal of Experimental Psychology: General,* 134(1): 23–37.

# Tables

**Table 1:** Distribution of participants by age and gender

| Age (years) | Grade | Total | # girls | # boys | # inconsistent choice list | |
|---|---|---|---|---|---|---|
| | | | | | Uncertainty | Delay |
| 10-11 | 5th | 208 | 118 | 90 | 3 (1%) | 7 (3%) |
| 12-13 | 7th | 184 | 94 | 90 | 4 (2%) | 5 (3%)[A] |
| 14-15 | 9th | 135 | 75 | 60 | 3 (2%) | 2 (1%) |
| 16-18 | 11th | 134 | 71 | 63 | 0 (0%) | 0 (0%) |
| SUM | | 661 | 358 | 303 | 10 (2%) | 14 (2%) |

[A] *Two subjects were inconsistent both in the risk preference task and the time preference task, implying that 639 subjects made consistent choices in both tasks.*

**Table 2:** OLS-regression analysis for risk and ambiguity attitude

| Dependent variable<br>Explanatory variables | Risk aversion | | Ambiguity Aversion | |
|---|---|---|---|---|
| Female | 0.067*** | (0.019) | 0.025 | (0.019) |
| Age (in years) | -0.004 | (0.005) | 0.006 | (0.005) |
| No. of siblings | -0.005 | (0.009) | 0.017* | (0.009) |
| Pocket money per week | -0.000 | (0.001) | -0.001 | (0.000) |
| Size prize urns | -0.003 | (0.009) | -0.013 | (0.009) |
| German grade[#] | 0.016 | (0.011) | 0.022* | (0.012) |
| Math grade[#] | -0.005 | (0.010) | -0.003 | (0.011) |
| No. of observations | 639 | | 639 | |
| R squared | 0.038 | | 0.038 | |

*Notes.* \*\*\*, \*\*, \* denote significance at the 1%, 5%, 10% level, robust standard errors in parentheses. Positive coefficients imply increasing risk/ambiguity aversion.

[#] Grades are relative to the average in class. Positive variables indicate better than average performance.

Controls for counterbalancing the two choice lists included.

**Table 3:** OLS-regression analysis for impatience (future equivalents)

| Dependent variable / Explanatory variables | Normalized future equivalent | | | |
|---|---|---|---|---|
| | Three weeks delay | | One year delay | |
| Upfront-delay | 0.004 | (0.005) | 0.001 | (0.004) |
| High stakes | -0.053*** | (0.005) | -0.076*** | (0.005) |
| Upfront-delay*high stakes | -0.004 | (0.004) | -0.009*** | (0.003) |
| Female | -0.010 | (0.011) | -0.006 | (0.013) |
| Female*upfront-delay | 0.003 | (0.006) | 0.003 | (0.004) |
| Female*high stakes | -0.007 | (0.007) | -0.010 | (0.006) |
| Age (in years) | 0.002 | (0.002) | 0.003 | (0.003) |
| Risk aversion | -0.069*** | (0.023) | -0.043* | (0.025) |
| Ambiguity aversion | 0.017 | (0.019) | 0.004 | (0.021) |
| No. of siblings | 0.010* | (0.005) | 0.010 | (0.006) |
| Pocket money per week | 0.001* | (0.000) | 0.001** | (0.000) |
| German-grade$^{\#}$ | 0.004 | (0.006) | 0.011 | (0.007) |
| Math-grade$^{\#}$ | -0.028*** | (0.005) | -0.026*** | (0.007) |
| No. of observations | 639 | | 639 | |
| R squared | 0.124 | | 0.128 | |

| *Wald tests for joint effects (p-values)* | Three weeks delay | One year delay |
|---|---|---|
| $H_0$: no delay effect in low stake size condition for males ($\beta_{delayed} = 0$) | 0.412 | 0.767 |
| $H_0$: no delay effect in low stake size condition for females ($\beta_{delayed} + \beta_{delayed*female} = 0$) | 0.117 | 0.267 |
| $H_0$: no delay effect in high stake size condition for males ($\beta_{delayed} + \beta_{delayed*high} = 0$) | 0.962 | 0.014 |
| $H_0$: no delay effect in high stake size condition for females ($\beta_{delayed} + \beta_{delayed*high} + \beta_{delayed*female} = 0$) | 0.391 | 0.094 |
| $H_0$: no female effect in low stake size and non-delayed condition ($\beta_{female} = 0$) | 0.385 | 0.639 |
| $H_0$: no female effect in low stake size and delayed condition ($\beta_{female} + \beta_{delayed*female} = 0$) | 0.572 | 0.819 |
| $H_0$: no female effect in high stake size and non-delayed condition ($\beta_{female} + \beta_{female*high} = 0$) | 0.066 | 0.147 |
| $H_0$: no female effect in high stake size and delayed condition ($\beta_{female} + \beta_{female*high} + \beta_{delayed*female} = 0$) | 0.131 | 0.232 |
| $H_0$: no high stake size effect in non-delayed condition for males ($\beta_{high} = 0$) | 0.000 | 0.000 |
| $H_0$: no high stake size effect in non-delayed condition for females ($\beta_{high} + \beta_{female*high} = 0$) | 0.000 | 0.000 |
| $H_0$: no high stake size effect in delayed condition for males ($\beta_{high} + \beta_{delayed*high} = 0$) | 0.000 | 0.000 |
| $H_0$: no high stake size effect in delayed condition for females ($\beta_{high} + \beta_{delayed*high} + \beta_{female*high} = 0$) | 0.000 | 0.000 |

*Notes.* ***, **, * denote significance at the 1%, 5%, 10% level, robust standard errors in parentheses. Clustered on the level of individual subjects.

Positive coefficients imply higher normalized future equivalents, i.e., more impatience.

$^{\#}$ Grades are relative to the average in class. Positive variables indicate better than average performance.

**Table 4:** Median annual discount rates (%)

| Stake size | Delay | 3 weeks | 3 weeks with upfront delay | 1 year | 1 year with upfront delay |
|---|---|---|---|---|---|
| Low | | 330 | 365 | 29 | 31 |
| High | | 179 | 179 | 21 | 19 |

**Table 5:** Determinants of field behavior (OLS- and Marginal-Probit-Regression) – Overview[§]

| | Saving | | Smoking | | Alcohol consumption | |
|---|---|---|---|---|---|---|
| | [A1] | [B1] | [A2] | [B2] | [A3] | [B3] |
| Impatience (future equivalent) | – (7 1 0)** | -0.175 [-0.025] | + (2 4 1)** | 0.034 [0.005] | + (4 2 1)*** | 0.175 [0.025] |
| Risk aversion | | | | | | |
| Ambiguity aversion | | | – (0 3 5)** | -0.016 [-0.004] | –           * | |
| Age | – (8 0 0)*** | -0.012 [-0.028] | + (8 0 0)*** | 0.007 [0.017] | + (8 0 0)*** | 0.056 [0.130] |
| Female | | | + (0 0 1)* | 0.006 [0.006] | | |
| German grade[#] | | | | | | |
| Math grade[#] | + (8 0 0)*** | 0.032 [0.032] | – (8 0 0)*** | -0.008 [-0.008] | | |
| No. of siblings | | | | | | |
| Pocket money per week | | | | | + (0 0 5)** | 0.001 [0.018] |
| No. of observations | 639 | | 639 | | 639 | |
| Mean (pseudo) R² | 0.168 | | 0.361 | | 0.397 | |
| Impatience (future equivalent)[a] | – (7 1 0)* | -0.174 [-0.025] | + (2 4 1)** | 0.039 [0.006] | + (3 4 0)*** | 0.172 [0.024] |
| Risk aversion [one regression][a] | | | | | | |
| Ambiguity aversion [one regression][a] | | | + ( _ _ 1) | -0.019 [-0.004] | | |

*Notes*:

[§] The table shows in columns [A1], [A2], [A3], [A4], and [A5] significant effects (by sign) of independent variables on the five dependent variables. We have run eight regressions per dependent variable, using each of the eight choice lists in the intertemporal choice task once. The entries in the table read as follows:

+: increases dependent variable, – : decreases dependent variable; (x y z) denotes the number of times the variable is significant at the 1% (= x), 5% (= y), 10% (= z) level.

The full set of regressions behind this table is reproduced in Table A in online Appendix A3, where Panel A concerns saving, Panel B smoking, Panel C alcohol consumption, Panel D the body mass index, and Panel E conduct at school

Columns [B1], [B2], [B3], [B4], and [B5] show the mean marginal effects/coefficients of the independent variables over the eight choice lists. [ ] gives the marginal effects/coefficients multiplied by one standard deviation of the independent variable.

[#] Grades are relative to the average in class. Positive variables indicate better than average performance.

***, **, * denote significance at the 1%, 5%, 10% level in a regression with all eight impatience measures included; for impatience, it refers to joint F-test over all eight measures.

[a] Significant effects from analogous regressions including each impatience/risk/ambiguity measure alone and excluding the two other measures.

**Table 5:** Determinants of field behavior (OLS- and Marginal-Probit-Regression) – Overview, continued[†]

| | Body mass index (BMI) | | Grade for conduct at school (higher grade is worse) | |
| | [A4] | [B4] | [A5] | [B5] |
|---|---|---|---|---|
| Impatience (future equivalent) | + (0 0 2) | 0.040 [0.006] | + (7 1 0)*** | 1.595 [0.227] |
| Risk aversion | – (7 1 0)*** | -0.062 [-0.014] | | |
| Ambiguity aversion | | | – * | |
| Age | | | | |
| Female | – (0 8 0)** | -0.024 [-0.024] | – (8 0 0)*** | -0.552 [-0.552] |
| German grade[#] | | | – (8 0 0)*** | -0.264 [-0.245] |
| Math grade[#] | | | – (0 7 1)* | -0.195 [-0.198] |
| No. of siblings | | | | |
| Pocket money per week | + (0 8 0)** | 0.001 [0.009] | | |
| No. of observations | 611 | | 389 | |
| Mean (pseudo) R² | 0.043 | | 0.134 | |
| Impatience (future equivalent)[a] | + (0 2 0) | 0.049 [0.007] | + (7 1 0)*** | 1.654 [0.235] |
| Risk aversion [one regression][a] | – (1 _ _) | -0.062 [-0.014] | | |
| Ambiguity aversion [one regression][a] | | | | |

[†] refer to first page of Table 5 for notes.

# Figures

**Figure 1:** Choice list for uncertainty task

[1] draw from bag A      O    or    O    €0.50 for sure
[2] draw from bag A      O    or    O    €1.00 for sure
[3] draw from bag A      O    or    O    €1.50 for sure

.... etc.

**Figure 2:** Choice list for uncertainty task

[6] draw from bag A      ⊗    or    O    €3.00 for sure
[7] draw from bag A      ⊗    or    O    €3.50 for sure
[8] draw from bag A      O    or    ⊗    €4.00 for sure

...etc.

**Figure 3:** Choice list for time preference task

[1] receive €10.10 now   O    or    O    receive €10.10 in thee weeks
[2] receive €10.10 now   O    or    O    receive €10.30 in thee weeks
[3] receive €10.10 now   O    or    O    receive €10.50 in thee weeks

....etc.

**Figure 4:** Choice list for time preference task

[6] receive €10.10 now   ⊗    or    O    receive €11.10 in three weeks
[7] receive €10.10 now   ⊗    or    O    receive €11.30 in three weeks
[8] receive €10.10 now   O    or    ⊗    receive €11.50 in three weeks

...etc.

**Figure 5:** Combinations of early and late payoffs[†]

1) €10.1( today    €10.10 + x   3 weeks

2) 3 weeks    6 weeks    €10.1(    €10.10 + ꓱ

3) €10.1( today    €10.10 + ꓱ   1 year    3 weeks

4) 3 weeks    €10.1(    1 year and 3 weeks    €10.10 + ꓱ
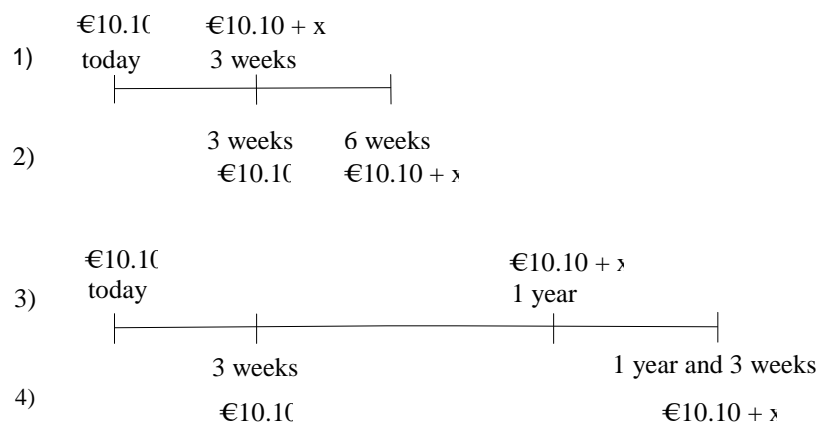
[†] Illustrated in this figure for the four choice lists with an early payoff of €10.10. Analogously, we had four choice lists withan early payoff of €4.05.

# Online Appendix accompanying "Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior"

## A1. Experimental instructions [translated from German]

*Procedures:*
*The experiments concerning risk and ambiguity preferences were run between November 2007 and January 2008, while the experiments concerning time preferences were conducted between April and May 2008. Each session lasted approximately 50 minutes, including the completion of a post-experimental questionnaire and the distribution of the earned money. In the risk and ambiguity preference experiment all subjects privately received their money at the very end of the session. Therefore, subjects were called one by one to a separate room where they first had to draw a card to determine the decision problem which was relevant for payment. In a second step the urn was played if the subject preferred the lottery over the sure amount in the respective decision. In the time preference experiment, subjects received an immediate payoff if they had chosen it over a delayed payoff at the end of the experiment in cash. In case a payoff in the future was chosen (or the selected choice had an upfront-delay of three weeks) the money was distributed in sealed envelopes at the predefined date.*
*Note that all sessions within a particular school were run at the same day.*
*In order to guarantee anonymity, we used partition walls and forbade any kind of conversation among students. Instructions were memorized by the experimenter and orally presented in class at the beginning of each session. Periodically the instructor paused and let the subjects raise their hands for questions which were then answered privately. An English translation of orally presented instructions and of the decision sheets is presented below.*

## Risk and ambiguity experiment *(here we present the order where the task to elicit risk attitudes has been explained before the task to elicit ambiguity attitudes)*

Welcome to our game. Before we start, we will explain the rules of our game. From now on, please don't talk to your neighbor and listen carefully. You can earn money in this game. We will give you the money in cash at the end of this lesson. How much money you will earn depends mainly on your decisions. That's why it is important that you understand the rules of our game. Please listen carefully now. We will frequently stop during our explanation and allow you to ask questions. Therefore, please raise your hand and one of us will come to you to answer your question.

Everybody ok so far? *Leave time for questions and answer them privately.*

Our game consists of two parts. In total, you will have to make 40 decisions, 20 in part one and 20 in part two. One of these decisions will be paid for real, and we will explain in the end how we determine the decision to be paid. First we will explain the first part. You have to choose 20 times between a safe amount of money and drawing a ball from bag (A). By drawing from the bag you may win €10 *€(respectively €6, €8 or €12, according to the treatment).* Only one of your decisions will be relevant. We will explain that carefully at the end of this instruction.
Next we explain to you how drawing a ball from bag (A) works: We fill this bag with ten orange and ten white balls. *(fill bag and show balls to children and count orange and white balls)* When you decide to draw a ball from bag (A), you draw a ball blindly. Before you draw the ball you

have to choose a color (let's say white). If the drawn ball is really white, you receive €10 *(respectively €6, €8 or €12, according to the treatment)*. If the drawn ball is orange, you get nothing.

Everybody ok so far? *Leave time for questions and answer them privately.*

You will receive a decision sheet which looks exactly like the slide on the overhead projector. (*Switch on overhead projector and point to the slide*) We will then, when we play the game, ask you to make a decision for each row between drawing a ball from bag (A) *(point to the left)* and a sure amount of money *(point to the right)*. This looks for example like this: In the first row you decide whether you prefer drawing a ball from bag (A) and thereby maybe winning €10 *(respectively €6, €8 or €12, according to the treatment)*, or if you prefer taking 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* home for sure. Assuming that you prefer drawing a ball from bag (A) instead of getting 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* for sure, which box do you have to check in this case? *(Assume answer is "left".)* Right, you check the box at the left side.

Everybody ok so far? *Leave time for questions and answer them privately.*

In the second row you decide again between drawing a ball from bag (A) and a sure amount of money. Now you are offered €1 *(respectively 60 cents, 80 cents, €1.20, according to the treatment)* to take home for sure. As you can see the sure amount on the right hand side increases successively. As long as you prefer drawing a ball from bag (A) to taking a sure amount of money home, you check the box at the left hand side.

Everybody ok so far? *Leave time for questions and answer them privately.*

Assume that you like drawing a ball from bag (A) very much, then you might check the boxes on the left hand side until the last but one row. In the very last row you then have to choose between getting €10*(respectively €6, €8 or €12, according to the treatment)* for sure if you check the box on the right side or maybe winning €10*(respectively €6, €8 or €12, according to the treatment)* by checking the box on the left side and then drawing a ball from bag (A).

Everybody ok so far? *Leave time for questions and answer them privately.*

Assume that you very much dislike drawing a ball from bag (A). In this case you might choose the sure amount of money of 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* already in the first row.

Everybody ok so far? *Leave time for questions and answer them privately.*

The point where you switch from the left hand side to the right hand side lies normally somewhere between the first and the last row. As soon as you have once checked the box at the right hand side, you should very carefully check whether it makes sense for you to switch back to the left hand side in any following row. Consider the following situation. If you preferred 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* in the first row to drawing from bag (A), then most likely you might prefer even more so €1*(respectively 60 cents, 80 cents, €1.20, according to the treatment)* in the second row over drawing from bag (A), because €1 *(respectively 60 cents, 80 cents, €1.20, according to the treatment)* is more money than 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* which, in this example, you preferred over drawing from bag (A) before.

Everybody ok so far? *Leave time for questions and answer them privately.*

Now we explain the second part to you. The second part of our game is similar to the first part. The only difference is that bag (A) is replaced by bag (B). Now you have to choose between drawing a ball from bag (B) thereby maybe winning €10 *(respectively €6, €8 or €12, according to the treatment)* or taking a sure amount of money home.
Drawing a ball from bag (B) works as follows: This bag contains twenty balls. The balls are either white ore orange as before, but this time we don't tell you the exact number of white and orange balls. However, in sum there are 20 balls in this bag (B). When you decide to draw a ball from bag (B), you draw a ball blindly. Before you draw the ball you choose a color (let's say white). If the drawn ball is really white, you receive €10*(respectively €6, €8 or €12, according to the treatment)*. If the drawn ball is orange, you get nothing.

Everybody ok so far? *Leave time for questions and answer them privately.*

You will receive a decision sheet which looks exactly like the slide on the overhead projector (*Switch on overhead projector and point to the slide*). We also ask you for this sheet to make a decision for each row. Now you have to decide between drawing a ball from bag (B) *(point to the left)* and a sure amount of money *(point to the right)*. This looks for example like this: In the first row you decide whether you prefer drawing a ball from bag (B) and thereby maybe winning €10 *(respectively €6, €8 or €12, according to the treatment)*, or if you prefer taking 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* home for sure. Assuming that you prefer drawing a ball from bag (B) instead of getting 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* for sure, which box do you have to check in this case? *(Assume answer is "left".)* Right, you check the box at the left side.

Everybody ok so far? *Leave time for questions and answer them privately.*

In the second row you decide again between drawing a ball from bag (B) and a sure amount of money. Now you are offered €1 *(respectively 60 cents, 80 cents, €1.20, according to the treatment)* to take home for sure. As you can see, the sure amount on the right hand side increases successively. As long as you prefer drawing a ball from bag (B) to taking a sure amount of money home, you check the box at the left hand side.

Everybody ok so far? *Leave time for questions and answer them privately.*

Assume that you like drawing a ball from bag (B) very much, then you might check the boxes on the left hand side until the last but one row. In the very last row you then have to choose between getting €10*(respectively €6, €8 or €12, according to the treatment)* for sure if you check the box on the right side or maybe winning €10*(respectively €6, €8 or €12, according to the treatment)* by checking the box on the left side and then drawing a ball from bag (B).

Everybody ok so far? *Leave time for questions and answer them privately.*

Assume that you very much dislike drawing a ball from bag (B). In this case you will choose the sure amount of money of 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* already in the first row.

Everybody ok so far? *Leave time for questions and answer them privately.*

The point where you switch from the left hand side to the right hand side lies normally somewhere between the first and the last row. As soon as you have once checked the box at the right hand side, you should very carefully check whether it makes sense for you to switch back to the left hand side in any following row. Consider the following situation. If you preferred 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* in the first row to drawing from bag (B), then most likely you might prefer even more so €1 *(respectively 60 cents, 80 cents, €1.20, according to the treatment)* in the second row over drawing from bag (B), because €1 *(respectively 60 cents, 80 cents, €1.20, according to the treatment)* is more money than 50 cents *(respectively 30 cents, 40 cents, 60 cents, according to the treatment)* which you preferred, in this example, over drawing from bag (B) before.

Everybody ok so far? *Leave time for questions and answer them privately.*

We still have to explain how you get your money. After all of you have made your 40 decisions (20 decisions on your first sheet, 20 decisions on your second sheet) everybody will draw a card from these 40 cards. The cards are numbered from 1 to 40. *(Ask a student to draw a card. Assume 5 is drawn.)* When you have drawn the number 5, your decision with number 5 on your decision sheets is played for real. This is the most important thing: If you have chosen to draw a ball from bag (A) in the selected decision, you have to draw a ball from bag (A). You win €10 *(respectively €6, €8 or €12, according to the treatment)*, if you announce the drawn color, otherwise you get nothing. If you have chosen the sure amount of money, you get €2.50 *(respectively €1.5, €2 or €3, according to the treatment)* in this example,

Everybody ok so far? *Leave time for questions and answer them privately.*

Let's make another example: If you have drawn the number 38, what will happen when you have checked the box on the left hand side? *(Assume the answer is correct.)* Right, you have to draw a ball from bag (B). You win €10 *(respectively €6, €8 or €12, according to the treatment)* if the color is correct and nothing otherwise. What will happen when you have checked the box on the right hand side? *(Assume the answer is correct.)* Right, you take €9 *(respectively €5.4, €7.2 or €10.8, according to the treatment)* home. Whether you draw a ball from bag (B) and maybe win €10 *(respectively €6, €8 or €12, according to the treatment)* or take the sure amount of money home depends on whether you have checked the box at the left or at the right hand side.

As each of your 40 decisions could be drawn, you should consider carefully in each row if you want to draw a ball from bag (A) or (B) or if you want to take a sure amount of money home.

Everybody ok ? *Leave time for questions and answer them privately.*

If no questions have been left unanswered, then you can start making your choices. Once you are finished, please turn over your decision sheet and wait until all others have finished this part.

*Let subjects make their decisions and collect decision sheets that have been turned over.*

**Decision sheet**

**Risk and ambiguity**

[1]   draw from bag A   O        **or**        O   0.50 euro for sure

[2]   draw from bag A   O        **or**        O   1 euro for sure

[3]   draw from bag A   O        **or**        O   1.50 euro for sure

[4]   draw from bag A   O        **or**        O   2 euro for sure

[5]   draw from bag A   O        **or**        O   2.50 euro for sure

[6]   draw from bag A   O        **or**        O   3 euro for sure

[7]   draw from bag A   O        **or**        O   3.50 euro for sure

[8]   draw from bag A   O        **or**        O   4 euro for sure

[9]   draw from bag A   O        **or**        O   4.50 euro for sure

[10]   draw from bag A   O        **or**        O   5 euro for sure

[11]   draw from bag A   O        **or**        O   5.50 euro for sure

[12]   draw from bag A   O        **or**        O   6 euro for sure

[13]   draw from bag A   O        **or**        O   6.50 euro for sure

[14]   draw from bag A   O        **or**        O   7 euro for sure

[15]   draw from bag A   O        **or**        O   7.50 euro for sure

[16]   draw from bag A   O        **or**        O   8 euro for sure

[17]   draw from bag A   O        **or**        O   8.50 euro for sure

[18]   draw from bag A   O        **or**        O   9 euro for sure

[19]   draw from bag A   O        **or**        O   9.50 euro for sure

[20]   draw from bag A   O        **or**        O   10 euro for sure

*[analogously for bag B or stake sizes €6, €8, €12]*

**A photograph illustrating how participants drew from one of the bags (A or B)**

**Time preference experiment** *(this experiment was run several months after the experiment on risk and ambiguity attitudes)*

Welcome to our game. Before we start, we will explain the rules of our game. From now on, please don't talk to your neighbor and listen carefully. We will frequently stop during our explanation and allow you to ask questions. Therefore, please raise your hand and one of us will come to you to answer your question.

Everybody ok so far? *Leave time for questions and answer them privately.*

You can earn money in this game. You will have to decide whether you want to get a certain amount of money at an earlier date or another, possibly larger, amount at a later date. For example, you might be asked to choose between a smaller amount of money today and a bigger amount of money in three weeks. If you decide for "today", you will get your money in cash at the end of this lesson. If you decide for "in three weeks", you will receive your money in a closed envelope in three weeks. The envelope will be marked with your student number.
It might also be the case that the earlier amount will be paid in three weeks only, and the later amount in six weeks from now, or even in more than one year from now. We will explain all possibilities in detail in the following. As you know, we will come back to run some experiments with you in the course of two years, hence you can be sure to get your money even if you choose a date that is in one-year time only.

Everybody ok so far? *Leave time for questions and answer them privately.*

You will receive eight different decision sheets. You have to choose 160 times between an earlier amount and a later but maybe higher amount of money. Only one of your decisions will be relevant. We will explain that carefully at the end of this instruction. We brought along here an example decision sheet. Note that this example will not be used in the experiment. The amounts of money indicated on this example sheet only serve illustration purposes. Let us have a look at the example together. *(Put slide on the overhead projector.)* When we play the game we will ask you to make a decision for each row. This looks, e.g., like this: In the first row you decide whether you prefer taking home €6.10 today*(point to the left)* or receiving €6.10 in three weeks from now *(point to the right)*. Assuming that you prefer taking home €6.10 today, where do you have to check the box? *(Assume answer is "left".)* Right, you check the box at the left hand side.

Everybody ok so far? *Leave time for questions and answer them privately.*

Assuming that you prefer receiving €6.10 in three weeks from now, where do you have to check the box? *(Assume answer is "right".)* Right, then you check the box at the right hand side. In the second row you decide again between taking home €6.10 today and now a larger amount of €6.30, which you could receive in three weeks from now. You can see that the amount on the right hand side increases successively row by row. As long as you prefer taking home €6.10 today, you check the box at the left hand side. As soon as you prefer receiving the higher amount in three weeks from now, you check the box at the right hand side. *(show example)*

Everybody ok so far? *Leave time for questions and answer them privately.*

As soon as you have once checked the box at the right hand side, you should consider carefully whether it makes sense for you to switch back to the left-hand side at any successive row. Consider the situation where you prefer receiving €6.50 in three weeks to taking home €6.10 today. Then it seems most likely that you will prefer receiving €6.70 in three weeks even more to

taking home €6.10 today, because €6.70 is more money than €6.50 which you preferred over the €6.10 before.

Everybody ok so far? *Leave time for questions and answer them privately.*

Let's consider another example with respect to the timing of payoffs. Here is another example decision sheet. *(Put slide with three weeks upfront-delay on the overhead projector.)* Here you have to decide whether you prefer receiving €6.10 in three weeks from now or if you prefer receiving a somewhat larger amount in six weeks from now. The rules to fill out the decision sheet stay the same. Depending on whether you prefer receiving the money in three or in six weeks from now, you check the box at the left or the right hand side. As soon as you have once checked the box at the right hand side, you should consider carefully whether it makes sense to you to switch back to the left-hand side in any successive row for the same reasons as in the previous example. Shall I repeat this example? (*If anybody says Yes, then repeat it, now in the frame of three and six weeks delay for early and late payoffs.*)

Everybody ok so far? *Leave time for questions and answer them privately.*

You see on this example sheet that the early and late payoffs are paid in three weeks, respectively six weeks, from now on. Now I show you another example. (*Put another slide with a one-year delay for the late payoff on the projector.*) Note that the amounts of money on this example are identical to the previous slide. The only change concerns the timing of the payment concerning the later payoff. In the previous example this was six weeks from now. In the current example it is one year and three weeks from now. You will also face such a timing on your decision sheets once we start the experiment. You will also find a situation where the early amount can be paid out today, and the late amount in exactly one year. Please note that all dates have been chosen such that on the possible dates you will have a regular school day. We have already checked back with the principal of your school that we will come back exactly on these future dates (in three weeks, six weeks, one year, or one year and three weeks), in case this is necessary to pay out the money to you. In the unlikely case that any of you will change schools, then we have asked an administrator of your school to send the money to your new address. Note that in this case we will give the administrator your anonymous code that he – and only he – can use to figure out your identity to send the money to you.

Now we explain to you how you get the money from this experiment. You will receive eight different decision sheets with twenty decisions each. This makes 160 decisions all together. Each of you may draw a card from these 160 cards at the end of the session. The cards are numbered from 1 to 160. Assume you have drawn the number 5. Therefore the decision with number 5 on your decision sheets is played for real. This is the most important thing: If you have checked the box on the left hand side in the selected decision, you receive in our example that I put on the overhead projector now €6.10 today. If you have checked the box on the right hand side, you receive €6.90 in three weeks from now.

Everybody ok so far? *Leave time for questions and answer them privately.*

Let's look at another example. Assume you have drawn the number 22. Now the decision with number 22 on your decision sheets is played for real. Let's consider this example sheet with the one-year delay. What will happen if you have checked the box on the left hand side? *(Assume the answer is correct.)* Right, you receive €6.10 in three weeks from now. What will happen if you have checked the box on the right hand side? *(Assume the answer is correct.)* Right, then you will receive €6.30 in one year and three weeks from now.

As each of your 160 decisions is equally likely to be drawn, you should consider your decision very carefully in each single row, since this row could be drawn for payment.

Everybody ok? *Leave time for questions and answer them privately.*

If no questions have been unanswered, then you can start making your choices. Once you are finished, please turn over your decision sheet and wait until all others have finished this part.

*Let subjects make their decisions and collect decision sheets that have been turned over.*

**Time preferences – Decision sheet** *(the order of decision sheets was random)*

| | amount **today** | | or | | amount in **3 weeks** |
|---|---|---|---|---|---|
| [1] | 10.10 euro today | O | **or** | O | 10.10 euro in 3 weeks |
| [2] | 10.10 euro today | O | **or** | O | 10.30 euro in 3 weeks |
| [3] | 10.10 euro today | O | **or** | O | 10.50 euro in 3 weeks |
| [4] | 10.10 euro today | O | **or** | O | 10.70 euro in 3 weeks |
| [5] | 10.10 euro today | O | **or** | O | 10.90 euro in 3 weeks |
| [6] | 10.10 euro today | O | **or** | O | 11.10 euro in 3 weeks |
| [7] | 10.10 euro today | O | **or** | O | 11.30 euro in 3 weeks |
| [8] | 10.10 euro today | O | **or** | O | 11.50 euro in 3 weeks |
| [9] | 10.10 euro today | O | **or** | O | 11.70 euro in 3 weeks |
| [10] | 10.10 euro today | O | **or** | O | 11.90 euro in 3 weeks |
| [11] | 10.10 euro today | O | **or** | O | 12.10 euro in 3 weeks |
| [12] | 10.10 euro today | O | **or** | O | 12.30 euro in 3 weeks |
| [13] | 10.10 euro today | O | **or** | O | 12.50 euro in 3 weeks |
| [14] | 10.10 euro today | O | **or** | O | 12.70 euro in 3 weeks |
| [15] | 10.10 euro today | O | **or** | O | 12.90 euro in 3 weeks |
| [16] | 10.10 euro today | O | **or** | O | 13.10 euro in 3 weeks |
| [17] | 10.10 euro today | O | **or** | O | 13.30 euro in 3 weeks |
| [18] | 10.10 euro today | O | **or** | O | 13.50 euro in 3 weeks |
| [19] | 10.10 euro today | O | **or** | O | 13.70 euro in 3 weeks |
| [20] | 10.10 euro today | O | **or** | O | 13.90 euro in 3 weeks |

**Time preferences – Decision sheet** *(the order of decision sheets was random)*

|  | amount **today** | | or | | amount in **3 weeks** |
|---|---|---|---|---|---|
| [21] | 4.05 euro today | O | **or** | O | 4.05 euro in 3 weeks |
| [22] | 4.05 euro today | O | **or** | O | 4.15 euro in 3 weeks |
| [23] | 4.05 euro today | O | **or** | O | 4.25 euro in 3 weeks |
| [24] | 4.05 euro today | O | **or** | O | 4.35 euro in 3 weeks |
| [25] | 4.05 euro today | O | **or** | O | 4.45 euro in 3 weeks |
| [26] | 4.05 euro today | O | **or** | O | 4.55 euro in 3 weeks |
| [27] | 4.05 euro today | O | **or** | O | 4.65 euro in 3 weeks |
| [28] | 4.05 euro today | O | **or** | O | 4.75 euro in 3 weeks |
| [29] | 4.05 euro today | O | **or** | O | 4.85 euro in 3 weeks |
| [30] | 4.05 euro today | O | **or** | O | 4.95 euro in 3 weeks |
| [31] | 4.05 euro today | O | **or** | O | 5.05 euro in 3 weeks |
| [32] | 4.05 euro today | O | **or** | O | 5.15 euro in 3 weeks |
| [33] | 4.05 euro today | O | **or** | O | 5.25 euro in 3 weeks |
| [34] | 4.05 euro today | O | **or** | O | 5.35 euro in 3 weeks |
| [35] | 4.05 euro today | O | **or** | O | 5.45 euro in 3 weeks |
| [36] | 4.05 euro today | O | **or** | O | 5.55 euro in 3 weeks |
| [37] | 4.05 euro today | O | **or** | O | 5.65 euro in 3 weeks |
| [38] | 4.05 euro today | O | **or** | O | 5.75 euro in 3 weeks |
| [39] | 4.05 euro today | O | **or** | O | 5.85 euro in 3 weeks |
| [40] | 4.05 euro today | O | **or** | O | 5.95 euro in 3 weeks |

*[Six further sheets varied the timing of these payoffs by once adding an upfront-delay of three weeks for the earlier payoff and once by using a delay between earlier and later payoff of one year instead of three weeks. See Figure 5 for an illustration. Note that the eight decision sheets were handed out in random order]*

## A2. Questionnaire [translated from German]

1) I am        O female        O male

2) I was born in the following year: _____.

3) I was born in the following month: _____.

4) I have _____ (how many?) siblings.

5) I was born as _____ (which number?) child in my family.

6) Per week I have roughly _____ euro pocket money.

I spend my pocket money on:

O mobile phone bill            O computer games            O clothes

O magazines                    O cinema                    O going out

O food and beverages           O sport                     O cosmetica

O music                        O sweets                    O concerts

O cigarettes                   O alcohol                   O expenses from school

O toys                         O other: _____

*(For our analysis we create the variables "smoking" and "alcohol consumption" and code it as 1 if a subject spends pocket money on cigarettes respectively alcohol and 0 otherwise.)*

7) I live in the following village: _____

8) How often do you attend religious celebrations per month? (for example mass, celebration at a mosque, …)

|   0 x   |   1 x   |   2 x   |   3 x   |   4 x   | > (more than) 4 x |
|---------|---------|---------|---------|---------|-------------------|
|    O    |    O    |    O    |    O    |    O    |         O         |

9) Please mark the appropriate item with a cross:

O My parents and I were born in Austria.

O I was born in Austria. My mother and my father were not born in Austria.

O I was born in Austria. One of my parents was not born in Austria.

O I was not born in Austria, nor were my parents.

10) Do you save money?

O yes          O no

*(For our analysis we create the variable "saving" and code it as 1 if a subject checks "yes" and 0 otherwise.)*

11) I am _____ m tall.

12) I weigh _____ kg.

*(For our analysis we create the variable "bodymass" = weight/height^2.)*

# A3. Table A. Regressions behind Table 5

**Panel A:** Determinants of field behavior: Saving (Marginal-Probit-Regression)

| Explanatory variables | Dependent variable: Saving | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model A | Model B | Model C | Model D | Model E | Model F | Model G | Model H |
| Delay aversion | -0.132** | -0.133*** | -0.194*** | -0.169*** | -0.165*** | -0.171*** | -0.224*** | -0.210*** |
| | (0.052) | (0.049) | (0.059) | (0.065) | (0.053) | (0.054) | (0.058) | (0.057) |
| Risk aversion | 0.002 | 0.004 | -0.006 | -0.002 | 0.003 | 0.001 | -0.003 | 0.002 |
| | (0.037) | (0.037) | (0.036) | (0.037) | (0.036) | (0.035) | (0.034) | (0.036) |
| Ambiguity aversion | 0.009 | 0.007 | 0.008 | 0.007 | 0.004 | 0.006 | 0.002 | 0.008 |
| | (0.024) | (0.024) | (0.024) | (0.024) | (0.023) | (0.023) | (0.022) | (0.023) |
| Age | -0.012*** | -0.013*** | -0.012*** | -0.013*** | -0.011*** | -0.011*** | -0.011*** | -0.012*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Female | -0.012 | -0.012 | -0.015 | -0.015 | -0.011 | -0.009 | -0.012 | -0.013 |
| | (0.016) | (0.015) | (0.015) | (0.015) | (0.015) | (0.015) | (0.014) | (0.014) |
| German grade | 0.002 | -0.001 | 0.003 | -0.000 | 0.002 | 0.001 | 0.003 | 0.004 |
| | (0.011) | (0.011) | (0.010) | (0.011) | (0.010) | (0.010) | (0.010) | (0.010) |
| Math grade | 0.033*** | 0.035*** | 0.030*** | 0.033*** | 0.033*** | 0.032*** | 0.028*** | 0.029*** |
| | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) | (0.009) | (0.009) |
| No. of siblings | -0.009 | -0.009 | -0.008 | -0.007 | -0.008 | -0.009 | -0.007 | -0.007 |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.007) | (0.007) |
| Pocket money per week | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 |
| Pseudo R² | 0.157 | 0.157 | 0.166 | 0.157 | 0.168 | 0.171 | 0.185 | 0.179 |

*Notes.* ***, **, * denote significance at the 1%, 5%, 10% level, robust standard errors in parenthesis.
Model A: 3 weeks delay, low stake, no upfront delay.
Model B: 3 weeks delay, low stake, upfront delay.
Model C: 3 weeks delay, high stake, no upfront delay.
Model D: 3 weeks delay, high stake, upfront delay.
Model E: 1 year delay, low stake, no upfront delay.
Model F: 1 year delay, low stake, upfront delay.
Model G: 1 year delay, high stake, no upfront delay.
Model H: 1 year delay, high stake, upfront delay.

**Panel B:** Determinants of field behavior: Smoking (Marginal-Probit-Regression)

| Explanatory variables | Dependent variable: Smoking | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model A | Model B | Model C | Model D | Model E | Model F | Model G | Model H |
| Delay aversion | 0.034** | 0.037*** | 0.041** | 0.046*** | 0.028* | 0.020 | 0.034** | 0.035** |
| | (0.018) | (0.019) | (0.022) | (0.023) | (0.018) | (0.018) | (0.020) | (0.020) |
| Risk aversion | -0.007 | -0.006 | -0.006 | -0.006 | -0.009 | -0.009 | -0.007 | -0.007 |
| | (0.009) | (0.007) | (0.010) | (0.008) | (0.011) | (0.012) | (0.011) | (0.010) |
| Ambiguity aversion | -0.015* | -0.011* | -0.017** | -0.015** | -0.017* | -0.019* | -0.017* | -0.017** |
| | (0.009) | (0.006) | (0.010) | (0.009) | (0.010) | (0.011) | (0.010) | (0.009) |
| Age | 0.007*** | 0.005*** | 0.008*** | 0.007*** | 0.008*** | 0.008*** | 0.008*** | 0.007*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Female | 0.006 | 0.004 | 0.006 | 0.007* | 0.006 | 0.006 | 0.006 | 0.007 |
| | (0.004) | (0.003) | (0.005) | (0.004) | (0.005) | (0.005) | (0.005) | (0.004) |
| German grade | -0.002 | -0.001 | -0.003 | -0.002 | -0.003 | -0.003 | -0.003 | -0.003 |
| | (0.002) | (0.002) | (0.003) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) |
| Math grade | -0.007*** | -0.005*** | -0.007*** | -0.006*** | -0.009*** | -0.009*** | -0.008*** | -0.008*** |
| | (0.004) | (0.003) | (0.004) | (0.003) | (0.004) | (0.004) | (0.004) | 0.004 |
| No. of siblings | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) | (0.002) | (0.002) |
| Pocket money per week | -0.000 | -0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of. observations | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 |
| Pseudo R² | 0.365 | 0.392 | 0.357 | 0.371 | 0.350 | 0.343 | 0.352 | 0.355 |

*Notes.* ***, **, * denote significance at the 1%, 5%, 10% level, robust standard errors in parenthesis.
Model A: 3 weeks delay, low stake, no upfront delay.
Model B: 3 weeks delay, low stake, upfront delay.
Model C: 3 weeks delay, high stake, no upfront delay.
Model D: 3 weeks delay, high stake, upfront delay.
Model E: 1 year delay, low stake, no upfront delay.
Model F: 1 year delay, low stake, upfront delay.
Model G: 1 year delay, high stake, no upfront delay.
Model H: 1 year delay, high stake, upfront delay.

**Panel C:** Determinants of field behavior: Alcohol consumption (Marginal-Probit-Regression)

| Explanatory variables | Dependent variable: Alcohol consumption | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model A | Model B | Model C | Model D | Model E | Model F | Model G | Model H |
| Delay aversion | 0.177*** | 0.157** | 0.209*** | 0.203** | 0.124* | 0.065 | 0.207*** | 0.255*** |
| | (0.062) | (0.063) | (0.078) | (0.085) | (0.061) | (0.063) | (0.069) | (0.068) |
| Risk aversion | 0.020 | 0.021 | 0.029 | 0.024 | 0.017 | 0.017 | 0.025 | 0.025 |
| | (0.049) | (0.048) | (0.049) | (0.049) | (0.050) | (0.050) | (0.049) | (0.048) |
| Ambiguity aversion | -0.057 | -0.051 | -0.058 | -0.056 | -0.051 | -0.055 | -0.052 | -0.058 |
| | (0.040) | (0.040) | (0.041) | (0.042) | (0.041) | (0.042) | (0.040) | (0.038) |
| Age | 0.054*** | 0.056*** | 0.056*** | 0.057*** | 0.056*** | 0.057*** | 0.055*** | 0.054*** |
| | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) |
| Female | 0.007 | 0.006 | 0.008 | 0.010 | 0.005 | 0.005 | 0.007 | 0.008 |
| | (0.019) | (0.019) | (0.019) | (0.019) | (0.019) | (0.020) | (0.019) | (0.018) |
| German grade | -0.002 | 0.000 | -0.002 | -0.001 | -0.002 | -0.002 | -0.002 | -0.004 |
| | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) | (0.012) |
| Math grade | -0.014 | -0.015 | -0.012 | -0.014 | -0.016 | -0.017 | -0.013 | -0.012 |
| | (0.010) | (0.010) | (0.011) | (0.010) | (0.010) | (0.011) | (0.010) | (0.010) |
| No. of. siblings | -0.005 | -0.005 | -0.006 | -0.007 | -0.005 | -0.004 | -0.005 | -0.005 |
| | (0.010) | (0.010) | (0.011) | (0.011) | (0.010) | (0.011) | (0.010) | (0.010) |
| Pocket money per week | 0.001 | 0.001 | 0.001* | 0.001* | 0.001* | 0.001* | 0.001 | 0.001* |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| No. of observations | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 |
| Pseudo R² | 0.399 | 0.396 | 0.397 | 0.395 | 0.393 | 0.388 | 0.400 | 0.408 |

*Notes.* ***, **, * denote significance at the 1%, 5%, 10% level, robust standard errors in parenthesis.
Model A: 3 weeks delay, low stake, no upfront delay.
Model B: 3 weeks delay, low stake, upfront delay.
Model C: 3 weeks delay, high stake, no upfront delay.
Model D: 3 weeks delay, high stake, upfront delay.
Model E: 1 year delay, low stake, no upfront delay.
Model F: 1 year delay, low stake, upfront delay.
Model G: 1 year delay, high stake, no upfront delay.
Model H: 1 year delay, high stake, upfront delay.

**Panel D:** Determinants of field behavior: Body mass index (OLS-Regression)

| Explanatory variables | Dependent variable: Body mass index | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model A | Model B | Model C | Model D | Model E | Model F | Model G | Model H |
| Delay aversion | 0.063* | 0.025 | 0.030 | 0.016 | 0.035 | 0.040 | 0.039 | 0.069* |
| | (0.034) | (0.033) | (0.046) | (0.044) | (0.031) | (0.030) | (0.036) | (0.037) |
| Risk aversion | -0.060** | -0.063*** | -0.062*** | -0.063*** | -0.063*** | -0.063*** | -0.063*** | -0.062*** |
| | (0.024) | (0.024) | (0.024) | (0.024) | (0.023) | (0.023) | (0.024) | (0.023) |
| Ambiguity aversion | -0.024 | -0.023 | -0.023 | -0.022 | -0.022 | -0.023 | -0.022 | -0.023 |
| | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) | (0.021) |
| Age | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 | -0.002 |
| | (0.003) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| Female | -0.024** | -0.024** | -0.024** | -0.024** | -0.024** | -0.024** | -0.024** | -0.023** |
| | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) | (0.010) |
| German grade | -0.008 | -0.007 | -0.007 | -0.007 | -0.007 | -0.007 | -0.007 | -0.008 |
| | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) |
| Math grade | 0.006 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 | 0.005 | 0.005 |
| | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) |
| No. of siblings | -0.004 | -0.004 | -0.004 | -0.004 | -0.004 | -0.004 | -0.004 | -0.004 |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) |
| Pocket money per week | 0.000** | 0.001** | 0.001** | 0.001** | 0.001** | 0.001** | 0.001** | 0.001** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| No. of observations | 611 | 611 | 611 | 611 | 611 | 611 | 611 | 611 |
| $R^2$ | 0.047 | 0.042 | 0.042 | 0.041 | 0.043 | 0.044 | 0.043 | 0.047 |

*Notes.* ***, **, * denote significance at the 1%, 5%, 10% level, robust standard errors in parenthesis.
Model A: 3 weeks delay, low stake, no upfront delay.
Model B: 3 weeks delay, low stake, upfront delay.
Model C: 3 weeks delay, high stake, no upfront delay.
Model D: 3 weeks delay, high stake, upfront delay.
Model E: 1 year delay, low stake, no upfront delay.
Model F: 1 year delay, low stake, upfront delay.
Model G: 1 year delay, high stake, no upfront delay.
Model H: 1 year delay, high stake, upfront delay.

**Panel E:** Determinants of field behavior: Grade for behavior (Ordered-Probit-Regression)

| Explanatory variables | Dependent variable: Grade for behavior | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model A | Model B | Model C | Model D | Model E | Model F | Model G | Model H |
| Delay aversion | 1.323*** | 1.117** | 1.890*** | 1.814*** | 1.357*** | 1.463*** | 1.633*** | 2.161*** |
| | (0.499) | (0.499) | (0.573) | (0.624) | (0.495) | (0.502) | (0.573) | (0.584) |
| Risk aversion | -0.349 | -0.390 | -0.292 | -0.302 | -0.431 | -0.448 | -0.383 | -0.393 |
| | (0.316) | (0.311) | (0.314) | (0.315) | (0.317) | (0.314) | (0.317) | (0.317) |
| Ambiguity aversion | -0.390 | -0.389 | -0.417 | -0.421 | -0.358 | -0.415 | -0.378 | -0.425 |
| | (0.291) | (0.296) | (0.286) | (0.290) | (0.296) | (0.299) | (0.300) | (0.303) |
| Age | 0.034 | 0.042 | 0.039 | 0.046 | 0.039 | 0.038 | 0.039 | 0.042 |
| | (0.029) | (0.029) | (0.030) | (0.030) | (0.029) | (0.029) | (0.030) | (0.031) |
| Female | -0.564*** | -0.561*** | -0.539*** | -0.533*** | -0.559*** | -0.558*** | -0.559*** | -0.542*** |
| | (0.150) | (0.149) | (0.149) | (0.149) | (0.149) | (0.149) | (0.149) | (0.150) |
| German grade | -0.263*** | -0.253*** | -0.265*** | -0.266*** | -0.262*** | -0.263*** | -0.261*** | -0.282*** |
| | (0.086) | (0.088) | (0.088) | (0.088) | (0.085) | (0.086) | (0.089) | (0.090) |
| Math grade | -0.198** | -0.207** | -0.177* | -0.183** | -0.205** | -0.205** | -0.196** | -0.185** |
| | (0.088) | (0.090) | (0.091) | (0.090) | (0.089) | (0.089) | (0.090) | (0.089) |
| No. of siblings | 0.027 | 0.027 | 0.026 | 0.004 | 0.023 | 0.032 | 0.019 | 0.008 |
| | (0.068) | (0.068) | (0.068) | (0.068) | (0.066) | (0.067) | (0.067) | (0.067) |
| Pocket money per week | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.003) | (0.003) | (0.004) | (0.004) |
| No. of observations | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 |
| R² | 0.131 | 0.127 | 0.136 | 0.133 | 0.132 | 0.135 | 0.134 | 0.145 |

*Notes.* \*\*\*, \*\*, \* denote significance at the 1%, 5%, 10% level, robust standard errors in parenthesis.
Model A: 3 weeks delay, low stake, no upfront delay.
Model B: 3 weeks delay, low stake, upfront delay.
Model C: 3 weeks delay, high stake, no upfront delay.
Model D: 3 weeks delay, high stake, upfront delay.
Model E: 1 year delay, low stake, no upfront delay.
Model F: 1 year delay, low stake, upfront delay.
Model G: 1 year delay, high stake, no upfront delay.
Model H: 1 year delay, high stake, upfront delay.