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Lessons from a university classroom experiment

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Abstract

We attempt to link laboratory-based measures of preferences with measures of school performance. We measure in an incentivized way risk, time, social and competitive preferences and also cognitive abilities of university students and look for associations between these measures and two important academic outcome measures: exam results and GPA.

We find consistently that cognitive abilities (proxied by the Cognitive Reflection Test (Frederick 2005)) are very well correlated with school performance. Regarding non-cognitive skills, we find suggestive evidence for many of our measured preferences. We use two alternative measures of time preference: patience and present bias. Present bias explains exam grades relatively better, while patience is better explaining GPA. Both measures of time preferences have a non-linear relation to school performance. Competitiveness matters, as students, who opt for a more competitive payment scheme in our experiments have a higher average GPA and better exam grades. We observe also that risk-averse students perform a little better than risk-loving students. That makes sense in case of multiple choice exams, because risk-loving students may want to try to pass the exam less prepared, as the possibility of passing as exam just by chance is not zero. Finally, we have also detected that cooperative preferences – the amount of money offered in a public good game – associates strongly with GPA, but in a non-linear way. Students who offered around half of their possible amounts had significantly higher GPAs than those, who offered none or all their money.

Keywords: competititive preferences, experiment, non-cognitive skills, risk preferences, school performance, social preferences, time preferences.

JEL codes: C91; D91; I20

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Melyik preferenciák függnek össze az iskolai teljesítménnyel?

Tanulságok egy egyetemi kísérletből

Horn Dániel – Kiss Hubert János

Összefoglaló

Laboratóriumban gyakran használt preferenciákat mérünk és azt vizsgáljuk, hogy mennyire függnek össze iskolai teljesítmény mérőszámaival. Ösztönzött módon mérjük egyetemi hallgatók kockázati, idő-, társas és versengési preferenciáit és kognitív képességeit és megnézzük, hogy ezen mértékek mennyire mozognak együtt két fontos teljesítménymutatóval: vizsgaeredményekkel és tanulmányi átlaggal.

Azt találjuk, hogy a kognitív képességek (amit a Cognitive Reflection Test-tel (Frederick 2005) mérünk) konzisztens módon korrelálnak az iskolai teljesítménnyel. A nem-kognitív képességek közül sok függ össze a fenti teljesítménymutatókkal. Az időpreferenciát kétféleképpen mérjük: a türelemmel és a jelen-torzítással. A jelen-torzítás a vizsgaeredményeket, míg a türelem a tanulmányi átlagokat magyarázza jobban. Mindkét időpreferencia-mutató nem-lineáris összefüggést mutat az iskolai teljesítménnyel. A versenyszellem is számít, ugyanis magasabb a tanulmányi átlaguk és jobbak a vizsgaeredményeik azon diákoknak, akik versengő kifizetést választottak a kísérletünkben. Megmutatjuk, hogy a kockázatkerülőbb diákok jobban teljesítenek a vizsgán, mint a kockázatkedvelőbb társaik. Ez azért lehetséges, mert feleletválasztós vizsga esetén a kockázatkedvelő diák megpróbálkozhat kevésbé felkészülten átmenni a vizsgán, hiszen ennek esélye nem nulla. Végül, azt is találjuk, hogy a kooperatív preferenciák – a közjószág-játékban felajánlott összeg – erősen összefügg a tanulmányi átlaggal, nem-lineáris módon. Azon diákok tanulmányi átlaga, akik megközelítőleg a lehetséges összeg felét ajánlották fel, számottevően magasabb volt, mint azoké, akik semmit vagy mindent felajánlottak.

Tárgyszavak: versengési preferencia, kísérlet, nem-kognitív képességek, kockázati preferencia, iskolai teljesítmény, társas preferencia, időpreferencia.

JEL-kódok: C91; D91; I20

Köszönetnyilvánítás: Nagyon hálásak vagyunk Péntek Zsófiának a kísérlet elvégzéséhez nyújtott segítségéért.

1. INTRODUCTION

There is growing literature that indicates that individual preferences studied by economists affect and predict a wide range of choices made at the individual level. For example, risky choices like smoking, drinking, not having insurance, holding stocks rather than Treasury bills or choosing an occupation with a high earning risks are positively and significantly correlated with risk attitudes (see for instance Barsky et al, 1997; Bonin et al., 2007; Dohmen et al., 2010). Similarly, time discounting predicts behavior in many walks of life like health (e.g. BMI - see for instance Borghans and Golsteyn, 2006) or finance (e.g. creditworthiness – see for example Meier and Sprenger, 2011; or savings – see Falk et al. 2015), labour supply and lifetime income (see Chabris et al., 2008; Golsteyn et al., 2014; Komlos et al., 2004).[1]

In this study, we focus on educational performance. Using a classroom experiment we attempt to see which preferences may affect school performance. Understanding the factors that shape school performance is of utmost importance, because school performance determines to a large extent the success in life as captured, for instance by the wage premium (e.g. Psacharopoulos and Patrinos 2004) or the positive relation between schooling and other socioeconomic outcomes (e.g. health – see for instance Grossmann 2006, or voting – see Geys 2006). We consider both cognitive and non-cognitive skills (preferences) and try to measure some of them in the classroom.[2] Then we relate the measures obtained to two measures of observable school performance of bachelor students: the exam result of a subject (Economics) and the grade point average (henceforth, GPA) of the semester when the exam was taken.

More precisely, we study four interrelated preferences that have received considerable academic attention in the last decades: risk, time, social and competitive preferences. These areas are interrelated as for instance any temporal choice involves risk as the future is inherently uncertain (Andreoni and Sprenger, 2012). Therefore, measures of these preferences may be correlated, as we show later.[3] Why is it important to consider the association between these preferences and school performance? We know that academic

[1] Two remarks are in order. First, the relationships are not always unambigous, for example for time discounting and health see Chapman and Elstein, 1995 and Chapman et al.,1999. Second, in many cases not all measures related to a preference have a predictive power, only some of them (see Chapman and Coups, 1999, Meier and Sprenger, 2010).

[2] Note that cognitive and non-cognitive skills are not orthogonal abilities as for instance cognition affects many aspects of human behavior (Borghans et al., 2008).

[3] We note that gender differences have been documented extensively regarding these preferences (see Croson-Gneezy (2009) or Niederle (2016) for two surveys). However, since our subject pool is not balanced regarding gender, we do not focus on this aspect.

success depends positively and to a large extent on intellectual ability. Borghans et al. (2008) report that IQ predicts outcomes in several fields of life (e.g. job performance and longevity) and is the best predictor for two academic outcomes (college grades and years of education) when compared to the Big Five personality factors. While the importance of cognitive abilities to explain academic success is a general finding, many studies also point out that they rarely explain more than 50% of the variance in academic performance (Chamorro-Premuzic & Furnham, 2004; O'Connor & Paunonen, 2007).[4] Duckworth and Seligman (2005) show in a longitudinal study that self-control explained more than twice as much variance in the final grades of eigth-grade students as IQ. In fact, the part not explained by cognitive skills is perhaps best understood considering personality traits and preferences.

We report here briefly our main results. In line with the existing literature, we find that cognitive abilities are important both for exam results and GPA. We consider two aspects of time preferences, patience and present bias and they affect exam results and GPA in the expected way. Patience is non-linear as it matters only for the very impatient. Also future-biased and time-consistent students perform similarly well, but better than present-biased student. The more present-biased a student is, the worse her expected grades are. Risk preferences seem to affect the exam result in the following way: the more risk-averse a student, the better are the exam results. Although, this relationship is very weak, to our best knowledge, we are the first to find significant effect of risk/uncertainty aversion on school performance (even though this finding is only partial as it affects only exam results). Competitive preferences are weakly related to exam results and GPA in the expected way. That is, the more competitive a student is, the higher is her grade.[5] We find an interesting non-linear effect of social preferences: compared to those who contribute nothing / everything to a public good, those who contributed half of their endowment, fared significantly better regarding their GPA.[6]

The differential effect of the preferences on exam results and GPA may be due to the different nature of these two. The exam that we use to measure school performance was an Economics exam for students not enrolled in the Economics program, so it was not a major or important subject in their track. On the other hand, GPA encompasses all subjects, giving a more balanced view of school performance. Moreover, the exam was a multiple choice test with clear good answer, hence there the grade can be seen as an objective measure. However,

[4] In fact, Borghans and colleagues (2016) report much smaller, below 0.1, R^2-statistics of IQ on wages using the British Cohort Study or the National Longitudinal Survey of Youth '79.
[5] Related to competitiveness, we find also that more overconfident students do worse in the exams but not in GPA.
[6] A caveat on social preferences is in order. Our analysis is carried out on an individual level, while cooperativeness may be important on the group or class level. Hence, classes that exhibit a higher degree of cooperativeness may be more successful academically, *ceteris paribus*. If this is the case, then social preferences should be measured and compared on the group level.

in the GPA there may be subjects that are not evaluated only on such objective scales. For example, oral exams or written assignments in form of an essay seem to let subjectivity play a larger role in grading.

The rest of the paper is structured as follows. Next, we review briefly the preferences that we study and also potential connections to educational attainment. We also formulate some hypotheses about how these preferences may affect school performance. Then in section 3 we present the experiment and validate our measurement of the preferences. Section 4 contains the results that considers both linear and non-linear relationships. In section 5 we discuss the results and outline some possible venues for future research.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 TIME PREFERENCE

Time preferences are important as many decisions involve costs and benefits that occur at different points in time. Many individuals tend to try to enjoy the benefits as soon as possible, while delaying costs and efforts. For instance, the marshmallow tests showed that the ability to delay gratification is positively related to many desirable behaviors and outcomes (for instance, better health, higher average SAT points, more rewarding social relationships, see Mischel 1996, Sutter et al. 2013).

Following the literature we consider two aspects of time preference: patience and present bias. The choice between different amounts of money at different points in time may reveal the implied discount factor that characterizes an individual. The more an individual values future payoffs, the more patient she is and probably the more she is willing to sacrifice to get those future rewards. When the discount factor is measured on different horizons, but involving the same time interval (say, now vs. 1 week later and in a year vs. in a year and a week), then the difference in discount rates on the different horizons is also informative. If an individual is more impatient on the short-term horizon than on the long-term, then she exhibits *present bias* that may make it hard for the individual to make efforts immediately, and she tends to procrastinate efforts and costs. Other studies relate these concepts to willpower and self-control.[7]

How do time preferences affect education outcomes? It is natural to think that those students who are more patient and hence value the future more and / or who are more able to delay gratification (that is, make efforts and study instead of playing or hanging around),

[7] Several studies (see for example the survey by Bucciol et al. (2010) and the references therein) note that self-control and willpower are limited resources and can be exhausted, a process described by psychologist as ego depletion.

will be more successful academically. There is some empirical evidence in this regard. Golsteyn et al. (2014) use longitudinal data from Sweden that links measured time preference at age 13 to later life outcomes gained from administrative registers. Their results indicate that high discount rates are related to worse school performance, among others. More patient individuals had significantly higher grades throughout the school years and were more likely to attain a university diploma. They also show that the effect operates through early human capital investments.[8] Cadena and Keys (2015) report very similar findings in an US setting and Falk et al. (2015) also show in a world-wide survey that patience is significantly related to educational attainment. Sutter et al. (2013) find evidence that children and adolescents in Austria who are more impatient show worse conduct during school years (smoke more and drink more alcohol). Castillo et al. (2011) document similar findings in the US. However, the empirical findings are not unambiguous as Bettinger and Slonim (2007) fail to find any correlation between patience and school performance.

Similarly to the above-cited studies, in our experiment we used intertemporal monetary choices to measure individual patience of the participants over two horizons. As a consequence, we can measure both patience and present bias.

Hypothesis 1 (Time preference): Based on the literature we conjecture that patience has a positive and present bias may have a negative effect on school performance.

2.2 RISK PREFERENCES

Even though generally we speak only about risk preferences, recent research has revealed that risk and uncertainty (or ambiguity) – though related – are different concepts. Broadly speaking, risk preferences capture how much individuals value safe and certain outcomes relative to risky (when probabilities of different events are known) or uncertain (when those probabilities are unknown) alternatives.

There is some evidence that risk preferences are related to schooling, but the direction of the effect is unclear. For instance, Guiso and Paiella (2008) show that more educated people are more risk tolerant, but we do not know if schooling makes individual less risk-averse or risk aversion affects schooling decisions. Analyzing an Italian panel data set Belzil and Leonardi (2007) find that risk attitudes only modestly explain whether an individual is admitted to higher education or not. Sutter et al. (2013) find that experimental measures of risk and uncertainty aversion predict field behavior in the school only weakly. Hartlaub and Schneider (2012) discuss how risk aversion and social background affect school choice and show compelling evidence in favour of the class-specific effect of risk aversion in Germany.

[8] Importantly, the authors control for a host of potential confounds. For instance, there is some evidence that time preferences and cognitive abilities are related (Dohmen et al. (2010) and Burks et al. (2009)), but cognitive abilities are controlled for in the study.

Importantly, we study the association between risk attitudes and school performance, a topic not touched upon in the cited papers.

We note that risk and time preferences may be correlated. For instance, Leigh (1986) reports a significant negative correlation between time discount and risk aversion. Anderhub et al. (2001) find a statistically significant negative correlation between risk aversion and discount factors in a within-subject design. However, being correlated does not mean that they are the same. In an experiment, Coble and Lusk (2010) reject the hypothesis that risk and time preferences are governed by a single parameter and conclude that the relationship between the two is that individuals prefer to delay the resolution of risk. Andreoni and Sprenger (2012) also state that while risk and time preferences are intertwined, they are not different manifestations of the same phenomenon. Epper and Fehr-Duda (2015) show that risk attitudes and time discounting are related through various channels, for example both risk tolerance and patience are on average higher for payoffs that materialize in the future compared to payoffs in the present. Epper and Fehr-Duda (2015) offer a unifying framework to capture all the interactions. In this study, we do not investigate the mechanisms that relate time and risk preferences, and they are not significantly correlated according to our data.

Hypothesis 2 (Risk preference): Based on the literature we do not expect a strong effect of risk attitudes on school performance.

2.3 SOCIAL PREFERENCES

Social preferences express the idea that other individuals' utility also enters the utility function of the decision-maker. It includes many aspects of human behavior ranging from trust and reciprocity to cooperation.

It seems plausible that in a more trusting and cooperative environment students help each other improving educational attainment in general. There is scant evidence that social preferences and especially prosocial behavior is related to school performance. Using Italian data, Caprara et al. (2000) find that prosocial attitude measured at age 8 predicted educational performance and peer acceptance 5 years later.[9] This study did not use experiments but assessment reported by the children themselves and teachers. We are not aware of any paper that uses experiments to relate prosocial behavior to school performance.

We focused on cooperation and measured it in our experiment with a two-person variant of the public goods game. There are studies that show that choice in the public goods game is generally positively related to effort in the field, see for instance Englmaier and Gebhardt (2016) or Galizzi and Navarro-Martinez (2015). That is why we conjecture that larger

[9] Layous et al. (2012) also report that prosociality is related to peer acceptance, suggesting a potential link between prosocial attitudes, peer effects and educational attainment.

contribution in this game may imply more effort in studying that eventually results in better performance, *ceteris paribus*.

Hypothesis 3 (Cooperativeness): We expect that cooperativeness goes well with higher school performance.

2.4 COMPETITIVE PREFERENCES

Competitive preferences may be important in school performance as individuals that are competitive may want to excel at school as well. The only study that we are aware of in this regard is Azmat and Iriberri (2010) who find such results in a natural field experiment during which students in a high school in Spain received for a year information that allowed them to know if they performed above or below the class average and the distance from the average. The provision of this information increased students' grades by 5%.

Hypothesis 4 (Competitiveness): Based on Azmat and Iriberri (2010) we expect that more competitive participants may have better results in the exam, *ceteris paribus*.

3. THE EXPERIMENT

There were 3 sessions, all of them carried out during university lectures. In total 226 students (144 women) participated in the experiment. Subjects were undergraduate students enrolled in different programs of the Eötvös Lóránd University (Budapest, Hungary). No student participated in more than one session. The first / second / third session was carried out on 17 November, 2015 / 27 November, 2015 / 3 December, 2015 with students mainly enrolled in International Affairs and Computer Science. Each session lasted about 40-45 minutes.

The experiment was a paper and pencil experiment. After seating the participants, they received the instruction sheets that also contained the situations in which the participants had to decide. At the beginning of each session an experimenter read aloud the relevant information that the participants could also follow on the instruction sheets.[10] More precisely, we made clear that participation was voluntary and anonymous. We also explained that we wished to connect answers in the experiment to school performance of the subject so we asked the participants to provide their code of the electronic education administration system. Providing the code was also voluntary and we pointed out that after connecting the data we would erase the code to make identification impossible. Next, we explained that the experiment would consists of six independent decisions and that at the end of the experiment we would select two participants randomly who would be paid according to their decisions in

[10] For the exact instructions, see Appendix A.

one of the randomly chosen decisions.[11] We also made clear that some of the payments related to some of the decisions may be postponed to 2 or 3 weeks later and explained carefully how they would receive the money in these cases. After all these explanations the experimenter answered the questions that emerged.

Participants made the decisions in the six situations using the instruction sheet that explained the scenarios with examples.

The first decision measured *cooperation* with a two-person public goods game. We explained on the instruction sheet that the participants would be randomly matched with another participant in the experiment and both start with an endowment of 4000 Ft (12.7 EUR / 14.1 USD) and could contribute any amount of this endowment to a common account, without knowing the contribution of the co-player. Each of them would receive 70% of the total contributions to the common account, independently of the individual contribution. The final payoff is the sum of the money from the common account plus the endowment that has not been used for contribution. We also made clear that if at the end of the experiment this situation is chosen for payoff, then we would pick randomly two participants and pay according to their decisions. Note that optimal decision from an individual point of view is to contribute zero to the common account, as a unit contribution returns only 0.7, that is the marginal benefit is less than the marginal cost. However, from a societal point of view contributing all the endowment is the optimal decision as a unit contribution generates 2*0.7 units. We consider the contribution to the common account as a natural measure of cooperation: the more a participant contributes the more cooperative she is.

The second decision meant to gauge the *risk attitude* of the participants. Similarly to Sutter et al. (2013), we elicited risk (and uncertainty) attitudes using the Ellsberg two-color choice task (Ellsberg, 1961). We told the participants that a bag contained 10 black and 10 red balls and we would draw one ball from the bag. Each participant was endowed with 3000 Ft (9.5 EUR/ 10.6 USD) and could choose the color to bet on and the amount to bet on the color of the ball drawn. We explained that if the participant guesses correctly the color of the ball, then we would double the bet. We consider the amount of the bet as a natural measure of risk aversion: the less a participant bets the more risk-averse she is.[12] We also explained that if this decision is chosen for payoffs, then we would again pick randomly two participants, carry out the drawing of the ball and pay according to their decisions.

The third decision was similar to the previous one, but we wanted to capture *uncertainty aversion*. Therefore, in this case the distribution of the balls in the bag was unknown to the

[11] The instruction sheets were numbered and each had two additional tags with the number of the sheet. When handing in the sheets, participants kept one of this number tags and the other was used to select the two participants to be paid.
[12] In the analysis below we will use the amount *not* placed on the bet as a measure of risk aversion.

participants. Again they were endowed with 3000 Ft (9.5 EUR/ 10.6 USD) and could choose the color to bet on and the amount to bet on the color of the ball drawn. The payoffs were as before: we doubled the bet if the the bet was correct.[13]

Decision 4 and 5 tested *time preferences*. More concretely, we used choices from two multiple price lists in which participants were asked to make a series of decisions between a smaller reward (Forint X) in period t and a larger reward (Forint Y >= Forint X) in period τ. We kept Forint Y constant and varied Forint X in two time frames, corresponding to the two decisions. In decision 4 we asked participants if they preferred 2400 Forints (7.6 Eur / 8.5 USD), 2500 Forints, 2600 Forints and so on up to 3500 Forints (11.1 EUR / 12.4 USD) today instead of 3500 Forints in a week. Based on previous experiments we expected that in the first decisions participants would choose the later, but substantially larger payoff, while in the last decisions they would switch to the earlier payoff. Based on the switching point we can calculate a proxy of their individual discount rate or patience over this horizon (now vs. 1 week later).[14] The closer is the switching point to 3500 Forints, the smaller is the individual discount rate / the more patient is the student. Decision 5 was identical, but there the earlier / later decision referred to amounts to be received in two / three weeks. For that decision problem we can also use the switching point to calculate the individual discount rate for each participant. Individual discount rates over these horizons are interesting *per se*, as previous work has shown that the degree of patience predicts behavior (see examples in the Introduction). Moreover, the relative magnitude of these patience measures reveals if somebody is present-biased or not. If the individual discount rate in decision 4 is larger, than that in decision 5, then the individual is more impatient over the short run, than over the long run and suffers present bias. Present bias may affect many decisions as a direct consequence of it is procrastination. Several studies indicate that students tend to procrastinate in their academic tasks, see for instance Solomon and Rothblum (1984), Steel (2007) or experimental evidence (Ariely and Wertenbroch 2002, Burger, Charness and Lyndham 2011).[15] Present bias implies that the individual has difficulties to delay gratification and this – as explained before – may affect academic achievement. Those that exhibit the reverse relationship are

[13] Randomly allocated, either after decision 3 or 5 there was an optional extra task. It represented a maze and we put clearly that it is not necessary to solve this exercise, but those who do it successfully would receive an extra 300 Forints (0.95 EUR / 1.1 USD) if chosen to be paid at the end of the experiment. The idea of including the maze was to see if ego depletion affects the completion of this task. We found no effect and since it is not tightly related to the rest of the paper, we ignore this task henceforth.

[14] It is only a proxy as the indifference point between the 3500 Ft to be received in a week and the money immediately is between the switching point and the previous choice. Thus, if somebody prefers 3500 Ft in a week to 3200 Ft now, but then chooses 3300 Ft now instead of 3500 Ft in a week, then her indifference point is between 3200 and 3300 Ft.

[15] There is a wide range of real-world phenomena affected by present bias, for example credit-card borrowing (Meier and Sprenger 2010), saving decisions (Laibson 1997 and Beshears et al. 2008) or physical exercise ((DellaVigna and Malmendier) to name a few.

called future-biased.[16] We measure present bias as the difference of the switching points on the two horizons (switching point at later horizin minus switching point at earlier horizon). Therefore, if a participant switches from the 3500 Ft in a week to the earlier payoff at 2800 Ft, but then on the later horizon she switches at 3000 Ft, then her present bias measure is 200 Ft.

Three remarks are in order. First, in other experiments these time preference tests involve a farther away time horizon for the second set of questions. For instance, Meier and Sprenger (2010) use now vs. 1 week and 6 weeks vs. 7 weeks, Dean and Ortoleva (2015) use now vs. 1 week and 5/6 weeks vs.6/ 7 weeks. However, in our case, we had to opt for a shorter timeframe as Christmas break was approaching which could have jeopardized the payment (had it been selected). Second, we explained carefully that if the payment involved getting paid later, then the participants would receive the corresponding amount of money in an envelope from the teacher of the course that we used to carry out the experiment.[17] Third, we had the time preference tasks close together. Individuals attempting to be consistent may have remembered their switching point in decision 4 and make the same choice in decision 5. Hence, possibly we underestimate present bias.

After decision 5 we had an 8-item test, see Appendix A for the exact questions. The first three questions were a variant of the cognitive reflection test (Frederick, 2005). We reformulated the questions and used different numbers to minimize the possibility that somebody remembered the questions and the right answers from some earlier experience. The rest of the questions involved general and popular knowledge (e.g. How many verses are there in an elegiac couplet?; How many seasons did the series Friends have?). We asked the participants how many of the questions they thought they answered correctly. They could have received 250 Forints plus, if they guessed correctly. The difference between this guess and the actual number of correct answers is a measure of overconfidence. The test served as a basis for decision 6 in which participants had to decide how they would like to be paid for their correct answers in the test. They could choose a flat-rate compensation of 250 Forints (0.79 EUR / 0.88 USD) per correct answer (maximum amount to be received this way is 2000 Forints (6.3 EUR / 7.1 USD)) or a competitive compensation that consisted in picking randomly two other participants and compare the number of correct answers. If the participant to be paid had more / an equal number of / less correct answers than the better one of the two randoméy chosen students, then she would receive 4500 / 2500 / 0 Forints (14.3 / 7.9 / 0 EUR 15.9 / 8.8 / 0 USD). The choice of the second compensation scheme reveals competitive preferences in a binary way.

[16] Future bias implies to delay taking a reward, a strange phenomenon at first sight. It has received scarce attention, see Loewenstein (1987), Rubinstein (2006) or Sayman and Öncüler (2009).
[17] We also added that if there was any problem with the payment, they should contact the secretary of the Department of Economics.

The number of correct answers to the first three questions measures cognitive skills. Several studies (Frederick 2005; Obrecht et al. 2009, Toplak et al. 2011) report a statistically significant correlation of about 0.4 between CRT performance and cognitive abilities.

After the 6 decisions we gathered some additional information and asked the gender, the year of birth and the highest level of education of the participant.

After everybody participating in the experiment handed in the instruction sheets with the answers, we rolled a die to determine which of the 6 decisions determines the payoffs and picked randomly two participants. We looked their corresponding decisions and paid on the spot.[18]

3.1 MEASUREMENT VALIDATION AND DESCRIPTIVES OF THE PREFERENCES

Our main objective is to see which preferences correlate with school performance and we can draw strong conclusions only if we can validate our preference measures. Table 1 below summarizes our main measures. Altogether we have more than 200 observations, but only have exam or GPA grades for around 150. We kept the variables unstandardized, which makes interpretation easier. Although for some variables we have divided the number by 100 (for time and risk preferences), so that the coefficients are more easily readable.

Time now / later represent our time preference measures on the shorter (now vs. 1 week) and longer (2 vs 3 weeks) horizons. The mean indicates that relative to the 3500 Ft to be received at the later date when do they switch to the earlier amount. Hence, 273 in *Time now* shows that on average our subjects' indifference point is 3500-273=3227. we also compute the corresponding discount factors that are in line with those found in the literature, see for instance Frederick et al. (2002). *Risk* and *uncertainty* show the attitude toward uncertainty as the amount that the participants *not* placed on the bet. *Present bias*, as explained above, measures the difference in the switching points of the two time horizons.[19] In experiments about one third of the participants is found to be present biased (see Meier and Sprenger 2010, Dohmen et al. 2006 and Ashraf et al. 2006), while in our experiment it is 30 per cent. *Cooperativeness* is gauged as the contribution to the common project in the public goods game that may range from 0 to 4000. In public goods game this contribution usually amounts to 40-60 per cent of the initial endowment (see Chaudhuri 2011). The mean in our experiment is at the upper end of this range. *Competitiveness* is a binary measure that is 1 for those who chose the competitive compensation scheme after the quiz and is 0 for those who

[18] The random choice of the payoff-relevant decision never was one of the time preference tasks (decision 4 and 5) that may have involved delayed payment.
[19] Here we present the difference that can be either positive or negative. However, remember that the definition of present bias is that somebody is more impatient now than later, so for these individuals the present bias measure is positive. Those with a negative measure are future-biased, while time consistent individuals have a present bias of zero.

opted for a piece rate payment. Compared to Niederle (2016), a superb survey that deals extensively with competitiveness, the 56 per cent in our sample is in line with the usual numbers reported in the literature. As explained already, we measured cognitive abilities using the Cognitive Reflection Test. Our measure *Cognitive (CRT)* reports the mean of the correct answers. Our mean of 1.36 correct answers is within the usual range and according to Frederick (2005) it places our sample between Harvard University (mean of 1.43) and University of Michigan (mean of 1.18). Remember that our quiz consisted of 8 questions, and the first three were those of the Cognitive Reflection Test, while the rest were general knowledge questions. *Cognitive (knowledge)* indicates the average number of correct answers to these questions. We use this measure as well as higher scores may capture abilities or knowledge not explained by the Cognitive Reflection Test. *Female* shows that 64 per cent of the participants were females. *Exam* and *GPA* are our performance measures. Grades in an exam may range from 1 to 5, 5 being the best grade. Since the GPA is an average of the exam grades, in principle it also ranges from 1 to 5, but as shown by the data the actual range is more compressed.

Table 1

Descriptive statistics of our main variables

	Full sample					With valid exam or GPA scores				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Time now (HUF)	198	273	252	0	1100	150	285	252	0	1100
Time later (HUF)	198	295	265	0	1100	150	319	271	0	1100
Time now (discount factor)	198	0.92	0.07	0.69	1	150	0.92	0.07	0.69	1
Time later (discount factor)	198	0.92	0.08	0.69	1	150	0.91	0.08	0.69	1
Risk	242	1451	787	0	3000	183	1382	759	0	3000
Uncertainty	241	1807	806	0	3000	182	1746	801	0	3000
Present Bias	198	22	226	-1100	700	150	35	236	-1100	700
Cooperativeness	239	2430	1241	0	4000	180	2499	1179	0	4000
Competitiveness	241	0.56	0.5	0	1	183	0.58	0.49	0	1
Cognitive (CRT)	242	1.36	1.04	0	3	183	1.14	1.04	0	4
Cognitive (knowledge)	242	1.14	1.01	0	4	183	1.25	1.02	0	3
Female	226	0.64	0.48	0	1	169	0.70	0.46	0	1
Exam	149	2.95	1.26	1	5	149	2.95	1.26	1	5
GPA	154	4.05	0.46	2.81	4.95	154	4.05	0.46	2.81	4.95

In Appendix A we report the survey in full. In Appendix B, we present to some detail the study by Dean and Ortoleva (2016), who have recent findings on the relationship between most of our variables within one experiment.[20] Table 2a reports the the pairwise correlations between Dean and Ortoleva's (2016) measures and Table 2b shows the correlation between our measures.[21] We represent all correlations and signal the ones that are significant at 1 / 5 / 10 % levels.

Table 2a

Correlation coefficients and significance level between variables in Dean and Ortoleva (2016)

	Time Now	Time Later	Risk	Uncertainty	Trust Sender	Trust Return
Time Now	1					
Time Later	0.67, ***	1				
Risk	0.32, ***	0.15	1			
Uncertainty	0.18, **	0.17, **	0.46, ***	1		
Trust Sender	-0.02	-0.09	-0.04	-0.04	1	
Trust Return	0.02	-0.04	0.07	0.1	0.46, ***	1
Cognitive	-0.08	-0.23, ***	-0.06	-0.11	0.1	-0.01
Overconfidence	-0.02	-0.01	0.04	0.05	0.06	0.09
Female	0.06	0.11	-0.07	-0.11	-0.02	0.08

***/** denotes significance at 1%/5%.

[20] We are not aware of other experimental studies that investigate all these measures within one experiment.

[21] Dean and Ortoleva do not report the correlations between the last three variables (see Table 3 in Dean and Ortoleva (2016)).

Table 2b

Pairwise correlation between our variables

	Time now	Time later	Present bias	Risk aversion	Uncertanity aversion	Cooperativeness	Competitiveness	Cognitive (CRT)	Cognitive (knowledge)
Time now	1								
Time later	0.621***	1							
Present bias	-0.390***	0.480***	1						
Risk aversion	-0.117	-0.0485	0.0735	1					
Uncertanity aversion	-0.102	-0.110	-0.0146	0.600***	1				
Cooperativeness	0.0572	0.00604	-0.0569	-0.175**	-0.117	1			
Competitiveness	0.0328	-0.0976	-0.151*	-0.101	-0.0876	-0.00151	1		
Cognitive (CRT)	-0.117	-0.150*	-0.0461	0.266***	0.367***	-0.0357	0.0273	1	
Cognitive (knowledge)	0.0400	0.0489	0.0127	0.0509	0.0340	0.107	-0.000380	0.149*	1
Female	0.0299	0.144*	0.133	-0.175**	-0.289***	0.120	-0.112	-0.386***	-0.0984
Observations	242								
	**	***							
* p<0.05	p<0.01	p<0.001"							

Similarly to Dean and Ortoleva (2016), we find significant positive pairwise correlations (about 0.6) between present and future time preferences and between risk and uncertainty aversion, but while they report significant positive relationship between measures of risk/uncertainty attitude and measured discount rates, we do not find such associations. Another result that we share with Dean and Ortoleva (2016) is the significant negative relationship between measured discount rate and cognitive abilities (that they call intelligence, for details see Appendix B). Frederick (2005) reports that those who obtain a higher score in the Cognitive Reflection Test, are generally more patient. We see this finding in our measures as Time later is negatively related to cognitive abilities. Frederick (2005) also reports that in gambles involving gains (as our decisions 2 and 3) those with higher CRT score were more willing to gamble, a finding that neither we nor Dean and Ortoleva (2016) do share.[22] In our experiment, participants with higher CRT score were betting lower amounts in decision 2 and 3. In our data, cognitive abilities correlate positively with risk and uncertainty aversion, and with time preferences at the longer horizon. Dean and Ortoleva (2016) only find negative correlation between cognitive abilities and time preferences at the more distant time horizon, but no significant correlation between cognitive abilities and risk or uncertainty.

Overall, the raw measures of the preferences that we study are in line with those found in the literature and the correlations between our measures resemble in most instances those in Dean and Ortoleva (2016).

4. RESULTS

4.1 LINEAR RELATIONSHIPS

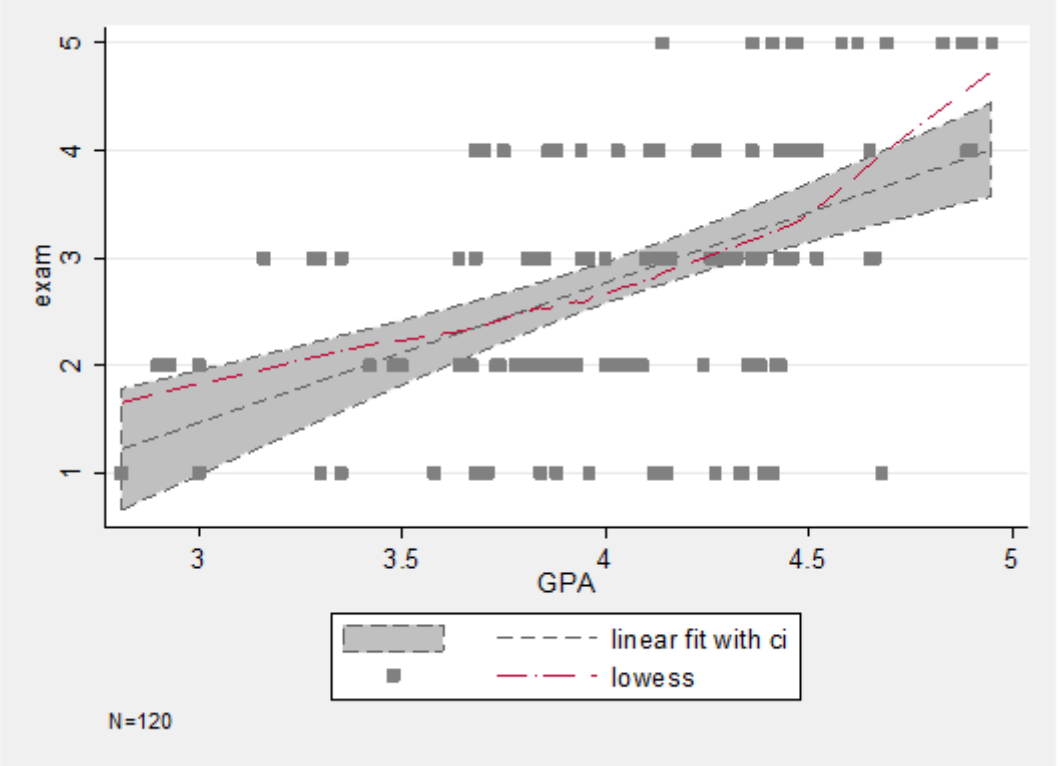
Our main question is whether and how the preferences that we measured are associated with school performance. Remember that we measure school performance using the exam results and also the GPA in the semester when the exam was taken.

We note that pairwise correlations indicate that our performance measures are highly positively correlated (p-value<0.001) (see figure 1).

[22] This finding has been confirmed by Dohmen et al. (2010). However, Andersson et al. (2015) show that this relationship may be spurious.

Figure 1

Linear and nonparametric association between the outcome variables



In Table 3, we show a correlation table indicating the association between our performance measures and the preferences and traits that we measured in our experiment.

Table 3

Correlation between preferences and academic performance

	Time now	Time later	Present bias	Risk aversion	Uncertainty aversion	Cooperativeness
Exam	-0.0833	-0.135	-0.0610	0.141	0.173*	0.0939
GPA	-0.0242	-0.0885	-0.0749	0.112	0.00465	0.00496
	Competitiveness	Cognitive (CRT)	Cognitive (knowledge)	Female	Exam	
Exam	0.000947	0.310***	0.101	-0.00324	1	
GPA	0.105	0.178*	0.122	0.208*	0.484***	

* p<0.05 ** p<0.01 *** p<0.001

Most of our measured preferences do not seem to correlate well with school performance. Only uncertainty aversion has a marginally significant linear relationship with exam grades. But, unsurprisingly, individuals with better cognitive abilities perform better. Note however,

that only the CRT measure correlates well with grades, our other – self-made – measure of cognition is a much weaker tool.

4.2 NON-LINEAR RELATIONSHIPS

Although these correlations are suggestive, they are based on the assumption that the potential relationship is linear. To allow for possible non-linearities we consider local regressions that can be represented in an illustrative way using *lowess smoothing*. Below, we show all the lowess curves that depict the relationship between the preferences and the performance measures, along with their linear associations. These curves confirm mainly the findings seen in correlations, but also give way to other, non-linear associations, which might be very important for future research.[23]

Risk and uncertainty aversion seem to have a positive effect on exam results, especially on the upper end of the distribution, but when considering GPA, the influence appears to be much smaller (Figure 2a). These associations are intuitive. At Eötvös Loránd University (our University) each student has a chance to retake all exams once per semester (and one exam per semester twice) without retaking the whole course. As our Economics exam is a twenty-item four-choice multiple choice test, so risk loving students might go for their first exam less prepared hoping that they can get a pass without much effort. Naturally, this can negatively affect their received exam grades. Many of their other exams follow different grading techniques: home assignments, oral exams or continuous testing, which makes risk taking less beneficial; hence the much weaker effect of risk preferences on GPA. (But note that due to this logic and also to the fact the Economics is one grade in the GPA we would expect a positive association between risk aversion and GPA.)

The measures related to time preferences behave as we expected based on the literature. More precisely, time preference is negatively related to exam results, but only on the upper half of the distribution. Students, whose weekly alternative costs are between 0 and 300 forints (that is those who switch from the later 3500 Ft to the earlier payment when those payments are at least 3200 Ft), perform similary well, but those, who accept less instead of the 3500 HUF later payment, on average perform worse both on the exam and have worse GPA. Some outliers blur this relationship in the *Time now* case. This suggests that more impatient students tend to have worse grades (Figure 2b), a finding that is in line with most results in the literature. This non-linear relationship is especially striking between present bias and educational outcomes. In Figure 2c, we represent on the x-axis the difference between the switching points on the two horizons. Those participants who are in the negative range are future-biased as they are relatively more patient now. If this difference is zero, then

[23] Note that on the x-axis in all figures we report minimum, median and maximum values in the given bivariate relation.

the participant is time-consistent, while in the positive range we have the present-biased individuals. The more present-biased a student is, the worse his/her performance is. The performance of future-biased students do not differ from their time-consistent peers.

We have assumed that cooperativeness has a positive effect on the grades. Looking at the exam results we see this positive linear slope but the difference between the not at all cooperative students and the very cooperative ones are slim. (see Figure 2d). However, cooperativeness seems to have a non-linear relationship with GPA. Students that offer little less than 2000 HUF for the others have the highest GPA and anyone under or over this amount perform worse (note that the median is around 2500). While it is intuitive that cooperativeness should have a higher effect on the GPA than on a single exam grade, the non-linear effect of cooperativeness is non-trivial.

Competitiveness looks to have no effect when considering the exam results, but there is a slight positive relationship regarding GPA (see Figure 2d), hinting at the possibility that more competitive students have better GPA. Note, that competitiveness was measured using the a small cognitive test. Thus, it might be wise to control for cognitive test scores to see a less biased relationhip between competitiveness and grades.

Cognitive abilities, have an especially strong positive relationship with grades. Cognitive abilities measured by the CRT have a clear positive effect (in line with expectations), but the other questions that made up the quiz do not seem to be clearly related to academic performance (see Figure 2e).

Figure 2a

Lowess curves of risk and uncertainty aversion and performance

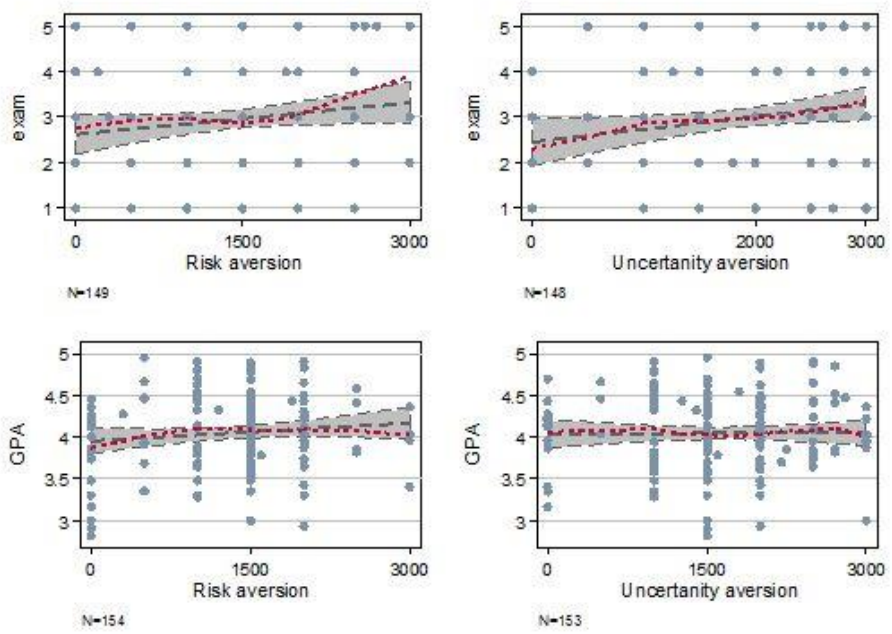


Figure 2b

Lowess curves of time preferences and performance

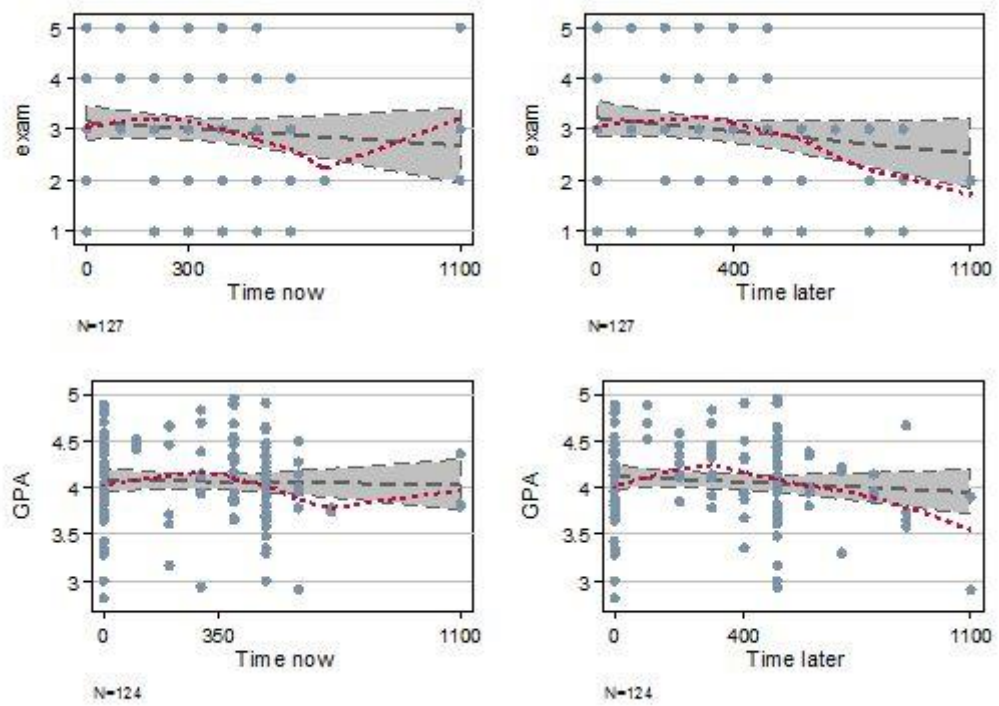


Figure 2c

Lowess curves of present bias and performance

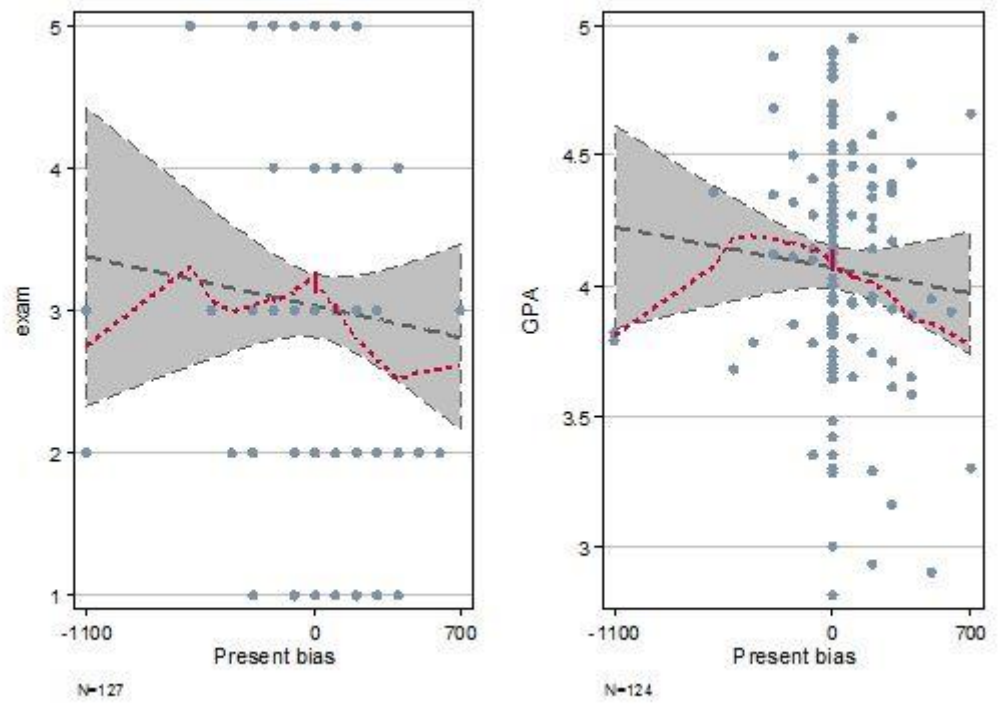


Figure 2d

Lowess curves of cooperation competition and performance

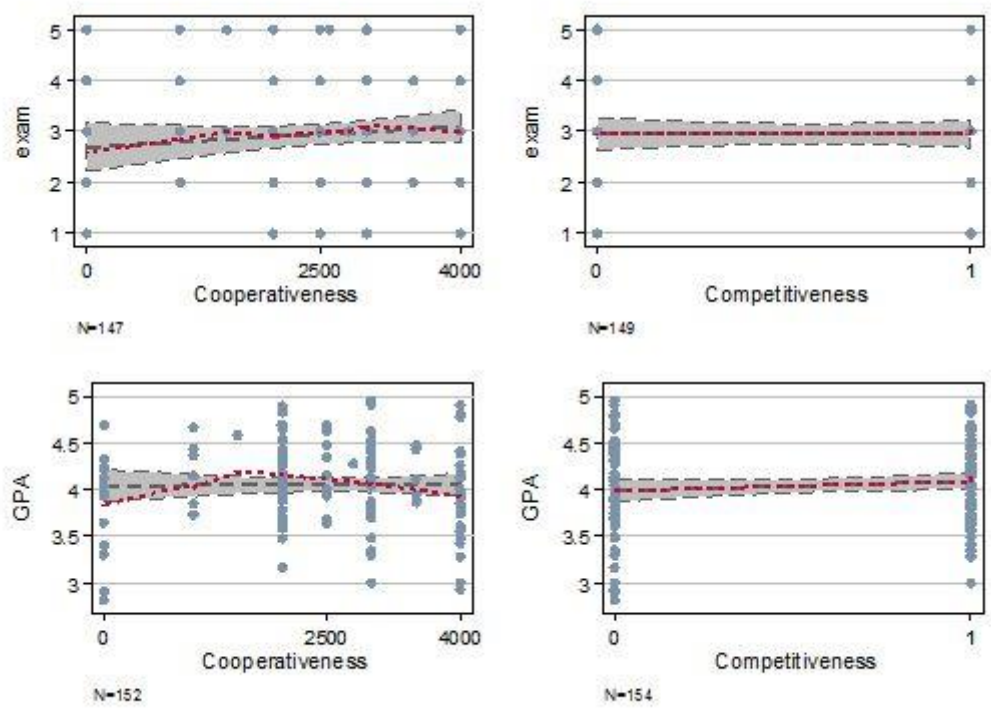
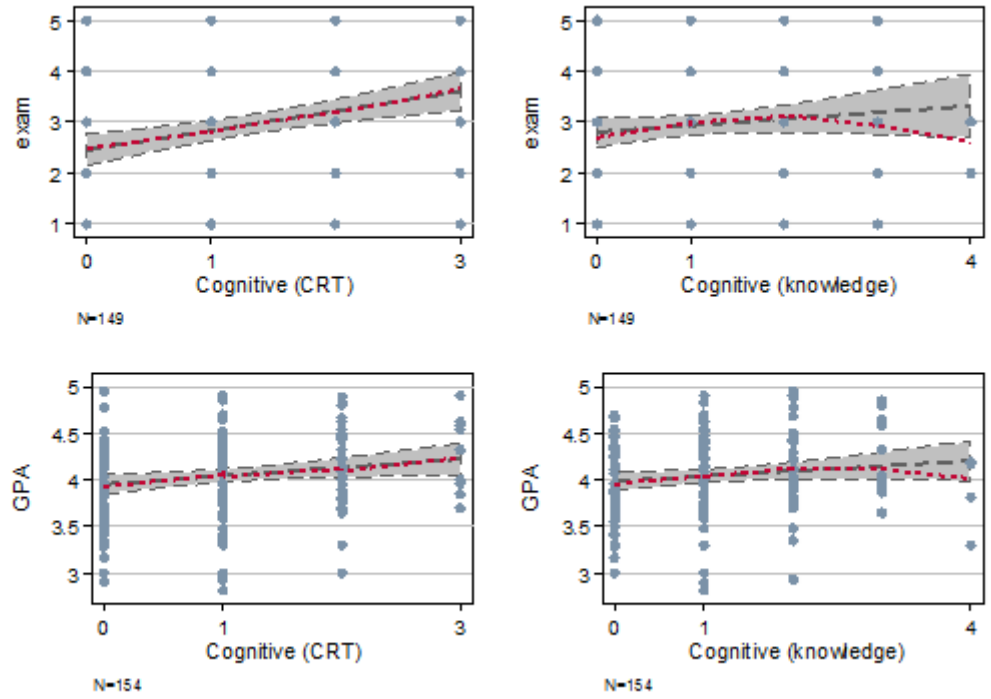


Figure 2e

Lowess curves of cognitive tests and performance



5. REGRESSIONS

5.1 LINEAR RELATIONSHIPS

As a next step, we see if the previous findings hold when we control for other variables, so we run OLS regressions. The lowess curves indicate that the relationships are linear in some cases, but non-linear in others. Whenever the bi-variate relations are linear, we will use the linear approximation, but for the time preferences we will experiment with non-linear functional forms as well.

For regressions on the exam result we include exam-time fixed effects, and also cluster the standard errors on exam time. Although the Economics exams are multiple choice tests, they are not standardized, so it might be that the exam is harder at one time than at another. Also students from different faculties – Social Science and Computer Science – take exams at different times. By including exam time fixed effects we intend to control for these two potential confounding effects.

For regressions on the GPA we included fixed effects for the study major. Assuming different departments grade differently and also that different majors have different subjects, this might – and sometimes do – change the results. We have also utilized the number of credits that students have gained: using the number of credits as frequency weights we give a higher weight to a student that takes more classes than another with fewer credits. We have clustered the standard errors on student level within these credit-weighted regressions. As a robustness check we also report the unweighted regressions.

In all regressions below, we control for the gender of the student. This is especially important as gender balance is not even across faculties and majors.

As can be seen in Tables 4a-c below, the regressions confirm most of the previous findings. The most solid result is that cognitive abilities measured by the Cognitive Reflection Test affect positively and significantly both exam results and the GPA (both when weighted and when not). Competitiveness seems to associate positively and significantly with GPA (both weighted and unweighted) once the gender and study-major fixed-effects are controlled for, and the point estimates of the exam grades are very similar to the GPA point estimates. Uncertainty / risk aversion is positively and significantly related to better exam results and GPA in the weighted regression. These linear regressions fail to detect any association between time preferences, present bias, cooperativeness and the educational performance.

Table 4a

Linear regressions of exam grades and preferences

VARIABLES	(1) exam	(2) exam	(3) exam	(4) exam	(5) exam	(6) exam	(7) exam	(8) exam	(9) exam
Time now (100HUF)	-0.0364								
	(0.0555)								
Time later (100HUF)		-0.0709							
		(0.0403)							
Risk aversion (100 HUF)			0.0234						
			(0.0152)						
Uncertanity aversion (100 HUF)				0.0290*					
				(0.0152)					
Present bias					-0.0447				
					(0.0605)				
Cooperativeness (100 HUF)						0.00844			
						(0.0101)			
Competitiveness							0.114		
							(0.353)		
Cognitive (knowledge)								0.146*	
								(0.0775)	
Cognitive (CRT)									0.487***
									(0.0868)
Female	-0.0343	0.0260	-0.0266	0.0738	-0.0229	-0.0569	-0.00557	0.00487	0.326
	(0.426)	(0.413)	(0.340)	(0.321)	(0.453)	(0.386)	(0.385)	(0.367)	(0.271)
Constant	3.160***	3.236***	3.363***	3.280***	3.062***	2.782***	2.910***	2.810***	2.128***
	(0.429)	(0.373)	(0.375)	(0.356)	(0.307)	(0.382)	(0.391)	(0.262)	(0.209)
Observations	121	121	139	138	121	138	139	139	139
R-squared	0.093	0.108	0.133	0.140	0.095	0.124	0.117	0.127	0.233
exam time FE	y	y	y	y	y	y	y	y	y
weights	n	n	n	n	n	n	n	n	n

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4b

Linear regressions of GPA and preferences – without weights

VARIABLES	(1) GPA	(2) GPA	(3) GPA	(4) GPA	(5) GPA	(6) GPA	(7) GPA	(8) GPA	(9) GPA
Time now (100HUF)	-0.000268								
	(0.0315)								
Time later (100HUF)		-0.0145							
		(0.0263)							
Risk aversion (100 HUF)			0.0112						
			(0.00558)						
Uncertainty aversion (100 HUF)				0.00141					
				(0.00177)					
Present bias					-0.0178				
					(0.0139)				
Cooperativeness (100 HUF)						0.000353			
						(0.00238)			
Competitiveness							0.150*		
							(0.0606)		
Cognitive (CRT)								0.0950***	
								(0.0164)	
Cognitive (knowledge)									0.0392
									(0.0276)
Female	0.150	0.163*	0.195***	0.210**	0.166*	0.204**	0.239***	0.234**	0.212**
	(0.0764)	(0.0631)	(0.0405)	(0.0493)	(0.0716)	(0.0523)	(0.0430)	(0.0538)	(0.0491)
Constant	3.956***	3.992***	4.108***	3.919***	3.949***	3.894***	3.791***	3.784***	3.855***
	(0.133)	(0.114)	(0.104)	(0.0333)	(0.0564)	(0.0638)	(0.0446)	(0.0441)	(0.0270)
Observations	118	118	142	141	118	141	142	142	142
R-squared	0.038	0.045	0.084	0.054	0.046	0.052	0.080	0.088	0.062
major FE	y	y	y	y	y	y	y	y	y
freq. weights	n	n	n	n	n	n	n	n	n

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4b

Linear regressions of GPA and preferences – with weights

VARIABLES	(1) GPA	(2) GPA	(3) GPA	(4) GPA	(5) GPA	(6) GPA	(7) GPA	(8) GPA	(9) GPA
Time now (100HUF)	-0.00435								
	(0.0161)								
Time later (100HUF)		-0.0139							
		(0.0185)							
Risk aversion (100 HUF)			0.0116**						
			(0.00531)						
Uncertanity aversion (100 HUF)				0.000825					
				(0.00473)					
Present bias					-0.0123				
					(0.0188)				
Cooperativeness (100 HUF)						0.000400			
						(0.00366)			
Competitiveness							0.139*		
							(0.0819)		
Cognitive (CRT)								0.0994**	
								(0.0402)	
Cognitive (knowledge)									0.0477
									(0.0369)
Female	0.154	0.167	0.194**	0.208**	0.166	0.203**	0.235**	0.231**	0.212**
	(0.108)	(0.106)	(0.0904)	(0.0947)	(0.110)	(0.0965)	(0.0954)	(0.0974)	(0.0950)
Constant	3.993***	4.016***	4.143***	3.941***	3.975***	3.921***	3.827***	3.810***	3.871***
	(0.121)	(0.116)	(0.118)	(0.107)	(0.0966)	(0.138)	(0.108)	(0.104)	(0.0964)
Observations	3,572	3,572	4,274	4,245	3,572	4,246	4,274	4,274	4,274
R-squared	0.039	0.045	0.083	0.052	0.043	0.051	0.074	0.089	0.065
major FE	y	y	y	y	y	y	y	y	y
freq. weights	y	y	y	y	y	y	y	y	y

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.2 NON-LINEAR RELATIONSHIPS

As we have argued above time preferences seem to have a non-linear relationship with grades. Both patience (Time Now and Time Later) as well as their differenes, the present bias, seem to correlate strongly with exam results and GPA but only on specific intervals on the lowess curves. In the regressions below we show that this partial relationship is also statistically significant.

Table 5 below shows that patience and present bias correlates significantly with exam results and that the correlation with GPA is also negative but insignificant on conventional levels. Moreover, Table 6 also shows that the squared function of Time Later significantly relates to both exam grades and the GPA (and that the estimation with Time Now has similar but insignificant point estimates due to a couple of outliers at the upper end).

Besides the facevalue of the lowess curves above these relations are also theoretically sound: we find that large present bias has a negative association with exam grades (but not GPA), but also that future bias has no relation to either exam grades or GPA. Also patience (concretely, our Time Later variable) matters especially for those, who are very impatient. Our estimates of time preference – as any – is inherently imperfect, thus we do not find much difference with not or little impatient student. However, students who value the future much less than the present also perform worse in school, as school is a very tipical investment in the future.

Table 5

Regressions of grades and present bias

	(1)	(2)	(3)
VARIABLES	exam	GPA	GPA
Future bias (100HUF)	0.0276	0.00843	0.0106
	(0.0629)	(0.0240)	(0.0169)
Present bias (100HUF)	-0.131**	-0.0467	-0.0442
	(0.0418)	(0.0228)	(0.0343)
Female	-0.00526	0.167*	0.179
	(0.444)	(0.0710)	(0.108)
Constant	3.162***	3.989***	3.990***
	(0.312)	(0.0800)	(0.101)
Observations	121	118	3,423
R-squared	0.110	0.061	0.060
exam time FE	y		
weights	n	n	y
faculty FE		y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6a

Regressions of grades and time now

VARIABLES	(1) exam	(2) exam	(3) GPA	(4) GPA	(5) GPA	(6) GPA
Time now (100HUF)	-0.0364	-0.0522	-0.000268	0.0343	-0.000488	0.0358
	(0.0555)	(0.113)	(0.0315)	(0.0582)	(0.0162)	(0.0344)
Time now, squared (100 HUF)		0.00220		-0.00477		-0.00499
		(0.0128)		(0.00387)		(0.00354)
Female	-0.0343	-0.0312	0.150	0.145	0.165	0.158
	(0.426)	(0.420)	(0.0764)	(0.0776)	(0.104)	(0.102)
Constant	3.160***	3.171***	3.956***	3.931***	3.956***	3.931***
	(0.429)	(0.463)	(0.133)	(0.154)	(0.116)	(0.122)
Observations	121	121	118	118	3,423	3,423
R-squared	0.093	0.093	0.038	0.047	0.039	0.049
exam time FE	y	y				
weights	n	n	n	n	y	y
major FE			y	y	y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6b

Regressions of grades and time later

VARIABLES	(1) exam	(2) exam	(3) GPA	(4) GPA	(5) GPA	(6) GPA
Time later (100HUF)	-0.0709	0.0734	-0.0145	0.0898	-0.0125	0.0942**
	(0.0403)	(0.0910)	(0.0263)	(0.0622)	(0.0180)	(0.0390)
Time later, squared (100 HUF)		-0.0194*		-0.0136**		-0.0140***
		(0.00894)		(0.00443)		(0.00480)
Female	0.0260	0.0215	0.163*	0.177*	0.177*	0.189*
	(0.413)	(0.407)	(0.0631)	(0.0679)	(0.102)	(0.0983)
Constant	3.236***	3.116***	3.992***	3.892***	3.987***	3.885***
	(0.373)	(0.395)	(0.114)	(0.165)	(0.111)	(0.113)
Observations	121	121	118	118	3,423	3,423
R-squared	0.108	0.126	0.045	0.120	0.044	0.121
exam time FE	y	y				
weights	n	n	n	n	y	y
major FE			y	y	y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The other preference, where we have seen a possible non-linear effect was cooperativeness. As seen in the regressions in Table 7 below a quadratic function describes the data better than the linear one, especially with GPA as dependent variable. Based on these estimates those, who have contributed to little over 2000HUF to the public good perform around 0.3 grades better than those, who have contributed nothing or everything to the pot. This is a significant difference.

Table 7

Regressions of grades and cooperativeness

VARIABLES	(1) exam	(2) exam	(3) GPA	(4) GPA	(5) GPA	(6) GPA
Cooperativeness (100 HUF)	0.00844	0.0270	0.000353	0.0277***	0.000414	0.0278**
	(0.0101)	(0.0326)	(0.00238)	(0.00421)	(0.00375)	(0.0113)
Cooperativeness squared (100 HUF)		-0.000433		-0.000646***		-0.000648***
		(0.000730)		(0.000117)		(0.000238)
Female	-0.0569	-0.0658	0.204**	0.187**	0.215**	0.197**
	(0.386)	(0.379)	(0.0523)	(0.0603)	(0.0941)	(0.0873)
Constant	2.782***	2.655***	3.894***	3.718***	3.892***	3.717***
	(0.382)	(0.498)	(0.0638)	(0.0677)	(0.141)	(0.154)
Observations	138	138	141	141	4,090	4,090
R-squared	0.124	0.127	0.052	0.107	0.054	0.109
exam time FE	y	y				
weights	n	n	n	n	y	y
major FE			y	y	y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.3 MULTIVARIATE LINEAR REGRESSIONS

Although the number of observations in our study is not very large, and thus running multivariate regressions risks the problem of overidentification, we still experimented with the inclusion of more than one preference in the regressions.

First of all, as we have shown above both risk aversion and non-linear time preferences (or present bias) associate with grades. These two preferences might signal the same non-cognitive trait, as impatience or present bias can easily stem from an inherent dispreference towards risk (cf. future is risky). Including both preferences in one regression (see table 8), however, does not affect the point estimates or their significance.[24] This suggests that risk aversion and time preferences are indeed different non-cognitive traits (Andreoni and Sprenger, 2012), which both relate, independently, to school performance.

[24] Note: we use Time Later to proxy impatience as it suffers less from outliers.

Table 8

Multivariate regressions of time preferences, risk aversion and grades

VARIABLES	(1) exam	(2) GPA	(3) GPA	(4) exam	(5) GPA	(6) GPA
Future bias (100HUF)	0.0106	0.00561	0.00746			
	(0.0667)	(0.0271)	(0.0178)			
Present bias (100HUF)	-0.136**	-0.0485	-0.0454			
	(0.0427)	(0.0252)	(0.0350)			
Time later (100HUF)				0.0733	0.0831	0.0857**
				(0.0989)	(0.0594)	(0.0367)
Time later, squared (100 HUF)				-0.0192*	-0.0129**	-0.0131***
				(0.00950)	(0.00395)	(0.00434)
Risk aversion (100 HUF)	0.0281*	0.0124	0.0138**	0.0265	0.0108	0.0123**
	(0.0147)	(0.00681)	(0.00592)	(0.0170)	(0.00558)	(0.00542)
Female	0.00819	0.168**	0.180*	0.0277	0.176**	0.189**
	(0.397)	(0.0500)	(0.0995)	(0.369)	(0.0493)	(0.0918)
Constant	3.589***	4.200***	4.226***	3.526***	4.087***	4.108***
	(0.414)	(0.0777)	(0.130)	(0.478)	(0.0873)	(0.136)
Observations	121	118	3,423	121	118	3,423
R-squared	0.136	0.097	0.104	0.150	0.147	0.156
exam time FE	y					
weights	n	n	y	n	n	y
major FE		y	y	y	y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

On a different note, one might argue that competitiveness matters only through higher cognitive test scores. Remember, competitiveness was measures using a small cognitive test. If a student knew that s/he was performing badly on that small test, she was less likely to opt for the competitive payment. Thus, including both cognitive scores in the regression could show whether they alter the association of competitiveness and performance (see table 9). Apparently this association does not depend on the cognitive scores of the students. Students, who opted for the competitive payment on average receive 0.13 higher grades, even after controlling for their cognitive test scores. And this effect is marginally significant for the GPA.

Table 9

Multivariate regressions of competitiveness, cognitive skills and grades

VARIABLES	(1) exam	(2) GPA	(3) GPA
Competitiveness	0.136	0.143*	0.132
	(0.275)	(0.0646)	(0.0808)
Cognitive (knowledge)	0.0955	0.0364	0.0419
	(0.0866)	(0.0314)	(0.0346)
Cognitive (CRT)	0.475***	0.0818***	0.0861**
	(0.0888)	(0.0166)	(0.0407)
Female	0.350	0.264***	0.275***
	(0.281)	(0.0469)	(0.0955)
Constant	1.947***	3.648***	3.642***
	(0.318)	(0.0558)	(0.135)
Observations	139	142	4,120
R-squared	0.240	0.115	0.118
exam time FE	y		
weights	n	n	y
major FE		y	y

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
clustered se in parentheses

Finally, plugging (almost) all variable in the regression (table 10) below does not really change the conclusions. Of course, as the power of our analysis is rather small, it eliminates some significant effects, and while some point estimates also decreased a little (e.g. time preferences) the main direction of associations remain, suggesting we were quite successful in finding and measuring independent preferences.

Table 10

Multivariate regressions of (almost) all preferences and grades

VARIABLES	(1) exam	(2) GPA	(3) GPA	(4) exam	(5) GPA	(6) GPA
Future bias (100HUF)	0.0227	0.0146	0.0159			
	(0.0485)	(0.0182)	(0.0150)			
Present bias 0 (100HUF)	-0.130***	-0.0293	-0.0268			
	(0.0397)	(0.0329)	(0.0315)			
Time later (100HUF)				-0.0529	0.0573	0.0601
				(0.100)	(0.0401)	(0.0371)
Time later, squared (100 HUF)				-0.00410	-0.00869**	-0.00899*
				(0.0131)	(0.00282)	(0.00464)
Risk aversion (100 HUF)	0.0170	0.0113	0.0121**	0.0160	0.0105	0.0113**
	(0.0170)	(0.00834)	(0.00569)	(0.0196)	(0.00766)	(0.00563)
Cooperativeness (100 HUF)	0.0501	0.0392**	0.0382***	0.0512	0.0334**	0.0324***
	(0.0460)	(0.0134)	(0.0110)	(0.0532)	(0.0115)	(0.0111)
Cooperativeness squared (100 HUF)	-0.00101	-0.000928**	-0.000905***	-0.00100	-0.000802**	-0.000777***
	(0.000991)	(0.000287)	(0.000249)	(0.00108)	(0.000246)	(0.000260)
Competitiveness	0.206	0.191***	0.178*	0.229	0.181***	0.163*
	(0.376)	(0.0346)	(0.0942)	(0.385)	(0.0328)	(0.0930)
Cognitive (CRT)	0.456***	0.0771*	0.0818*	0.468***	0.0757*	0.0790*
	(0.0919)	(0.0343)	(0.0489)	(0.104)	(0.0301)	(0.0474)
Cognitive (knowledge)	0.135	-0.00407	0.000671	0.124	-0.00763	-0.00251
	(0.107)	(0.0480)	(0.0373)	(0.0864)	(0.0497)	(0.0380)
Female	0.275	0.190**	0.201**	0.329	0.202***	0.213**
	(0.391)	(0.0450)	(0.0942)	(0.397)	(0.0401)	(0.0894)
Constant	1.912**	3.695***	3.712***	1.924**	3.668***	3.688***
	(0.640)	(0.0396)	(0.184)	(0.704)	(0.0721)	(0.180)
Observations	120	117	3,393	120	117	3,393
R-squared	0.285	0.231	0.231	0.293	0.251	0.253
exam time FE	y	n	n	y	n	n
major FE	n	y	y	n	y	y
weights	n	n	y	n	n	y
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1					

6. DISCUSSION AND CONCLUSION

Our paper has aimed to be a frontrunner in connecting laboratory-based measures of preferences with real-life measures of school success. Being an exploratory pilot study we experimented with four different preferences, which, according to the literature, might have an impact on school performance. We measure in an incentivized way risk, time, social and competitive preferences and also cognitive abilities of university students and attempted to find associations between these measures and two important academic outcome measures: exam results and GPA.

We find consistently that cognitive abilities are very well correlated with school performance. We used the Cognitive Reflection Test (Frederick 2005) to proxy cognitive skills and found that it explains grades on the Economics exam extremely well, and also associates well with the more general GPA.

Regarding non-cognitive skills, we find suggestive evidence for many of four measured preferences.

First of all, the most emphatic non-cognitive skill in the literature is time preference (see also: conscientiousness, or self-control, or discipline). We used two alternative measures of time preference: patience and present bias. We measured patience as a choice between different amounts of money at different points in time. The more an individual values future payoffs, the more patient she is. Moreover, if an individual is more impatient on the short-term horizon than on the long-term, then she exhibits *present bias* that may make it hard for the individual to make efforts immediately, and she tends to procrastinate efforts and costs. While these two indicators of time preference seem to act similarly for both measures of school performance, it is the present bias that explains exam grades relatively better, and patience that explains GPA better. We have also pinpointed that both measures of time preferences have a non-linear relation to school performance. Students exhibiting future bias (those who are more patient on the short run than on the long run) perform similarly to time-consistent students (who are just as patient in the short as in the long run). However, the more present-biased a student is, the worse her grades are. Similarly, patience does not differentiate between very patient and a between little impatient students, however very impatient students seem to perform worse in school.

Economists might be pleased to hear that competitiveness seems to matter. At least this is what we find. Students, who opt for a more competitive payment scheme in our experiments seem to have a little higher average GPA and better exam grades. This,

however, might be confounded by the gender of the students. Unfortunately, we could not study this aspect, as our sample was seriously gender imbalanced across faculties (Social Science students are mainly girls while boys are more likely come from the Computer Science faculty).

We have also seen that risk-averse students perform a little better than risk loving students. And that risk preferences matter a slightly bit more for the exam grade than for the general GPA. In case of multiple choice exams it makes perfect sense for risk loving students to go for their first try less prepared, as the possibility of passing as exam just by chance is not zero. Thus, the expected exam grades of risk lovers tend to be lower, which might affect their GPA as well.

Finally, we have also detected that cooperative preferences – the amount of money offered in a public good game – associates strongly with GPA, but in a non-linear way. Students who offered around half of their possible amounts had significantly higher GPAs than those, who offered none or all their money. We do not find this effect for exam grades, and have no real theoretical explanations for the non-linear relationship.

All in all, we consider this research a pilot. All our results can be considered preliminary, for three reasons. First, although our sample size is relatively large for an experimental study, we still run the risk of overidentification when looking at several preferences simultaneously. Second, although our experiments were incentivized, these incentives were relatively small, as we could only pay a couple of students per class based on their decisions. Third, although these preference measures are relatively well established in the behavioural economics literature, they are not at all validated in the economics of education studies. It might be that time preferences – as we measure them – are but poor proxies of more important non-cognitive traits (as self-discipline, for instance, see Duckworth and Seligman, 2005), and that cooperativeness should matter not on the individual but on the group level. Thus, we intend this research to generate debate and inspire future research, which could underline or falsify our findings.

REFERENCES

Anderhub, V., Güth, W. Gneezy, U., & Sonsino, D. (2001) On the interaction of risk and time preferences: An experimental study. German Economic Review, 2(3). 239-253.

Andersson, O., Tyran, J. R., Wengström, E., & Holm, H. J. (2015). Risk Aversion Relates to Cognitive Ability: Preferences or Noise?. Journal of the European Economic Association, forthcoming.

Andreoni, J., & Sprenger, C. (2012). Risk preferences are not time preferences. American Economic Review, 102(7), 3357-3376.

Ariely, D., and K. Wertenbroch (2002): "Procrastination, Deadlines, and Performance: Self-Control by Precommitment," Psychological Science, 13(3), 219–224.

Ashraf, Nava, Dean Karlan, and Wesley Yin. 2006. "Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines." Quarterly Journal of Economics, 121(2): 635-72.

Azmat, G., & Iriberri, N. (2010). The importance of relative performance feedback information: Evidence from a natural experiment using high school students. Journal of Public Economics, 94(7), 435-452.

Barsky, Robert B., F. Thomas Juster, Miles S. Kimball, and Matthew D. Shapiro, "Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study," Quarterly Journal of Economics, 1997, 112, 537–579.

Belzil, C., & Leonardi, M. (2007). Can risk aversion explain schooling attainments? Evidence from Italy. Labour Economics, 14(6), 957-970.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. Games and economic behavior, 10(1), 122-142.

Beshears, John, James J. Choi, David Laibson, and Brigitte C. Madrian. 2008. 'The Importance of Default Options for Retirement Saving Outcomes: Evidence from the USA." In Lessons from Pension Reform in the Americas , edited by Stephen J. Kay and Tapen Sinha, 59-87. Oxford: Oxford University Pres

Bettinger, E., & Slonim, R. (2007). Patience among children. Journal of Public Economics, 91(1), 343-363.

Bonin, Holger, Thomas Dohmen, Armin Falk, David Huffman, and Uwe Sunde, "Cross-Sectional Earnings Risk and Occupational Sorting: The Role of Risk Attitudes," Labour Economics, 2007, 14 (6), 926–937.

Borghans, L., & Golsteyn, B. H. (2006). Time discounting and the body mass index: Evidence from the Netherlands. Economics & Human Biology, 4(1), 39-61.

Borghans, L., Duckworth, A. L., Heckman, J. J., & Ter Weel, B. (2008). The economics and psychology of personality traits. Journal of human Resources,43(4), 972-1059.

Bucciol, A., Houser, D., & Piovesan, M. (2010). Willpower in children and adults: a survey of results and economic implications. International Review of Economics, 57(3), 259-267.

Burger, N., G. Charness, and J. Lynham (2011): "Field and Online Experiments on Self-Control," Journal of Economic Behavior & Organization, 77, 393–404.

Cadena, Brian C., and Benjamin J. Keys. 2015. "Human Capital and the Lifetime Costs of Impatience." American Economic Journal: Economic Policy, 7(3): 126-53.

Castillo, M., Ferraro, P., Jordan J. and Petrie, R. (2011), "The Today and Tomorrow of Kids: Time Preferences and Educational Outcomes of Children," Journal of Public Economics 95 (11- 12), 1377-85.

Chabris, Christopher F., David Laibson, Carrie L. Morris, Jonathan P. Schuldt, and Dmitry Taubinsky, "Individual Laboratory-Measured Discount Rates Predict Field Behavior," Journal of Risk and Uncertainty, 2008, 37 (2-3), 237–269.

Chamorro-Premuzic, T., & Furnham, A. (2003). Personality predicts academic performance: Evidence from two longitudinal university samples. Journal of Research in Personality, 37(4), 319-338.

Chamorro-Premuzic, T., & Furnham, A. (2004). A possible model for explaining the personality-intelligence interface. British Journal of Psychology, 95, 249–264.

Chapman, G., Coups, E., 1999. Time preferences and preventive health behavior: acceptance of the influenza vaccine. Med. Decis. Making 19, 307–314.

Chapman, G., Nelson, R., Hier, D., 1999. Familiarity and time preferences: decision making about treatments for migraine headaches and Crohn's disease. J. Exp. Psych. Appl. 5 (1), 17–34.

Chapman, G., Elstein, A., 1995. Valuing the future, temporal discounting of health and money. Med. Decis. Making 15 (4), 373–386.

Chaudhuri, Ananish., 2011. Sustaining cooperation in laboratory public goods experiments. Experimental Economics, 14: 47–83

Cornsweet, Tom N., "The Staircase-Method in Psychophysics," American Journal of Psychology, 1962, 75 (3), 485–491.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. Journal of Economic Literature, 448-474.

Dean, M., & Ortoleva, P. (2016). Is it all connected? A testing ground for unified theories of behavioral economics phenomena. A Testing Ground for Unified Theories of Behavioral Economics Phenomena (August 13, 2015).

Della Vigna, Stefano, and Ulrike Malmendier. 2006. "Paying Not to Go to the Gym." American Economic Review 96 (3): 694-71

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde. 2006. "Dynamic Inconsistency Predicts Self-Control Problems in Humans." Unpublished.

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. (2010). Are Risk Aversion and Impatience Related to Cognitive Ability?. American Economic Review, 100, 1238-1260.

Duckworth, A. L., & Seligman, M. E. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. Psychological science,16(12), 939-944.

Duckworth, A. L., & Seligman, M. E. (2006). Self-discipline gives girls the edge: Gender in self-discipline, grades, and achievement test scores. Journal of Educational Psychology, 98(1), 198.

Ellsberg, Daniel. 1961. "Risk, Ambiguity and the Savage Axioms." Quarterly Journal of Economics, 75: 643–669.

Englmaier, F., & Gebhardt, G. (2016). Social Dilemmas in the Laboratory and in the Field. Journal of Economic Behavior & Organization.

Epper, Thomas & Fehr-Duda, Helga (2015) The Missing Link: Unifying Risk Taking and Time Discounting. Discussion Paper.

Falk, Armin and Becker, Anke and Dohmen, Thomas J. and Enke, Benjamin and Huffman, David, The Nature and Predictive Power of Preferences: Global Evidence. IZA Discussion Paper No. 9504. Available at SSRN: https://ssrn.com/abstract=2696302

Falk, A., Becker, A., Dohmen, T. J., Huffman, D., & Sunde, U. (2016). The preference survey module: A validated instrument for measuring risk, time, and social preferences.

Frederick, S. (2005). Cognitive reflection and decision making. The Journal of Economic Perspectives, 19(4), 25-42.

Frederick, S., Loewenstein, G., & O'donoghue, T. (2002). Time discounting and time preference: A critical review. Journal of economic literature, 351-401.

Galizzi, M. M., & Navarro-Martínez, D. (2015). On the external validity of social-preference games: A systematic lab-field study. Workin Paper Series.

Golsteyn, Bart HH, Hans Grönqvist, and Lena Lindahl. "Adolescent time preferences predict lifetime outcomes." The Economic Journal 124.580 (2014): F739-F761.

Guiso, L., & Paiella, M. (2008). Risk aversion, wealth, and background risk.Journal of the European Economic association, 6(6), 1109-1150.

Hartlaub, V., & Schneider, T. (2012). Educational choice and risk aversion: How important is structural vs. individual risk aversion? (No. 433). SOEPpapers on multidisciplinary panel data research.

Komlos, J., P. Smith, and B. Bogin (2004): "Obesity and the Rate of Time Preference: Is There a Connection?," Journal of Biosocial Science, 36(2), 209–219.

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

Leigh, J. P. (1986) Accounting for tastes: correlates of risk and time preferences. Journal of Post Keynesian Economics, 9(1), 17-31

Loewenstein, G., 1987. Anticipation and the valuation of delayed consumption. Econ. J. 97 (387), 666–684.

Meier, S., & Sprenger, C. (2010). Present-biased preferences and credit card borrowing. American Economic Journal: Applied Economics, 193-210.

Meier, S., & Sprenger, C. D. (2012). Time discounting predicts creditworthiness. Psychological Science, 23(1), 56-58.

Mischel W (1996) From good intentions to willpower. In: Gollwitzer PM, Bargh JA (eds) The psychology of action: linking cognition and motivation to behavior. Guilford, New York

Niederle, Muriel, "Gender" in Kagel, J. H., & Roth, A. E. (Eds.). (2016). The Handbook of Experimental Economics, Volume 2: The Handbook of Experimental Economics. Princeton University Press.

Niederle, Muriel, and Lise Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" Quarterly Journal of Economics, 122(3): 1067–1101

O'Connor, M., & Paunonen, S. (2007). Big Five personality predictors of post-secondary academic performance. Personality and Individual Differences, 43, 971–990

Obrecht, N. A., Chapman, G. B., & Gelman, R. (2009). An encounter frequency account of how experience affects likelihood estimation. Memory & Cognition, 37, 632–643.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. Psychological Bulletin, 135(2), 322.

Rubinstein, A., 2006. Discussion of “behavioral economics”. In: Blundell, R., Newey, W.K., Persson, T. (Eds.), Advances in Economics and Econometrics. In:Econ. Soc. Monogr., vol. 42. Cambridge University Press, pp. 246–257.

Sayman, S., Öncüler, A., 2009. An investigation of time-inconsistency. Manage. Sci. 55 (3), 470–482.

Solomon, L., and E. Rothblum (1984): “Academic procrastination: Frequency and cognitive-behavioral correlates,” Journal of Counseling Psychology, 31(4), 503–509.

Steel, P. (2007): “The Nature of Procrastination: A Meta-Analytic and Theoretical Review of Quintessential Self-Regulatory Failure,” Psychological Bulletin, 133(1), 65–94.

Sutter, M., Kocher, M., Glaetzle-Rützler, D., & Trautmann, S. (2013). Impatience and uncertainty: experimental decisions predict adolescents’ field behavior. American Economic Review, 103, 510–531.

Toplak, M. E., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. Memory & Cognition, 39(7), 1275-1289.

APPENDIX A – INSTRUCTIONS

Dear participant!

You particpate in a scientific research carried out by Dániel Horn and Hubert János Kiss, assistant professors at Eötvös Loránd University.

Participation is VOLUNTARY. You can interrupt the experiment at any moment or refuse to answer the questions without giving any explanation.

Participation is ANONYMOUS. We treat any information gathered in this research confidentially. However, we would like to ask for your NEPTUN code as it is an important part of the research to lint the results of this experiment with your academic results. After linking the data, we will erase your code.

Neptun code: _____

The results of this experiment will be used for research purposes carried out at the Department of Economics, Faculty of Social Sciences, Eötvös Loránd University.

Thanks for particpating in this experiment!

INSTRUCTIONS

In this experiment each participant makes decisions in six different and independent situations. You may earn money depending on yoir choices! The maximum earning is 7100 Ft.

At the end of the experiment we select randomly to participants who will receive their earnings in cash.

The selection will be as follows: Each answer sheet has two tags in the upper right corner with a number on them. (Please, check that the numbers on the tag are identical with the number of the answer sheet!) 1) Keep one of the tags; 2) hand in the other tag with the answer sheet after you have completed the experiment. We will select randomly two numbers that identify two participants, and using a die we will select one of the situations in which you made the decisions. The decisions of the chosen participants will determine their earnings. The selection takes place once everybody hended in the answer sheets and earnings will be paid immediately (or depending on the situation in 1,2 or 3 weeks).

PLEASE, DO NOT SPEAK WITH OTHER PARTICIPANTS DURING THE EXPERIMENT. SHOULD YOU HAVE ANY QUESTIONS, PLEASE TURN TO THE ADMINISTRATORS OF THE EXPERIMENT!

SITUATION 1

You will be randomly matched with another participant in this room and both of you recieve 4000 Ft. You and the other participant independently may contribute any amount (between 0 and 4000 Ft) from this initial endowment to a joint account. After contribution *both* of you will receive the 70% of the total contribution. Your final earning consists of the money *not* contriuted to the joint account plus the money received from the joint account.

For example, if you contribute 3000 Ft, while the other participant 4000 Ft, then there will be 7000 Ft on the joint account. 70% of this amount is 4900 Ft, hence this the amount that both of you receive from the joint account. Since you contributed 3000 Ft out of 4000 Ft, so you have still 1000 Ft left, and consequently your final earning is 4900+1000=5900 Ft.

The next table shows some possible contributions and the ensuing earnings. (Note: youare free to choose any contribution, you are not restricted to the numbers shown in the table.)

Contribution of participant 1	Contribution of participant 2	Joint account	Earning of participant 1	Earning of participant 2
3000	4000	7000	5900	4900
3000	2000	5000	4500	5500
0	0	0	4000	4000
4000	0	4000	2800	6800
4000	4000	8000	5600	5600

How much do you contribute to the joint account?

_____ Ft

If the payoff at the end of the experiment occurs according to this situation, then the selected participants will receive the final earnings.

(In the original answer sheets, each situation was presented on a new sheet. To save space here, we present the situations compressed.)

SITUATION 2

Suppose that you receive 3000 Ft and you can use part of that amount to place a bet (between 0 and 3000 Ft) on a colour in the next gamble.

There is a bag that contains 10 black and 10 red balls. We will draw one. If the colour of the ball drawn coincides with your bet, then we double the amount of your bet.

How much would you bet?

Amount of the bet: _____ Ft

Selected colour: _____

If the payoff at the end of the experiment occurs according to this situation, then the selected participants will receive the amount of money nout used for the bet (3000-bet) and the money won on the bet.

SITUATION 3

This situation is quite similar to the previous one, but there is an important difference.

Suppose that you receive 3000 Ft and you can use part of that amount to place a bet (between 0 and 3000 Ft) on a colour in the next gamble.

There is a bag with black and red balls, but it is unknown how many of the balls are black / red. We will draw a ball and if the colour of the ball drawn coincides with your bet, then we double the amount of your bet.

How much would you bet?

Amount of the bet: _____ Ft

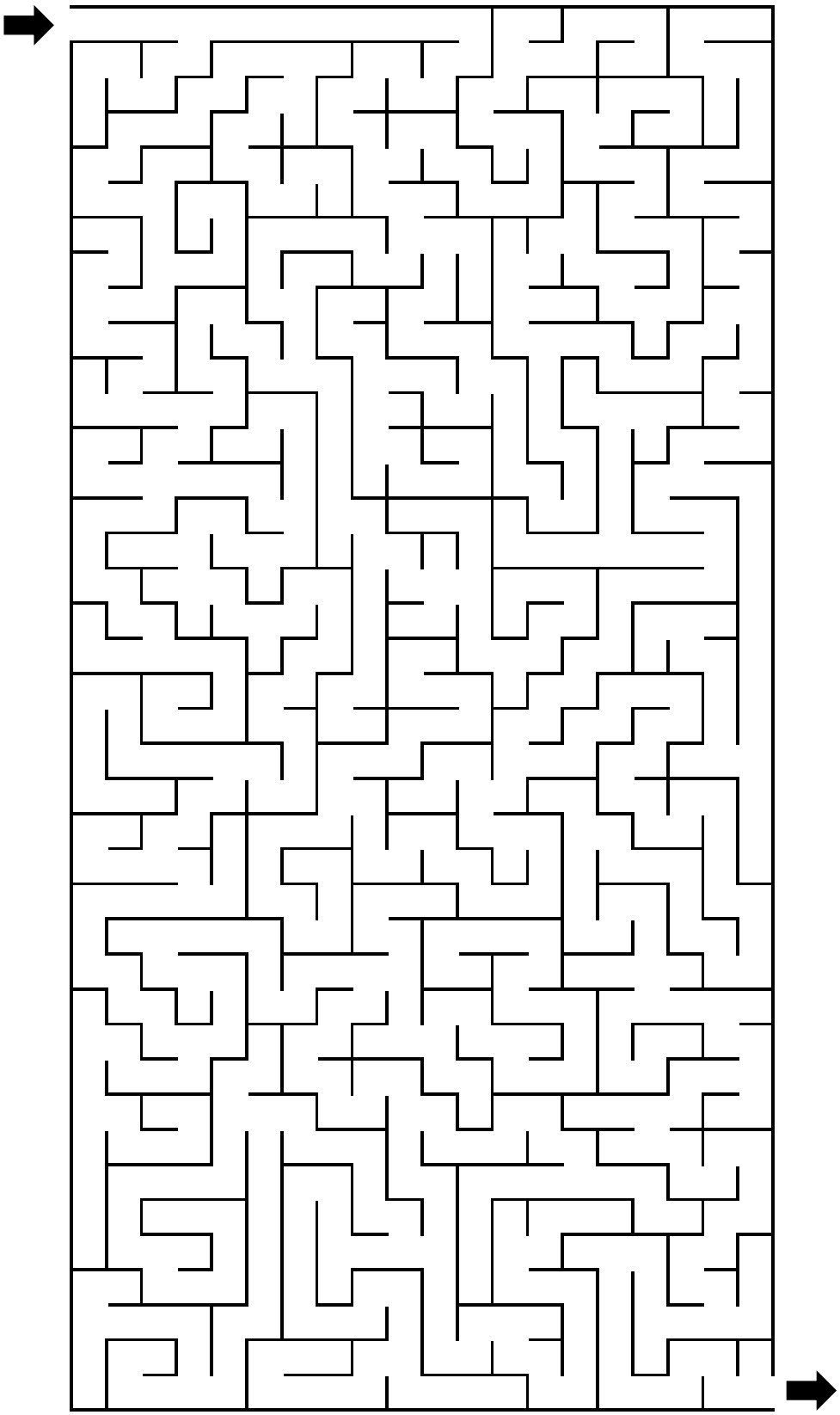
Selected colour: _____

If the payoff at the end of the experiment occurs according to this situation, then the selected participants will receive the amount of money nout used for the bet (3000-bet) and the money won on the bet.

OPTIONAL TASK

This task is optional

If you find the solution of the following maze and you will be selected, then we give you an additional 300 Ft on top of the other earnings.



SITUATION 4

In this situation you have to choose between earnings today and earnings in the future.

You may decide to have 3500 Ft in a week or a lower amount today. Choose according to if you prefer a given amount today or 3500 Ft in a week. Mark one of the possibilities in each row.

	Earning today	Earning in a week
Do you prefer **2400** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **2500** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **2600** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **2700** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **2800** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **2900** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3000** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3100** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3200** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3300** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3400** Ft today OR **3500** Ft in a week?	☐	☐
Do you prefer **3500** Ft today OR **3500** Ft in a week?	☐	☐

If the payoff at the end of the experiment occurs according to this situation, then first we select which of the above question will determine the earning. The selected participant will receive her / his earning according to her / his choice for the selected question and the earning will be paid immediately or in a week. If according to her / his choice the earning is to be paid in a week, then we put the corresponding amount of money in a sealed envelope that she / he will receive next week in this class from the professor. If this arrengement is not convenient for her / him, then she / he can collect the money at any time after the class in a week at the secretary of the Department of Economics (E3.59).

SITUATION 5

This situation is very similar to the previous one, but now you have to choose between amounts of money to be received in two or three weeks.

Choose according to if you prefer a given amount in two weeks or 3500 Ft in three weeks. Mark one of the possibilities in each row.

	Earning in two weeks	Earning in three weeks
Do you prefer **2400** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **2500** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **2600** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **2700** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **2800** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **2900** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3000** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3100** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3200** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3300** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3400** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐
Do you prefer **3500** Ft in two weeks OR **3500** Ft in three weeks?	☐	☐

If the payoff at the end of the experiment occurs according to this situation, then first we select which of the above question will determine the earning. The selected participant will receive her / his earning according to her / his choice for the selected question and the earning will be paid according to her / his choice. We put the corresponding amount of money in a sealed envelope that she / he will receive in this class from the professor on the corresponding week. If this arrengement is not convenient for her / him, then she / he can collect the money at any time after that class at the secretary of the Department of Economics (E3.59).

QUIZ

Next you find a quiz of 8 questions that is necessary for situation 6. Please answer the questions before proceeding. You are not allowed to use any help. After completing the

quiz, please answer the following questions that will determine your earnings for this situation. (We will tell the correct answers of the quiz at the end of the experiment.)

1. 4 cats eat 4 cans of cat food in 4 days. How long does it take for 40 cats to eat 40 cans?
2. In a pond, algae begin to expand and each day it doubles the surface covered. If it covers the entire pond in 10 days, how long does it take to cover half of the pond?
3. A flashlight with battery costs $3.3. The flashlight costs $3 more than the battery. How much does the battery cost?
4. How many neighbouring country does Switzerland have?
5. How many carbon atoms does a glucose molecule have?
6. How many verses does an elegiac couplet have?
7. How many members should the Hungarian Constituional Court have at least?
8. How many seasons did the series „Friends" have?

What do you think, how many of the questions did you answer correctly?

_____

SITUATION 6

Choose a compensation scheme for your answers given in the quiz. You may choose to be paid according to the number of correct answers. In this case, you will receive 250 Ft for each correct answer. Alternatively, you may choose to be paired randomly with two other participants and if the number of correct answers that you gave is higher than any of the other two participants, then you will receive 4500 Ft. In case of a tie (with the participant that had more correct answers), you will receive 2500 Ft. If the number of correct answers that you gave is less than the number of correct answers of the participant that scored better, then you receive nothing.

What do you choose? (Underline your choice)

Being paid according to the number of correct answers
OR
Being paid after comparing with two randomly chosen participants

If the payoff at the end of the experiment occurs according to this situation, then the selected participant receives the amount according to the chosen scheme. She / he receives an extra 250 Ft if she / he correctly guessed the number of correct answers.

QUESTIONNAIRE

Gender:

Year of birth:

Educational attainment

Vocational school

High school

BA degree

MA degree

other: _____

We thank for your cooperation! When you finish, please let it know the experimenters so the he can collect the answer sheets. Remember to keep one of the number tags.

APPENDIX B – MEASUREMENT VALIDATION: DEAN AND ORTOLEVA (2016)

Dean and Ortoleva (2016) have measured in a single experiment with 190 subjects many of the preferences that we have investigated also.

Dean and Ortoleva (2016) measure time preferences (they call them discount rates) as we do, that is using lists of choices that involve different amounts of money at different points in time. However, the amounts of money and the time horizons are different. Related to time preferences, they also measure present bias that captures the idea that individuals tend to exhibit higher discount rates when the payment is available immediately.

Dean and Ortoleva (2016) measure risk aversion by eliciting certainty equivalents in three 50/50 lotteries and the difference between the expected value of the lottery and the certainty equivalent is taken as risk aversion. We use also a 50/50 lottery, but we measure risk aversion as the amount of money that the individuals are willing to bet on that lottery. Dean and Ortoleva (2016) also measure uncertainty aversion (that they call ambiguity aversion) in the same vein as we do.

Dean and Ortoleva (2016) do not measure social preferences as we do, but they use the trust game to capture social concerns. Given the difference in the measures, no direct comparison can be made. Dean and Ortoleva (2016) do not measure competitive preferences.

They gauge cognitive skills with Raven's Matrices, a standard measure of perceptual reasoning. Similarly to us, they also assess overconfidence (they call it overestimation) as the difference between the number of questions that they think they got right in the test and the number of actual performance in the test.