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**Working Paper**

## Mindfulness, preferences and well-being: Mindfulness predicts adolescents' field behaviour

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# KIEL WORKING PAPER

## Mindfulness, Preferences and Well- Being

Mindfulness predicts  
adolescents' field behaviour



*No. 2127 April 2019*

*Katharina Lima de Miranda*

# Mindfulness, Preferences and Well-Being: Mindfulness predicts adolescents' field behaviour

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## Abstract

Mindfulness could influence economic and health related behaviour by bringing about increased and unbiased attention to the present moment, for example to a decision making process. This study explores the relationship between mindfulness and economic preferences, and consequently well-being, of adolescents. Comprehensive data of 525 German secondary school students were elicited and show no evidence for a strong linear or non-linear correlation between mindfulness and economic preferences. However, both mindfulness and preferences have explanatory power for adolescents' field behaviour and thus contribute to explaining variation in behaviour that may translate into serious health and economic consequences. In this regard, my findings indicate that the two concepts play rather complementary than substitutable roles, which implies that an integration of economic preferences and personality traits such as mindfulness may improve the analysis of potential sources of variation in life outcomes. As mindfulness reflects on a healthier lifestyle (less smoking and smaller BMI) and higher life satisfaction, the findings furthermore point into the direction that the development of mindfulness skills might help students to grow social-emotional capacities and increase physical and psychological well-being.

JEL-Code: C93, D81, D90, I12, I20

Keywords: time preference, risk preferences, mindfulness, personality, experiments with adolescents, subjective well-being.

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## 1. Introduction

Many decisions which set the course of life, like investment in education, are taken at a young age. Furthermore, a crucial set of non-cognitive abilities is formed and developed during childhood and these abilities appear to be as important, if not more important than cognitive abilities in determining social, economic and physical well-being in adolescence and in adulthood (Bowles et al., 2001; Heckman et al., 2006). While the predictive power of cognitive ability is well documented, economists and psychologists continue to examine the influence of non-cognitive abilities on life outcomes (Almlund et al., 2011).

The analysis of economists in this regard typically focuses on economic preferences and empirical evidence has shown that these are indeed able to explain heterogeneity in behaviour and life outcomes. In particular, experimentally elicited time and risk preferences of adults predict a wide range of important field behaviour, as for example smoking, alcohol consumption or obesity (Chabris et al., 2008; Weller et al., 2008) as well as saving decisions and credit card borrowing (Eckel et al., 2005; Meier and Sprenger, 2010). Also for children and adolescents time preferences seem to serve as a good predictor for health and economic related behaviour. Less patient behaviour in adolescents has been found to be related to a higher propensity to spend money on alcohol and cigarettes, a higher body mass index, a lower propensity to save, lower grades, and more violations of the school's code of conduct (Castillo et al., 2011; Sutter et al., 2013). Moreover, the positive relationship between patience as a child or adolescent and school performance, health, labor supply and lifetime income seems to persist even after several decades (e.g. Golsteyn et al., 2014; Moffitt et al., 2011). This is also supported from a theoretical point of view as human capital theory postulates a reverse relationship between high discount rates and investment in education (Mincer, 1958; Becker, 1964). Sutter et al. (2013, p.510) even conclude that *"taken together, more impatient children and adolescents have a considerably worse health and economic outlook"*.

In contrast to economists, psychologists rather concentrate on personality traits in the analysis of the influence of non-cognitive abilities on life outcomes. Their findings indicate that measures of personality predict a wide range of life outcomes, which are also of interest for economists (Almlund et al., 2011). Hence recently, there has been a raising interest in integrating psychological personality concepts into theories of economic choice (see e.g. Borghans et al., 2008; Camerer, 2010; Almlund et al., 2011). Empirical evidence is starting to grow as well, but overall the analysis of the relation

between economic preferences and personality and their predictive power for life outcomes is still limited (Becker et al., 2012).

To gain new insights in the relation between economic preferences and personality, this study explores whether economic preferences are related to mindfulness. Mindfulness is a psychological concept which increasingly achieves attention and is defined as purposely paying attention in the present moment in a non-judgmental way (Kabat-Zinn, 1994). It has been shown to predict health related behaviour both in terms of mental and physical health (see for example reviews by Black et al. (2009) and Burke (2010)). Mindfulness can be interpreted as a particular form of awareness which can be achieved through attention regulation, bringing about a kind of non-elaborative awareness to current experience and the capacity to relate to one's experience with curiosity, experiential openness, and acceptance (Bishop et al., 2004). One aspect of mindfulness is thus, taking an objective stand with regard to a current situation, for example a decision making process, and respond more skilfully to whatever is actually happening. Therefore, it seems likely that mindfulness influences decision making and might be related to economic preferences elicited in choice experiments.

Whether and how mindfulness relates to economic preferences is, to my knowledge, not documented in the economics literature so far. There is only one study that mentions mindfulness in relation to preferences and finds that mindfulness is one component of a factor which is negatively associated with the discount rate (Daly et al., 2009). Scarce evidence point into the direction that meditation, which is one part of mindfulness training, is related to efficient decision making. Experienced meditators have been found to accept unfair offers more often than non-meditators in an ultimatum game (Kirk et al., 2011) and subjects exposed to meditation shortly before an investment game exhibited more trust and pro-social behaviour than controls (Di Bartolomeo and Papa, 2016). Other personality measures that are closely related to mindfulness and have been analysed in relation to economic preferences are self-control, emotion regulation, and conscientiousness<sup>2</sup>. Self-control, is described as the ability to utilize regulatory resources to consciously regulate emotion and behaviour and, therefore, may describe an important ability to take inter-temporal decisions (Vohs et al., 2008). It has indeed been found to be positively correlated with patience (Daly et al., 2009). Emotion regulation is another personality trait related to being able to resist immediate rewards. It seems to influence the pattern of trading among financial investors

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<sup>2</sup> Mindfulness has been found to be positively correlated with emotion and self-regulation, as well as conscientiousness (Brown et al., 2011).

(Seo and Barrett, 2007) and to diminish loss aversion in experimental settings (Sokol-Hessner et al., 2007). Conscientiousness is one component of the well-established *Big Five* personality taxonomy and involves the ability to make sacrifices now for future rewards. Mindfulness and conscientiousness are related as they share a focus on self-discipline and self-regulation as well as thoughtful and deliberate response (see Giluk (2009) for a meta-analysis of the relation between mindfulness and the Big-Five). Conscientiousness has been linked to economic preferences, but findings are mixed. There is some evidence for a significant positive correlation between conscientiousness and patience in survey data (Becker et al., 2012; Mahalingam et al., 2014). However, others find no significant relationship between this personality trait and preference measures for time and risk attitudes (Dohmen et al., 2010; Rustichini et al., 2016).

The relationship between mindfulness and decision making is of additional interest because mindfulness training and mindfulness based interventions gain more and more popularity. For though mindfulness is regarded a trait (e.g. Kabat-Zinn, 2003), there is concordance among researchers that it can be strengthened and cultivated by mindfulness training (Brown et al., 2011). Practices in mindfulness are originally based on Buddhist meditation practices, but are conducted mainly in secular ways. Interventions like the *Mindfulness Based Stress Reduction* program have been shown to increase mindfulness (Brown et al., 2011). Furthermore, numerous studies have shown that mindfulness training can lead to a reduction of symptoms of anxiety and depression and to promote self-regulated behaviour and positive emotional states in adults (e.g. Baer, 2003). There is less evidence with children and adolescents, but research and clinical interest is growing and there are a certain number of studies suggesting benefits of mindfulness based interventions for this target group (for an overview see e.g. Burke, 2010 or Weare, 2013).

Therefore, this study will explore whether mindfulness relates to economic preferences and thereby influences field behaviour or whether mindfulness acts directly on field behaviour. The analysis will proceed in three steps. First, it is tested whether and how mindfulness relates to time and risk preferences. In a next step, it is analysed whether there is a relationship between mindfulness and field behaviour and finally it is assessed whether mindfulness and economic preferences substitute or complement each other in predicting field behaviour. The analysis is done with the help of a cross-sectional experimental study with German secondary school students. Time and risk preferences of 525 adolescents in the tenth grade (mean age=16) were elicited in a fully incentivized experiment. Mindfulness was measured through self-reports by the Mindful Attention Awareness Scale -

Adolescents (MAAS-A). Students' field behaviour includes health related behaviour (smoking, drinking alcohol and BMI), economic related behaviour (saving and education), and subjective well-being. In contrast to other studies that assess time preferences of children and adolescents (Castillo et al. 2011; Sutter et al., 2013), this study thoroughly controls for the socio-economic background with a well-established measure (family affluence scale by Currie et al., 1997). This is important because the socio-economic background has been shown to influence time and risk preferences of adolescents (Deckers et al., 2015). In a nutshell, this student sample contains experimental indicators for preferences, a well-adapted measure for trait mindfulness, several indicators of field behaviour and detailed demographic information. It therefore, allows to assess potential relations between economic preferences and mindfulness and their predictive power for adolescents' field behaviour.

Relating mindfulness to economic preferences I find no evidence for a strong linear or non-linear correlation. However, both mindfulness and preferences have explanatory power for adolescents' field behaviour and thus contribute to predict behaviour that may translate into serious health and economic consequences. In this regard, my findings indicate that the two concepts play rather complementary than substitutable roles. This implies that an integration of economic preferences and personality traits such as mindfulness may improve the analysis of potential sources of variation in life outcomes. As mindfulness reflects on a healthier lifestyle (less smoking and smaller BMI) and higher life satisfaction, the findings furthermore point into the direction that the development of mindfulness skills might help students to grow social-emotional capacities and increase physical and psychological well-being.

The rest of the paper is organized as follows. In Section 2 the sample of adolescents, the experimental design and the methods used to elicit mindfulness and economic preferences are described. Section 3 analyses the link between mindfulness and economic preferences. Section 4 assesses how mindfulness relates to field behaviour. In Section 5 the explanatory power of field behaviour by mindfulness and economic preferences is evaluated jointly. Section 6 discusses the main findings and concludes the paper.

## 2. Experimental design and methods

### 2.1 Participants and general experimental set-up

Classroom experiments with 525 tenth grade students on average 16 years old were conducted from February to May 2015 (Age:  $M=15.94$ ,  $SD=0.64$ , Gender: 261 girls (49.7%))<sup>3</sup>. 27 classes from eight secondary schools in the state of Schleswig-Holstein, Germany, agreed to participate. The German secondary education system includes different types of schools varying in the level and length of schooling. Three different types of secondary schools participated (Gymnasium (3), Gemeinschaftsschule (3), Regionalschule (2)), which led to a broad set of students with different socio-economic and intellectual backgrounds. The experiments were conducted during school hours which minimized dropouts and self selection. Although participation was not mandatory and parents were asked for their permission, in seven out of eight schools all students of each class present at that day participated in the experiment. The study was approved by the Ministry for School and Professional Education of Schleswig-Holstein.

The experiment was computer based and lasted one school hour (45 minutes). It was administered anonymously in the classroom or the school's computer lab using the mobile Kiel Econ Lab and running Z-tree (Fischbacher, 2007) with a maximum of 25 participants. The decisions were incentivized and each student was paid according to his or her choices. Payments ranged between €1 and €10 and the average payment was €4.32. Students completed several economic experiments (incentivized decision tasks) and had to fill out a questionnaire. All students faced the same instructions, decision tasks, questionnaire and payments. While inside a class all students faced the same sequence of decision tasks, it was randomized on the class level in order to account for order effects. We took particular care to explain to the students that they could earn money in the experiments and that their payments would depend on their choices. Payments were determined at the end of the experiments. To do so one choice set out of one experiment was randomly selected and became relevant for payment. Students were then paid according to the choice they had made. They were directly paid in cash, except for future payoffs in the time preference task, for which a

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<sup>3</sup> This experiment was part of a larger cross-sectional experimental study which analyzed various preferences and several aspects of behavior. The impact of birth order and siblings' sex composition on risk, time and social preferences has been analyzed in Detlefsen et al. (2018). "Are Economic Preferences Shaped by the Family Context? The Impact of Birth Order and Siblings' Sex Composition on Economic Preferences". CESifo Working Paper No. 7362.



sealed envelope was handed to the teacher who was instructed to hand it to the according student on the determined date in the future<sup>4</sup>.

## 2.2 Methods

### 2.2.1 Measuring mindfulness: Mindful Attention Awareness Scale - Adolescents (MAAS-A)

In order to measure mindfulness the Mindful Attention Awareness Scale - Adolescents (MAAS-A) was used. The MAAS-A evolved from the MAAS, its adult counterpart, which is one of the most commonly used mindfulness questionnaires (Bruin et al., 2011). The MAAS permits a concise assessment of mindfulness in healthy and clinical samples. It was first developed and validated for adults (MAAS) by Brown and Ryan (2003) and was then validated for adolescents (MAAS-A) in several samples and countries (Brown et al. (2011) in the USA, Black et al. (2012a) in China, Bruin et al. (2011) in the Netherlands). These studies showed that the MAAS-A is related to a variety of emotion regulation, behaviour regulation, mental health, and well-being phenomena.

The MAAS-A is a 14-item self-assessment scale, which measures trait mindfulness. Items include for example “I find it difficult to stay focused on what’s happening in the present,” “I could be experiencing some emotion and not be conscious of it until sometime later,” and response options range from 1 (almost never) to 5 (almost always). It attempts to capture the open and undivided observation of inner and external stimuli, thus conceptualizes mindfulness as a one-dimensional degree of inattention regarding external or internal stimuli (Brown et al., 2011). To control for social desirability, students were made aware that there was no right or wrong and that their own opinion was of interest. Here the German adaptation by Michalak et al. (2008) was used. For the analysis mean scores were reversed such that higher scores indicate higher trait mindfulness.

### 2.2.2 Measuring impatience: Time preference task

In order to measure impatience two decision sets with 20 binary choices each were presented to the students. In Set 1 they were asked to choose between a fixed payment today and a fixed payment three weeks later. The early payment remained fixed at €4.00 and the delayed payment increased monotonically in €0.10 steps from €4.00 to €5.90. Since the delayed payment increases with each step it becomes more attractive and students should switch from the immediate payment to the delayed payment at some point according to their time preferences. For each student the future

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<sup>4</sup> One school refused payments in cash. At this school coupons for the schools canteen were used, which, in my view, is most likely perceived as equivalent to cash because students could spend their coupons on whatever they liked in the canteen, for example lunch or sweets.

equivalent - average between the amount of the last tick on the left hand side (immediate payment) and the amount of the first tick on the right hand side (delayed payment) - is taken as the measure for impatience. Consider for example a student that chose to receive €4.00 today instead of receiving €4.20 in 3 weeks in row 3 and then switches to the right hand side by choosing €4.30 in 3 weeks instead of €4.00 today in row 4 (see Figure 1). The future equivalent thus equals €4.25 in our example. Students are considered to be more impatient the higher the future equivalent is, in other words the later they switch from the left to the right hand side of the choice list.

Figure 1: Example of a Set 1 choice list with future equivalent equal to €4.25

1)	€4.00 today	<input checked="" type="checkbox"/>	or	€4.00 in 3 weeks	<input type="checkbox"/>
2)	€4.00 today	<input checked="" type="checkbox"/>	or	€4.10 in 3 weeks	<input type="checkbox"/>
3)	€4.00 today	<input checked="" type="checkbox"/>	or	€4.20 in 3 weeks	<input type="checkbox"/>
4)	€4.00 today	<input type="checkbox"/>	or	€4.30 in 3 weeks	<input checked="" type="checkbox"/>
5)	€4.00 today	<input type="checkbox"/>	or	€4.40 in 3 weeks	<input checked="" type="checkbox"/>

Set 2 is nearly identical to Set 1 except that there was an upfront delay of three weeks. Students had to choose between a fixed payment in three weeks and an increasing payment in 6 weeks.

This procedure is well adapted in the literature and has shown good results with children and adolescents (Bettinger and Slonim, 2007; Sutter et al., 2013). Euro amounts were similar to the ones used by Sutter et al. (2013), who study children at approximately the same age and culture area (their study was conducted in Austria with children and adolescents aged 10 to 18 years and showed robust results). The binary choices, the exact €4.00 front-end payment, and the monotonically increasing amount of compensation in the 3 weeks delayed period were meant to help to reduce the cognitive difficulty of the task. The choice lists were designed in a way that it was possible to switch only once from the left to the right hand side in each list.

A comparison of future equivalents between the two choice sets allows to test for exponential versus hyperbolic discounting (e.g. Laibson, 1997; Prelec, 2004). Exponential discounting would imply that the switching point is the same for both choice sets as the period between the two payments remains constant (3 weeks). On the contrary, a higher switching point in Set 1 than in Set 2 indicates that the immediate payment receives more weight than the early payment in three weeks time. This would imply a present moment bias, accounted for in hyperbolic or quasi-hyperbolic discounting.

### 2.2.3 Measuring risk preferences: Lottery task

Risk preferences were elicited using an Eckel and Grossman (2002) type lottery as depicted in Table 1. This method is relatively easy to understand and has been shown to be significantly correlated with the results of other more complex risk elicitation methods while producing less noisy estimates (see Charness et al. (2013) for an overview). It is therefore practical for the use with adolescents. Students had to choose one out of six lotteries each with a 50% chance of winning and losing. The first lottery is a sure thing with a certain payoff of €4. For lotteries 1 to 5 the expected value and the risk, as represented by the variance, increase linearly. Lottery 6 has the same expected value as lottery 5 with a higher variance. Under expected utility risk-averse students would choose lotteries with a lower standard deviation (1–4), risk-neutral students the lotteries with the highest expected value (5 or 6). See Table 1 for an overview of the lottery task.

Table 1: Lottery task - Eckel and Grossman method

Lotteries (50/50 Chance)	Low payoff	High payoff	Expected value	Variance
Lottery 1	€ 4.00	€ 4.00	€ 4.00	0.00
Lottery 2	€ 3.50	€ 5.00	€ 4.25	1.06
Lottery 3	€ 3.00	€ 6.00	€ 4.50	2.12
Lottery 4	€ 2.50	€ 7.00	€ 4.75	3.18
Lottery 5	€ 2.00	€ 8.00	€ 5.00	4.24
Lottery 6	€ 1.00	€ 9.00	€ 5.00	5.66

### 2.2.4 Measuring field behaviour

Data on several aspects of students' field behaviour were collected through self-reports. As indicators for health related behaviour information on smoking, drinking alcohol and the body mass index (BMI) were gathered. The variables smoking and drinking are binary variables, which take the value 1 in case a subject reported to smoke (drink alcohol) at least sometimes. The BMI is defined as weight divided by height squared, therefore resembles a continuous variable in the analysis. BMI is commonly categorized into normal weight (BMI between 18 and 25), underweight (BMI below 18) and overweight (BMI above 25). In terms of psychological well-being subjective life satisfaction was elicited via the German Students' Life Satisfaction Scale (Weber et al., 2013). It is the German adaptation of the Students' Life Satisfaction Scale (SLSS) first developed by Huebner (1991) and consists out of seven questions about ones overall satisfaction with life and in reference to others. As indicators for economic related behaviour measures for saving and educational attainment were

elicited. Students reported the amount of monthly pocket money and its use. One of the categories for the use of pocket money was saving which was then used to construct a measure for saving. It is coded as 1 if subjects indicated in the questionnaire to save a substantive part of their monthly pocket money. As a measure of educational attainment the students' type of secondary school was used. The variable education is measured as an ordered variable ranging from 1 (regional school) over 2 (community school) to 3 (high school)<sup>5</sup>. In addition to the field behaviour several other characteristics and demographic information were gathered. Students performed a short cognitive reflection test using raven matrices (Raven, 2000) and the results are used as an indicator of the students' cognitive abilities. Students also reported their grades in math, German, biology and physics. As an indicator of the socio-economic status the family affluence scale (FAS) by Currie et al. (1997) is used. Higher levels indicate a higher socio-economic background.

### 3. The relation between mindfulness and economic preferences

#### 3.1 Descriptive statistics

To give an overview of the measures for mindfulness, time and risk preferences Table 2 displays descriptive statistics as well as pair-wise correlations of the variables. The average MAAS-A score among participants is 3.35 (SD: 0.52) with a minimum of 1.64 and a maximum of 4.71. The histogram in Figure 2 shows the distribution of MAAS-A scores across the sample. A closer assessment of the mindfulness measure shows that mindfulness is not related to cognitive reflection, number of siblings or socio-economic background (see Appendix Table 9). Boys score slightly higher (M=3.41, SD=0.31) than girls (M=3.30, SD=0.33) and this difference is significant (paired t-test:  $p=0.02$ ). However, the effect size (Cohen, 1988) of this gender difference is rather small ( $d = 0.34$ ).

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<sup>5</sup> This exploits the fact that the German education system includes different types of secondary schools varying in the level and length of schooling. The education act of Schleswig-Holstein (Schleswig-Holsteinisches Schulgesetz) intends since 2014 a two-tier secondary education system with community schools (Gemeinschaftsschule) and high schools (Gymnasium), which start after 4 years of elementary school. In a community school all educational qualifications of secondary education can be acquired in a common educational background, this includes "Erster allgemeinbildender Schulabschluss" after the 9th grade, the "Mittlere Reife" after the 10th grade, which both qualify for vocational training, and in addition the "Abitur" after the 13th grade, qualifying for university admission. High schools prepare students for higher education and in the majority of high schools students can achieve their "Abitur" after the 12th grade. Besides community schools and high schools, there are still regional schools in place which terminate after the 10th school year. This school type will be discontinued in 2019/20, however in the school year 2015/16 approximately 12,900 students were enrolled (information from this paragraph is based on the state's website (Landesportal Schleswig-Holstein; 2016)).

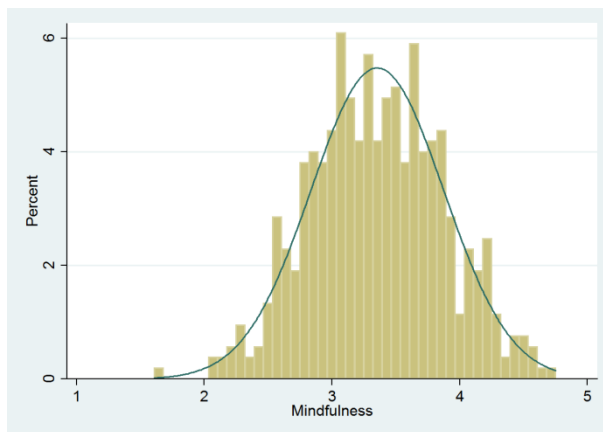
**Table 2: Descriptive statistics and correlations of mindfulness and economic preferences**

Variable	Descriptive statistics				Pair-wise correlations		
	M	SD	n	Range	Mindfulness	Risk	Future equ.
Mindfulness	3.35	0.52	525	2-5	1.00		
Risk	2.60	1.69	525	1-6	-0.02 (0.60)	1.00	
Future equivalent	€ 4.90	0.62	525	€ 4-5.90	-0.02 (0.71)	-0.07 (0.11)	1.00

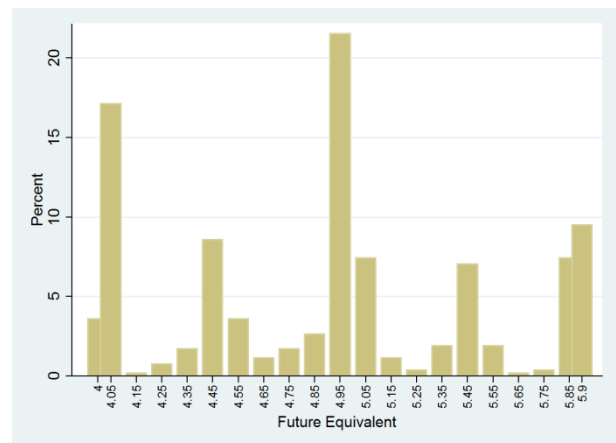
Significance levels are displayed below each correlation coefficient. Mindfulness = Mindful Attention Awareness Scale - Adolescents (MAAS-A), Future equivalent = measure for impatience (switching point from €4 today to a higher amount in 3 weeks), Risk = measure for risk attitudes (risk increases gradually from lottery 1 to 6).

The average future equivalent in this sample is €4.90 (SD=0.62), this means that an average student would want to receive at least €4.90 in three weeks to abstain from an immediate payment of €4.00. Figure 3 displays the distribution of the future equivalents across the sample in a histogram. The difference between the average future equivalent without (M=4.90 SD=0.62) and with upfront delay (M=4.93, SD=0.62) is small and no general evidence for hyperbolic discounting is found. The average future equivalent of girls is 4.95 (SD 0.040) and thus slightly higher than that of boys 4.86 (SD 0.037). But a Wilcoxon ranksum test shows no significant difference between the future equivalent of boys and girls ( $z=1.276, p>|z|=0.202$ ).

**Figure 2: Histogram of MAAS-A scores**



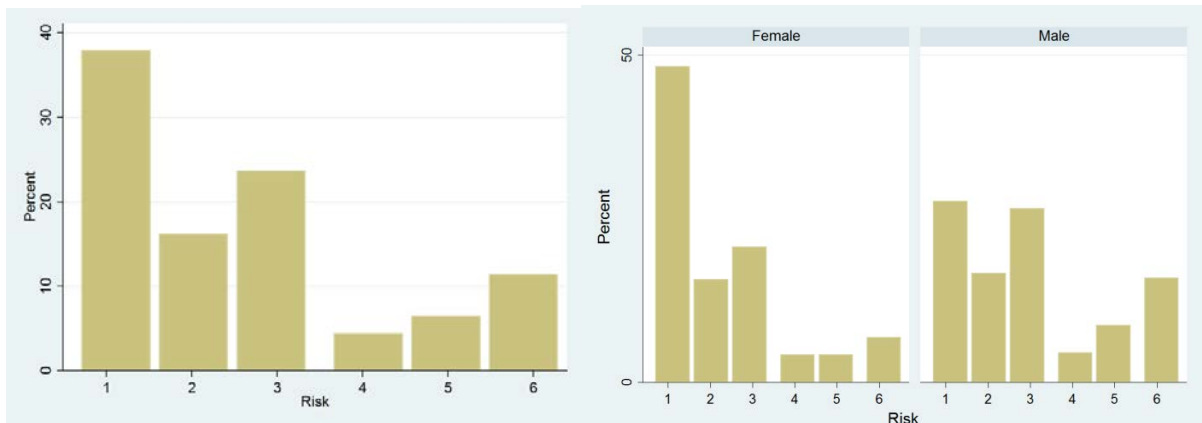
**Figure 3: Histogram of the future equivalent**



In terms of risk preferences the average subject decides for lottery 3 (M=2.60, SD=1.69). There is a substantive difference between the average risk taking of boys (M=3.00, SD=0.11) and girls (M=2.21, SD=0.09). A Wilcoxon ranksum test confirms that the difference is significant at the 1% level ( $z=$  -

5.343,  $p=0.00$ ). The histograms in Figure 4 show that 38% of the students decide for the save option (lottery 1) and about one quarter (24%) chooses lottery 3. Considering girls only one observes that about half (48%) choose lottery 1 (sure payoff of €4.00). Considering boys only one can see that lotteries 1 and 3 are chosen by about one quarter each (28% and 27%).

Figure 4: Histograms of risk preferences over all subjects and by gender



In summary, the collected data confirm the typical patterns observed in other studies. On average, students are risk averse and impatient (e.g. Sutter et al., 2013; Castillo et al., 2011; Bettinger & Slonim, 2007). The distribution and size of the future equivalents are similar to the ones found in other studies with adolescents (in particular to the study by Sutter et al. (2013) who use the same method and Euro amounts with adolescents in Austria). There is no evidence for hyperbolic discounting in this sample, which is in line with the findings from Sutter et al. (2013) but stands in contrast to those of Bettinger and Slonim (2007). Regarding gender differences, boys are slightly more mindful than girls, a pattern which has also been found in another adolescents' samples (Brown et al., 2011). There is no significant gender difference in the future equivalents. The findings of other studies in this regard are contradictory, while Deckers et al. (2015) find that boys are more patient than girls, Bettinger and Slonim (2007) and Castillo et al. (2011) find that girls are more patient. Confirming previous evidence there is a significant gender difference in risk taking with boys taking more risk on average than girls (e.g. Cárdenas et al., 2012; or Deckers et al., 2015).

### 3.2 Regression analysis

Table 2 displays pair-wise correlation coefficients between mindfulness and time as well as risk preferences with significance levels in parenthesis. It shows that time preferences as well as risk attitudes are not significantly linearly correlated with mindfulness. In a next step a regression analysis

is performed to extend the preliminary insights from the correlation table. Time and respectively risk preferences are taken as the dependent variable and are regressed on mindfulness. Demographic background variables are included as controls.

### 3.2.1 Time preferences and mindfulness

Table 3 depicts the regression analysis for time preferences, where the future equivalent without upfront delay becomes the dependent variable<sup>6</sup>. It confirms that there is no direct relationship between the average future equivalent and mindfulness (Model 1). To account for the fact that the future equivalent is censored from above and below a Tobit regression was run (Model 2). Furthermore, an interaction term between mindfulness and gender was introduced to see whether there is different variation for boys and girls (Model 3).

All model specifications show a very small and insignificant coefficient for mindfulness indicating that there is no strong linear correlation between time preferences and mindfulness. Finally, mindfulness squared was added to the regression to check for a non-linear relationship (Model 4). The coefficient for mindfulness remains positive and increases (from 0.02 in Model 2 to 0.2 in Model 4) and the coefficient for mindfulness squared is negative. Therefore, there is a trend of a u-shaped relation between mindfulness and time preferences, which would mean that average mindful adolescents are the most impatient ones. However, both coefficients are insignificant and a zero coefficient cannot be ruled out.

Looking at the demographic control variables, the regressions confirm that there is no significant gender effect. Also, the coefficient for risk is insignificant (which is in line with the results of Bettinger and Slonim, 2007) . Adolescents which are the first born of siblings are significantly more patient confirming the findings by Lampi and Nordblom (2011). Interestingly, students who receive more monthly pocket money are significantly more impatient on average. This seems counterintuitive as these students would depend less on the money from the experiment. However, this result comes in

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<sup>6</sup> I only consider the future equivalent without upfront delay here for two reasons. First, it was always elicited before the future equivalent with upfront delay and therefore, I can rule out learning or ordering effects. Second, there is no significant difference between the future equivalent with and without upfront delay, as shown above. Finally, taking the future equivalent with upfront delay as the dependent variable does not change the signs or significance of the coefficients (see Appendix

Table 10).

line with the finding of Sutter et al. (2013), who hypothesize that those students receiving more pocket money are less accustomed to abstain from spending money immediately and are therefore less willing to wait. The socio-economic background shows a significant negative coefficient, which indicates that students coming from a lower socio-economic background are more impatient (confirming the results of Deckers et al., 2015).

**Table 3: Regression analysis of the future equivalent (impatience)**

	Model 1 OLS	Model 2 Tobit	Model 3 Interaction	Model 4 Non-linear
Mindfulness	0.003 (0.060)	0.021 (0.069)	0.046 (0.098)	0.203 (0.662)
Mind. x Male			-0.055 (0.117)	
Mindfulness <sup>2</sup>				-0.027 (0.102)
Male	-0.075 (0.050)	-0.077 (0.058)	-0.077 (0.058)	-0.079 (0.061)
Risk	-0.018 (0.024)	-0.022 (0.027)	-0.022 (0.027)	-0.022 (0.027)
First born	-0.126** (0.059)	-0.154** (0.069)	-0.155** (0.069)	-0.153** (0.068)
Pocket Money	0.002** (0.001)	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)
Raven	-0.002 (0.031)	0.010 (0.038)	0.010 (0.038)	0.010 (0.038)
FAS	-0.047*** (0.013)	-0.050*** (0.016)	-0.050*** (0.016)	-0.050*** (0.016)
constant	5.485*** (0.351)	5.402*** (0.434)	5.317*** (0.522)	5.102*** (1.089)
Model	OLS	Tobit	Tobit	Tobit
No. of Obs.	524	524	524	524
Adj./Psd. R <sup>2</sup>	0.048	0.027	0.027	0.027
Prob>chi2/F	0.001	0.000	0.000	0.000

Robust standard errors clustered at the classroom level in parentheses, P-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

### 3.2.2 Risk preferences and mindfulness

Considering the relationship between risk preferences and mindfulness, there is a trend that mindfulness is related to less risk taking (see Table 4). The negative coefficient for mindfulness is found in all specifications (OLS, ordered Logit, interaction, non-linear) but is never significant and, therefore, I cannot reject the null hypothesis. When mindfulness squared is added to the regression



(Model 4), the coefficient for mindfulness remains negative and increases in magnitude (from -0.2 in Model 2 to -1.3 in Model 4), the coefficient for mindfulness squared is positive. This, indicates an inverse u-shaped relation between mindfulness and risk preferences, which would mean that average mindful adolescents are more risk averse. However, both coefficients are insignificant and a zero coefficient cannot be ruled out.

In terms of control variables, the regression analysis again confirms the significant gender effect, with boys taking more risk on average than girls. Furthermore, the positive coefficient for FAS indicates that a higher socio-economic background is associated with higher risk taking (which is in line with the findings by Deckers et al. (2015) or Dohmen et al., 2011). All other coefficients are insignificant.

### **3.3 Discussion**

The analysis of the relation between mindfulness and economic preferences showed that there is no indication for a strong linear or non-linear correlation between these measures. This finding might not come as a surprise as other researchers that relate personality traits and economic preferences find contradicting results. While some find a significant association for example between conscientiousness and time preferences (Becker et al., 2012; Mahalingam et al., 2014), others find no relationship between this personality trait and time or risk preferences (Dohmen et al., 2010; Rustichini et al., 2012).

One argument for not finding a correlation between mindfulness and time preferences is that there might be two opposing mechanisms at hand. On the one hand one might expect that mindfulness will lead to more patient decisions, as mindfulness has been found to be positively associated with self-regulation (Brown et al., 2011; Bruin et al., 2011) and self-control (Black et al., 2012a). On the other hand mindfulness puts the emphasis on the presence (e.g. Kabat-Zinn, 1990), which could in turn imply that more mindful people would discount the future more heavily than less mindful people.

**Table 4: Regression analysis of risk preferences**

	Model 1 OLS	Model 2 Ord. Logit	Model 3 Interaction	Model 4 Non-linear
Mindfulness	-0.145 (0.161)	-0.175 (0.161)	-0.123 (0.206)	-1.313 (1.540)
Mind. x Male			-0.108 (0.382)	
Mindfulness <sup>2</sup>				0.170 (0.225)
Male	0.761*** (0.171)	0.876*** (0.179)	0.876*** (0.179)	0.886*** (0.185)
First born	-0.078 (0.211)	-0.091 (0.228)	-0.092 (0.226)	-0.097 (0.231)
Pocket Money	0.004* (0.002)	0.004 (0.002)	0.004 (0.002)	0.004 (0.002)
Raven	0.074 (0.070)	0.103 (0.080)	0.103 (0.080)	0.104 (0.080)
FAS	0.082** (0.030)	0.098*** (0.033)	0.099*** (0.034)	0.097*** (0.034)
Model	OLS	Ord. Logit	Ord. Logit	Ord. Logit
No. of Obs.	524	524	524	524
Adj./Psd. R2	0.067	0.027	0.027	0.027
Prob>chi2/F	0.000	0.000	0.000	0.000

Robust standard errors clustered at the classroom level in parentheses, Significance/p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

Another argument for insignificant or very low associations between personality traits and economic preferences is that these measures are constructed in different ways (Becker et al., 2012). In my case mindfulness, as measured by the MAAS-A, tries to capture whether an adolescent is mindful in day-to-day life, which means to be frequently in a receptive state of attention in which one simply observes what is happening. The MAAS-A is rooted both in Buddhist practices and in clinical research on mindfulness and is measured by self-reports (Brown et al., 2011). Preferences on the other hand are based on utility maximization and are measured in standard incentivized experiments. Time preferences for example capture an adolescent's willingness to abstain from money today in order to receive a larger amount in the future and, therefore, the underlying concept is narrow. Hence, it might be possible that economic preferences are one particular aspect of mindfulness. However, the fact that no correlation is found between mindfulness and economic preferences, points rather into the direction that mindfulness and economic preferences actually measure distinct non-cognitive abilities and are complementary to each other.

## 4. Health and economic consequences of mindfulness

As argued by Bowles et al. (2001) and Heckman et al. (2006), non-cognitive abilities, such as preferences or personality, influence educational and labour market outcomes. In the previous section the relation between mindfulness and economic preferences were analysed and it is found that these measures are not correlated and are therefore not substitutable. This section will explore whether mindfulness has explanatory power for adolescents' field behaviour. If it does, mindfulness might contribute to explaining heterogeneity in field behaviour and, consequently, well-being of adolescents. The analysis here focuses on health related behaviour (smoking, drinking alcohol and BMI), economical behaviour (saving and education) and subjective well-being, which are all behaviours that may translate into severe health and economic consequences.

### 4.1 Descriptive results

Table 5 displays descriptive statistics of the variables of interest. 26% of the students reported smoking cigarettes at least sometimes and 81% reported drinking alcohol at least sometimes. The average BMI lies with 21.42 (SD 2.92) in the normal weight category<sup>7</sup> and represents a typical value for adolescents of that age in Germany<sup>8</sup>. About one half of the students (48%) reported to use a major part of their monthly pocket money to save. On average, students reported to be quite satisfied with their life with a mean value of 3.69 (SD .77) on a scale from 1 (low satisfaction) to 5 (high satisfaction)).

The right hand side of Table 5 displays pair-wise correlations between field behaviour and mindfulness as well as economic preferences (which will be discussed in the next section). It shows that there is considerable correlation between mindfulness and field behaviour. Mindfulness is significantly negatively correlated with smoking indicating that more mindful students are less likely to smoke. The significant negative correlation coefficient between mindfulness and BMI points into the direction that more mindful students are less likely to become obese. Furthermore, the positive correlation between mindfulness and satisfaction indicates that more mindful students are on

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<sup>7</sup> Five observations were omitted due to implausibly low values of the BMI, probably because subjects did not want to report their true weight.

<sup>8</sup> A representative examination survey of 17,641 children and adolescents aged 0–17 years living in Germany (KiGGS 2003–2006 study) found that the median BMI for boys at the age of 16 is 21.10, and 21.37 for girls respectively (Rosario et al., 2010).

average more satisfied with their life. In terms of magnitude one can observe that all correlations coefficients are rather low according to Cohen (1988) and range between 0 and 0.32. As the correlation coefficients reported here only indicate a linear relationship between the two variables and do not account for non-linear relationships or control variables a regression analysis will be performed next.

**Table 5: Descriptive statistics of field behaviour and pair-wise correlations with mindfulness and time and risk preferences**

Variable	Descriptive statistics			Pair-wise correlations		
	Mean	n	Values	Mindful	Impatienc e	Risk
Smoking	26%	525	0/1	-0.15 (0.00)	0.05 (0.22)	0.05 (0.23)
Drinking	81%	525	0/1	0.00 (0.98)	0.16 (0.00)	0.02 (0.64)
BMI	21.42 (SD=2.92)	520	14-34	-0.10 (0.02)	0.04 (0.39)	0.05 (0.27)
Saving	48%	478	0/1	0.04 (0.40)	-0.07 (0.13)	0.05 (0.23)
Education	14% regional school, 46% community school, 30% high school		0 1 2	-0.4 (0.42)	0.20 (0.00)	-0.20 (0.00)
Satisfaction	3.69 (SD=0.77)	525	1-5	0.32 (0.00)	0.03 (0.45)	0.06 (0.19)

Significance levels below each correlation coefficient, Smoking = Dummy variable indicating whether a student reported to smoke at least sometimes (=1), Drinking = Dummy variable indicating whether a student reported to drink alcohol at least sometimes (=1), BMI = weight divided by height squared, Saving = Dummy variable indicating whether a student reported to save (a major) part of his or her monthly pocket money (=1), Education = indicator of the school type (regional school=0, community school=1, high school=2), Satisfaction = Life satisfaction measured via the German Students' Life Satisfaction Scale.

## 4.2 Regression analysis

Table 6 summarizes the regression results where each column represents the individual regression of the field behaviour regressed on mindfulness and some control variables (gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background). In order to compare effect sizes more easily all continuous independent variables were standardized.

Overall, the results reported in Table 6 show that mindfulness seems to be a good predictor for adolescents' field behaviour. Five out of six behaviours are highly significantly correlated to mindfulness. Concerning health related behaviour (columns 1-3 in Table 6), the analysis shows a

statistically significant negative relationship between mindfulness and smoking. This indicates that on average the more mindful a student is the less likely he or she is to smoke. No such effect is found for drinking alcohol. For the BMI again a significant negative coefficient is found, which indicates that more mindful students are thinner on average. Therefore, the regression analysis confirms the correlation patterns found before even after controlling for demographic variable.

**Table 6: Regression analysis of field behaviour and mindfulness**

	Smoking	Drinking	BMI	Saving	Education	Satisfaction
Mindfulness	-0.203*** (0.058)	-0.000 (0.076)	-0.300** (0.128)	-1.536*** (0.551)	1.134** (0.484)	1.629*** (0.198)
Mindfulness <sup>2</sup>				0.450*** (0.152)	-0.338** (0.146)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Model	Probit	Probit	OLS	Probit	Ord. Probit	OLS
No. of Obs.	523	523	518	478	523	523
Adj./Psd. R2	0.078	0.040	0.088	0.043	0.057	0.161
Prob>chi2/F	0.000	0.000	0.001	0.000	0.000	0.000

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Mindfulness is standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

In contrast to the health related behaviour, the economic behaviour did not show any linear correlation with mindfulness. However, having a closer look into the sample, reveals that these variables are related to mindfulness in a non-linear way (Table 6, column 4 and 5). Concerning the saving behaviour, the significant coefficients for mindfulness (negative sign) and mindfulness squared (positive sign), indicate a u-shaped relationship between saving and mindfulness. This implies that average mindful students have the lowest probability to save. Dividing the sample at the median shows that for above average mindful students the saving probability increases linearly with mindfulness, while for below average mindful students the relation is reversed and insignificant. A detailed regression table for saving can be found in the Appendix Table 14. Regarding education there is again a significant quadratic relationship, but this time it is inversely u-shaped. This indicates that average mindful students have a higher probability to study at higher level schools. Again, dividing the sample at the median gives a clearer picture and shows that for below average mindful students the educational attainment increases significantly with mindfulness, while for above average mindful students the relation is reversed and insignificant. A detailed regression table for education can be found in the Appendix Table 15.

Finally, subjective life satisfaction shows a significant positive correlation with mindfulness, which maintains highly significant also after controlling for demographic variables (Table 6, column 6). This shows that the more mindful a student is the more satisfied with his or her life the student is on average.

### 4.3 Discussion

The analysis of the determinants for variations in field behaviour shows that mindfulness seems to be a good predictor for students' health and economic related behaviour. Some of the results confirm the findings of other researchers (Black et al., 2012; Loucks et al., 2015; Bruin et al., 2011; Brown et al. 2011), while other field behaviours have not been analysed in relation to mindfulness so far and are therefore new. To my knowledge, this is the first comprehensive overview of the relationship between mindfulness and health and economic behaviour.

The finding that mindfulness decreases the propensity to smoke in this sample, confirms the results of a large study with Chinese adolescents ( $N = 5,287$ , mean age = 16.2 years) by Black et al. (2012). Using the same mindfulness measure (MAAS-A) they also find a negative correlation between mindfulness and smoking and furthermore establish that mindfulness might reduce decision-making processes that possibly translate into higher risk smoking behaviour. Concerning drinking alcohol the present study could not establish a relationship with mindfulness. However, Chatzisarantis and Hagger (2007) found a significant negative correlation between habitual binge-drinking and mindfulness in a sample of university students ( $N = 292$ , mean age = 19.48). One explanation for the null effect in this study might be that due to the fact that 81% of the sample reported to drink, drinking seems to be part of adolescents' normal behaviour at this age. Therefore, a measure for the frequency of alcohol consumption or a dummy for excessive drinking might be better able to capture the expected moderation effect of mindfulness on drinking. Regarding the inverse link between mindfulness and BMI found in this study, there is evidence that mindfulness is negatively associated with obesity (Loucks et al., 2015). Generally, there is quite extensive medical and psychological research that relates mindfulness to health indicators and establishes a causal relationship by showing that mindfulness interventions increase psychological and physical well-being of adolescents (see for example reviews by Black et al. (2009) and Burke (2010)). In these lines also the current study points into the direction that trainings enhancing trait mindfulness among adolescents may translate into positive health outcomes.

Now turning to the more economic related behaviour saving and education, which have not been analysed in depth in the literature so far. To my knowledge this study is even the first to analyse saving behaviour and mindfulness. The fact that the probability to save only increases significantly with mindfulness for above average mindful students could be an indicator of the counteracting thoughts already discussed for impatience. On the one hand mindfulness leads to valuing the moment (spend everything) and on the other hand mindfulness is related to self-control (save now to buy something bigger in the future). Possibly, with increasing mindfulness different mechanisms occur; up to a certain level mindfulness adolescents particularly value the present moment and spend their entire pocket money, while very mindful students are able to abstract from momentary feelings and are capable of self-control. Behaviour related to school performance has also not been the core target of mindfulness research so far. There is some evidence pointing into the direction that mindfulness can improve academic learning and performance, however, there are no larger studies and there is a lack of robust evidence (Weare, 2013; Wisner et al., 2010). Mindfulness significantly increases the probability to attend a high-school for below average mindful students, but this effect is insignificant and reversed for above average mindful students (see Appendix Table 15). This could be an indication that mindfulness training might only have an effect on education for those with an initially low level of mindfulness.

The positive link between mindfulness and satisfaction found in this study, has been documented in several studies before (e.g. using the MAAS-A: Bruin et al., 2011; Brown et al. 2011). Life satisfaction is not only desirable as such but has also been shown to mitigate harmful consequences of stressful life events and shield psychological and behavioural problems among adolescents (Park, 2004). Therefore, mindfulness may bring about further positive consequences in terms of subjective well-being.

## **5. Joint analysis of the explanatory power of field behaviour**

The previous results have shown that mindfulness and economic preferences are not correlated and are therefore not substitutable. In the last section it was shown that mindfulness has explanatory power for adolescents' field behaviour and thus contributes to explain heterogeneity in behaviour that may translate into serious health and economic consequences. To analyse whether mindfulness

and economic preferences complement each other in predicting field behaviour a joint regression framework is used.

Before starting the joint analysis it is, however, necessary to show that economic preferences are able to explain variation in field behaviour also in this sample. The pair-wise correlation table in the previous section (Table 5) showed that impatience is related to drinking alcohol and that both impatience and risk taking are associated with education. While these are pure correlations, Table 7 displays the results of a regression analysis in which control variables are included (gender, monthly pocket money, math and German scores, and the socio-economic background). Impatience still shows a significant positive coefficient for drinking, indicating that more impatient students have a higher probability to drink alcohol (which is in line with Sutter et al., 2013). In addition, impatience is negatively related to education, i.e. more impatient students are less likely to study in a school leading to an academic track (confirming findings e.g. by Golsteyn et al., 2014). In contrast, higher risk taking translates into a higher probability to study in higher level schools (in line with Dohmen et al., 2010). Finally, impatience seems to be positively associated with satisfaction, i.e. more impatient students are more satisfied on average.

**Table 7: Regression analysis of field behaviour and preferences**

	Smoking	Drinking	BMI	Saving	Education	Satisfaction
Impatience	0.049 (0.064)	0.277*** (0.076)	0.075 (0.139)	-0.070 (0.066)	-0.176** (0.085)	0.460** (0.201)
Risk	0.082 (0.068)	0.065 (0.053)	0.101 (0.112)	0.060 (0.055)	0.194*** (0.073)	-0.057 (0.208)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Model	Probit	Probit	OLS	Probit	Ord. Probit	OLS
No. of Obs.	523	523	518	478	523	523
Adj./Psd. R <sup>2</sup>	0.064	0.074	0.078	0.034	0.075	0.077

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Impatience and risk are standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

These results and the findings from Section 4 show that both mindfulness and preferences are associated with field behaviour. To analyse whether mindfulness and economic preferences complement each other a joint regression framework is used. Each field behaviour is regressed on mindfulness, economic preferences, as well as some demographic control variables. Overall, the joint regressions lead to similar results compared to the separate regressions. Table 8 shows that the



signs, magnitudes and significances of the regression coefficients of mindfulness, time and risk preferences do not change. In terms of health related behaviour the joint regressions show that mindfulness decreases the probability to smoke, while impatience increases the probability to drink alcohol. The coefficient of mindfulness for smoking and the coefficient of impatience for drinking are of about the same magnitude (both variables are standardized), thus their effect on the respective field behaviour seems equally important. A one point increase in the standard deviation of mindfulness decreases the probability to smoke by 0.2, whereas a one point increase in the standard deviation of impatience increases the probability to drink alcohol by 0.2. More mindful students have a lower BMI on average. Risk taking shows no association with health related behaviour. Concerning the economic related behaviour, one can observe that mindfulness is non-linearly related to saving and educational attainment, while economic preferences are linearly related to educational attainment but are not related to saving. Impatience reduces the probability of attending a secondary school with academic track, while higher risk taking increases the probability. In relation to subjective well-being, the regression shows that life satisfaction increases with mindfulness and impatience, and that the effect of mindfulness on satisfaction is about 3 times higher than the effect of impatience.

**Table 8: Regression analysis of field behaviour, mindfulness and preferences**

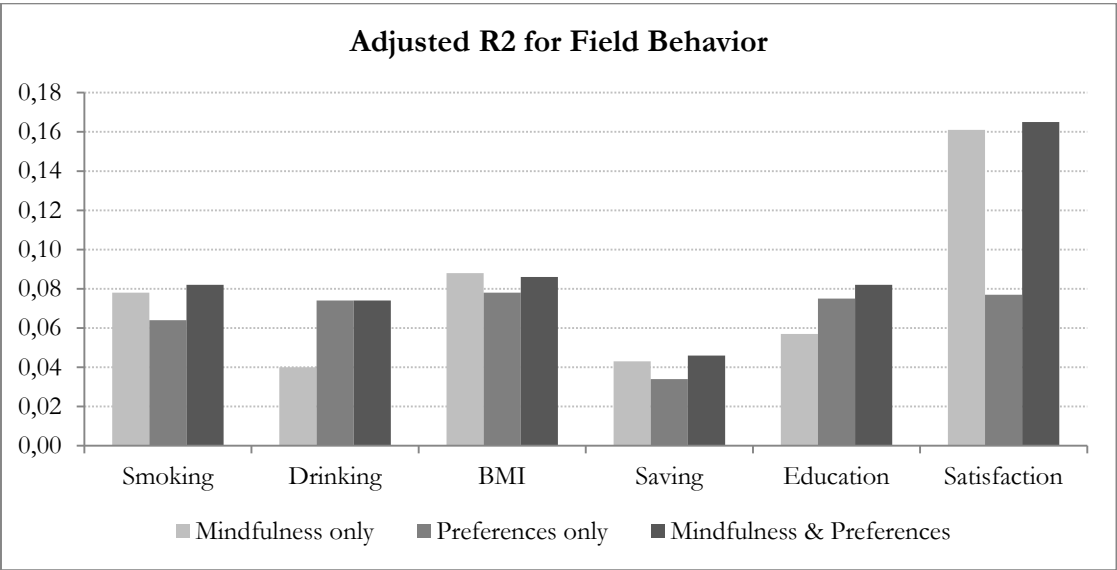
	Smoking	Drinking	BMI	Saving	Education	Satisfaction
Mindfulness	-0.201*** (0.058)	-0.007 (0.074)	-0.296** (0.130)	-1.492*** (0.552)	1.284*** (0.439)	1.630*** (0.200)
Mindfulness <sup>2</sup>				0.439*** (0.152)	-0.378*** (0.132)	
Impatience	0.052 (0.064)	0.278*** (0.076)	0.077 (0.135)	-0.064 (0.064)	-0.182** (0.087)	0.460** (0.207)
Risk	0.073 (0.069)	0.065 (0.053)	0.082 (0.110)	0.059 (0.058)	0.197*** (0.073)	0.026 (0.228)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Model	Probit	Probit	OLS	Probit	Ord. Probit	OLS
No. of Obs.	523	523	518	478	523	523
Adj./Psd. R <sup>2</sup>	0.082	0.074	0.086	0.046	0.082	0.165
Prob>chi2/F	0.000	0.000	0.001	0.000	0.000	0.000

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Mindfulness, impatience and risk are standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

Due to the significant gender difference in mindfulness additional regressions were performed dividing the sample into boys and girls (see Appendix Table 13). Although, some effects seem to be stronger for boys or girls, the overall pattern remains. In general, the regression analysis points into the direction that mindfulness and economic preferences complement each other in predicting field behaviour.

This hypothesis is further underpinned by an assessment of the explanatory power of mindfulness and preferences in isolation and in combination. Comparing the residuals from the regressions (adjusted or pseudo  $R^2$ ) allows to check the extent to which explanatory power varies when combining the two concepts and therefore enables to draw a conclusion regarding their complementarities. Figure 5 displays the  $R^2$ 's for the different field behaviours. Values range from 3% to 16% and vary between concepts and behaviours. One observes that it is either mindfulness or preferences explaining most of the variation and that adding the other concept does not improve the regression (but it also does not deteriorate the regression precision). In addition, all models have significant explanatory power as a whole and the joint hypothesis that all coefficients are equal to zero is always rejected at the 1% level (Chi2/F-statistics).

Figure 5:  $R^2$  comparison for separate (mindfulness or preferences) and joint regressions of field behaviour



In summary, the joint analysis shows that mindfulness and economic preferences seem to measure quite different non-cognitive abilities which complement each other in explaining heterogeneity in field behaviour. This supports the results of other studies and substantiates the claim that both

economic preferences and personality traits have predictive power and should be used jointly (see e.g. Becker et al., 2012). Furthermore, the finding supports recent efforts to integrate psychological personality concepts into theories of economic choice (see e.g. Borghans et al., 2008; Camerer, 2010; Almlund et al., 2011).

## 6. Conclusion

In a comprehensive experimental study with adolescents the relation between mindfulness and economic preferences was explored. First, it was tested whether and how mindfulness relates to time and risk preferences. In a next step, it was analysed whether there is a relationship between mindfulness and field behaviour. And finally, it was assessed whether mindfulness and economic preferences substitute or complement each other in predicting field behaviour. The analysis was done with the help of a cross-sectional experimental study with 525 German secondary school students from the tenth grade (Age:  $M=15.94$ ,  $SD=0.64$ , 261 girls (50%)). Time and risk preferences were elicited in a fully incentivized experiment. Mindfulness was defined as being able to regulate attention to an open and receptive awareness of present-moment experience and was measured by self-report using the *Mindful Attention Awareness Scale - Adolescents* (MAAS-A, developed by Brown et al., 2011). Students' field behaviour included health related behaviour (smoking, drinking alcohol and BMI), economic related behaviour (saving and education), and subjective well-being.

Relating mindfulness to economic preferences I find no evidence for a strong linear or non-linear correlation. This indicates that the two concepts represent rather distinct non-cognitive abilities and may play complementary roles in determining human behaviour. While this is, to my knowledge, the first study relating mindfulness to time and risk preferences in a comprehensive framework, contradicting results have been found associating conscientiousness, a closely related concept, to economic preferences (Becker et al. (2012) and Mahalingam et al. (2014) find a positive link between conscientiousness and time preferences, whereas Dohmen et al. (2010) and Rustichini et al. (2012) find no relationship between this personality trait and time or risk preferences).

The analysis of the determinants of field behaviour showed that mindfulness seems to be a good predictor for students' health and economic related behaviour. In particular, I find that mindfulness reflects on a healthier lifestyle with more mindful students having a lower probability to smoke and a

lower BMI. Furthermore, mindfulness is found to be strongly associated with higher life satisfaction. These findings are in line with the results of other researchers (Black et al., 2012; Loucks et al., 2015; Bruin et al., 2011; Brown et al. 2011). In addition, a non-linear relationship between mindfulness and saving as well as educational attainment is found. The analysis further revealed that impatience is related to a higher propensity to drink alcohol and that both impatience and risk taking are associated with educational attainment. Thus, both mindfulness and preferences have explanatory power for adolescents' field behaviour and, therefore, contribute to predict behaviour that may translate into serious health and economic consequences. In this regard, my findings indicate that the two concepts play rather complementary than substitutable roles. This implies that an integration of economic preferences and personality traits such as mindfulness may improve the analysis of potential sources of variation in life outcomes.

In addition, the findings of this study suggest that practices which enhance mindfulness among adolescents may be beneficial. For though mindfulness is regarded a human trait (e.g. Kabat-Zinn, 2003), there is concordance among researchers that it can be strengthened and cultivated by mindfulness-based practices (Brown et al., 2011). Indeed, interventions like the *Mindfulness Based Stress Reduction* program have been shown to increase mindfulness in adolescents, as measured by the MAAS-A (Brown et al., 2011). In contrast to mindfulness, it is unclear to which extent and how economic preferences are malleable (see e.g. Borghans et al. (2008) for a discussion). Therefore, as mindfulness reflects on a healthier lifestyle (less smoking and smaller BMI) and higher life satisfaction, the development of mindfulness skills might help students to grow social-emotional capacities and increase physical and psychological well-being.

This is exploratory work and more research is needed to further assess the relation between economic preferences and mindfulness. It remains unclear for example whether mindfulness and economic preferences indeed resemble distinct non-cognitive abilities or whether they are different aspects of another underlying human trait. Another avenue for future research would be to explore whether and how mindfulness training affects economic preferences.

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## Appendix

**Table 9: Regression analysis: mindfulness**

	All	Girls	Boys
Male	0.100** (0.042)		
Raven	0.008 (0.017)	0.017 (0.030)	-0.002 (0.023)
Nb. siblings	-0.027 (0.024)	0.011 (0.029)	-0.070* (0.040)
FAS	0.005 (0.012)	-0.006 (0.015)	0.017 (0.015)
constant	3.228*** (0.192)	3.233*** (0.324)	3.337*** (0.208)
Model	OLS	OLS	OLS
No. of Obs.	525	261	264
Adj. R2	0.007	-0.009	0.017
Prob>chi2/F	0.019	0.750	0.225

Robust standard errors clustered at the classroom level in parentheses, P-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**Table 10: Regression analysis: future equivalent with upfront-delay**

	OLS	Tobit	Tobit Interaction	Tobit non-linear
Mindfulness	0.056 (0.056)	0.073 (0.063)	0.062 (0.081)	-0.011 (0.643)
Mind. x Male			0.025 (0.105)	
Mindfulness^2				0.013 (0.101)
Male	-0.018 (0.057)	-0.013 (0.067)	-0.013 (0.066)	-0.012 (0.067)
Risk	-0.039* (0.020)	-0.042* (0.022)	-0.042* (0.022)	-0.042* (0.023)
First born	-0.058 (0.063)	-0.069 (0.070)	-0.069 (0.070)	-0.070 (0.071)
Pocket Money	0.002*** (0.001)	0.003*** (0.001)	0.003*** (0.001)	0.003** (0.001)
Raven	-0.009 (0.027)	-0.007 (0.032)	-0.007 (0.032)	-0.007 (0.032)
FAS	-0.047*** (0.010)	-0.051*** (0.012)	-0.051*** (0.012)	-0.051*** (0.012)
constant	5.383*** (0.317)	5.379*** (0.358)	5.418*** (0.411)	5.518*** (1.032)
No. of Obs.	524	524	524	524
Adj. R2	0.046			
Pseudo R2		0.027	0.027	0.027
Prob>chi2/F	0.000	0.000	0.000	0.000

Robust standard errors clustered at the classroom level in parentheses, P-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**Table 11: Regression analysis: Field behaviour, mindfulness and preferences (future equivalent with upfront-delay)**

	Smoking	Drinking	BMI	Saving	Education	Satisfaction
Mindfulness	-0.214*** (0.055)	-0.010 (0.075)	-0.305** (0.132)	-1.500*** (0.554)	1.229*** (0.458)	1.605*** (0.207)
Mindfulness^2				0.442*** (0.153)	-0.360*** (0.138)	
Future equivalent with upfront delay	0.183*** (0.058)	0.218*** (0.056)	0.196 (0.173)	-0.073 (0.052)	-0.214*** (0.067)	0.523** (0.203)
Risk	0.090 (0.069)	0.065 (0.053)	0.099 (0.108)	0.055 (0.059)	0.185** (0.072)	0.056 (0.227)
Male	0.253 (0.154)	0.140 (0.142)	1.038*** (0.300)	-0.026 (0.145)	0.011 (0.152)	1.691*** (0.449)
Pocket Money	0.062 (0.064)	-0.067 (0.063)	0.081 (0.144)	-0.111 (0.078)	0.054 (0.049)	-0.025 (0.198)
Math score	-0.325*** (0.070)	-0.293*** (0.070)	-0.162 (0.129)	0.137** (0.061)	-0.035* (0.021)	0.432** (0.208)
German score	0.104* (0.058)	0.003 (0.073)	-0.319** (0.140)	0.112 (0.073)	-0.025 (0.027)	-0.184 (0.260)
FAS	-0.120* (0.063)	0.103 (0.071)	-0.429*** (0.154)	0.092 (0.070)	0.326*** (0.064)	1.073*** (0.241)
constant	-0.861*** (0.102)	0.874*** (0.133)	20.890*** (0.196)	-5.117*** (1.789)		24.976*** (0.293)
Model	Probit	Probit	OLS	Probit	Ord. Probit	OLS
No. of Obs.	523	523	518	478	523	523
Adj./Psd. R2	0.094	0.061	0.090	0.046	0.087	0.167
Prob>chi2/F	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Mindfulness, impatience (with upfront delay) and risk are standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**Table 12: Regression analysis: Field behaviour, mindfulness (including mindfulness squared) and preferences**

	Smoking	Drinking	BMI	Saving	Education	Satisfaction
Mindfulness	-0.789 (1.159)	1.228 (1.313)	-1.572 (2.516)	-2.871*** (1.061)	2.471*** (0.844)	3.473 (4.159)
Mindfulness^2	0.060 (0.176)	-0.184 (0.195)	0.149 (0.384)	0.439*** (0.152)	-0.378*** (0.132)	-0.050 (0.609)
Impatience	0.085 (0.103)	0.440*** (0.123)	0.126 (0.219)	-0.103 (0.102)	-0.291** (0.139)	0.736** (0.333)
Risk	0.043 (0.041)	0.041 (0.031)	0.047 (0.065)	0.035 (0.034)	0.117*** (0.043)	0.015 (0.135)
Male	0.254 (0.155)	0.165 (0.137)	1.049*** (0.302)	-0.030 (0.139)	-0.009 (0.150)	1.727*** (0.457)
Pocket Money	0.002 (0.002)	-0.002 (0.002)	0.002 (0.004)	-0.003 (0.002)	0.001 (0.001)	-0.001 (0.006)
Math score	-0.321*** (0.072)	-0.320*** (0.072)	-0.167 (0.129)	0.140** (0.061)	-0.026 (0.021)	0.411* (0.206)
German score	0.103* (0.055)	0.014 (0.070)	-0.321** (0.139)	0.114 (0.072)	-0.022 (0.027)	-0.191 (0.262)
FAS	-0.062** (0.028)	0.051* (0.030)	-0.196*** (0.067)	0.040 (0.030)	0.143*** (0.029)	0.464*** (0.108)
constant	1.199 (2.029)	-3.893* (2.349)	25.832*** (4.198)	4.624** (1.904)		4.997 (7.300)
Model	Probit	Probit	OLS	Probit	Ord. Probit	OLS
No. of Obs.	523	523	518	478	523	523
Adj./Psd. R2	0.082	0.076	0.085	0.046	0.082	0.163
Prob>chi2/F	0.000	0.000	0.001	0.000	0.000	0.000

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Mindfulness, impatience (with upfront delay) and risk are standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**Table 13: Regression analysis: Field behaviour, mindfulness and preferences differentiated by gender**

	Smoking Boys	Smoking Girls	Drinking Boys	Drinking Girls	BMI Boys	BMI Girls
Mindfulness	-0.064 (0.084)	-0.312*** (0.093)	-0.073 (0.120)	0.055 (0.099)	-0.078 (0.156)	-0.476** (0.180)
Impatience	0.184** (0.080)	-0.085 (0.084)	0.358*** (0.133)	0.216** (0.094)	-0.038 (0.166)	0.176 (0.153)
Risk	0.104 (0.102)	0.033 (0.084)	-0.061 (0.095)	0.224* (0.117)	0.144 (0.162)	0.015 (0.145)
Pocket Money	0.032 (0.069)	0.270 (0.165)	-0.077 (0.081)	-0.019 (0.126)	0.065 (0.145)	0.189 (0.335)
Math score	-0.364*** (0.096)	-0.276*** (0.095)	-0.442*** (0.086)	-0.213** (0.102)	0.014 (0.199)	-0.339* (0.173)
German score	0.082 (0.104)	0.136 (0.102)	0.056 (0.130)	-0.055 (0.115)	-0.347* (0.172)	-0.294 (0.186)
FAS	-0.118 (0.076)	-0.185** (0.092)	0.046 (0.116)	0.197 (0.124)	-0.514*** (0.183)	-0.416* (0.214)
constant	-0.617*** (0.111)	-0.876*** (0.107)	1.154*** (0.093)	0.939*** (0.142)	21.883*** (0.201)	20.844*** (0.195)
Model	Probit	Probit	Probit	Probit	OLS	OLS
No. of Obs.	263	260	263	260	262	256
Adj./Psd. R <sup>2</sup>	0.084	0.111	0.129	0.062	0.022	0.078
Prob>chi2/F	0.000	0.000	0.000	0.000	0.021	0.001

	Saving Boys	Saving Girls	Education Boys	Education Girls	Satisfaction Boys	Satisfaction Girls
Mindfulness	-2.324*** (0.822)	-1.015 (0.744)	-0.125* (0.068)	0.037 (0.066)	1.599*** (0.203)	1.650*** (0.351)
Mindfulness <sup>2</sup>	0.674*** (0.235)	0.303 (0.210)				
Impatience	-0.191* (0.111)	0.036 (0.082)	-0.165** (0.083)	-0.194* (0.110)	0.628** (0.304)	0.306 (0.329)
Risk	0.022 (0.067)	0.123 (0.085)	0.124 (0.079)	0.280** (0.123)	-0.103 (0.253)	0.154 (0.375)
Pocket Money	-0.204* (0.107)	-0.001 (0.106)	0.004 (0.058)	0.098 (0.129)	-0.031 (0.191)	-0.014 (0.430)
Math score	0.300*** (0.092)	-0.042 (0.119)	-0.097** (0.044)	0.055 (0.062)	0.201 (0.287)	0.634* (0.327)
German score	0.023 (0.092)	0.236*** (0.090)	0.086 (0.065)	-0.134** (0.066)	0.079 (0.402)	-0.481 (0.415)
FAS	0.102 (0.089)	0.043 (0.107)	0.376*** (0.092)	0.301*** (0.067)	1.024*** (0.301)	1.169*** (0.358)
constant	-7.832*** (2.724)	-3.535 (2.428)			26.791*** (0.291)	25.066*** (0.305)
Model	Probit	Probit	Ord. Probit	Ord. Probit	OLS	OLS
No. of Obs.	240	238	263	260	263	260
Adj./Psd. R <sup>2</sup>	0.100	0.038	0.082	0.083	0.134	0.119
Prob>chi2/F	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors clustered at the classroom level are displayed in parentheses. For Probit models average marginal effects are displayed. Mindfulness, impatience (with upfront delay) and risk are standardized to make effect sizes comparable. Control variables include gender, monthly pocket money, math and German score, both relative to the class, and socio-economic background. Stars represent the following p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**Table 14: Regression analysis: Saving**

	Model 1	Model 2 (non-linear)	Model 3 (below median <sup>a</sup> )	Model 4 (above median <sup>b</sup> )
Mindfulness	0.040 (0.058)	-1.492*** (0.552)	-0.197 (0.160)	0.331*** (0.110)
Mindfulness <sup>2</sup>		0.439*** (0.152)		
Impatience	-0.071 (0.065)	-0.064 (0.064)	-0.135 (0.090)	-0.012 (0.097)
Risk	0.063 (0.057)	0.059 (0.058)	0.057 (0.079)	0.079 (0.089)
Male	-0.054 (0.132)	-0.030 (0.139)	0.025 (0.126)	-0.095 (0.225)
Pocket Money	-0.070 (0.095)	-0.111 (0.080)	-0.076 (0.117)	-0.109 (0.101)
Math score	0.140** (0.063)	0.140** (0.061)	0.198* (0.105)	0.083 (0.110)
German score	0.126* (0.070)	0.114 (0.072)	0.172* (0.101)	0.087 (0.087)
FAS	0.096 (0.068)	0.092 (0.069)	0.073 (0.087)	0.131 (0.088)
Model	Probit	Probit	Probit	Probit
No. of Obs.	478	478	232	246
Pseudo R2	0.035	0.046	0.056	0.044
Prob>chi2/F	0.001	0.000	0.001	0.000

Robust standard errors clustered at the classroom level in parentheses, marginal coefficients are reported, significance/p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010

<sup>a</sup> Only subjects that have a MAAS-A score below the median.

<sup>b</sup> Only subjects that have a MAAS-A score above the median.

**Table 15: Regression analysis: Education**

	Model 1 Education	Model 2 Education (non-linear)	Model 3 Education (< median <sup>a</sup> )	Model 4 Education (> median <sup>b</sup> )	Model 5 High-school (Gymnasium) (< median <sup>a</sup> )	Model 6 High-school (Gymnasium) (> median <sup>b</sup> )
Mindfulness	-0.035 (0.053)	1.284*** (0.439)	0.097 (0.105)	-0.221 (0.148)	0.274** (0.120)	-0.221 (0.148)
Mindfulness <sup>2</sup>		-0.378*** (0.132)				
Impatience	-0.175** (0.086)	-0.182** (0.087)	-0.181* (0.109)	-0.185* (0.104)	-0.150 (0.125)	-0.185* (0.104)
Risk	0.192*** (0.072)	0.197*** (0.073)	0.264** (0.107)	0.149** (0.068)	0.368*** (0.116)	0.149** (0.068)
Male	0.010 (0.155)	-0.009 (0.150)	0.070 (0.175)	-0.098 (0.168)	0.131 (0.217)	-0.098 (0.168)
Pocket Money	0.032 (0.047)	0.054 (0.052)	-0.025 (0.063)	0.191* (0.103)	-0.045 (0.076)	0.191* (0.103)
Math score	-0.024 (0.022)	-0.026 (0.021)	0.010 (0.060)	-0.064 (0.064)	0.052 (0.071)	-0.064 (0.064)
German score	-0.034 (0.028)	-0.022 (0.027)	-0.063 (0.071)	0.005 (0.061)	-0.096 (0.074)	0.005 (0.061)
FAS	0.323*** (0.065)	0.327*** (0.066)	0.228*** (0.085)	0.420*** (0.088)	0.236** (0.096)	0.420*** (0.088)
Model	Ord. Probit	Ord. Probit	Ord. Probit	Ord. Probit	Probit	Probit
No. of Obs.	523	523	254	269	254	269
Pseudo R2	0.075	0.082	0.066	0.109	0.112	0.109
Prob>chi2/F	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors clustered at the classroom level in parentheses, for probit models the marginal coefficients are reported, significance/p-values: \* p<0.10, \*\* p<0.05, \*\*\* p<0.010

<sup>a</sup> Only subjects that have a MAAS-A score below the median.

<sup>b</sup> Only subjects that have a MAAS-A score above the median.