The Impact of Financial Education on Adolescents' Intertemporal Choices

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ONLINE APPENDIX

Appendix A: Detailed Program Description and Experimental Instructions

A.1. Detailed Program Description

Table A.1. provides a summary of the contents of the financial education program.

A.2. Instructions

The instructions below were read aloud by the same experimenter at the beginning of each class visit. They are translated from German into English. Text in parenthesis and italics was not read aloud.

Description of the experiment

Welcome to our experiment. Our experiment today will consist of 2 parts. We will now go through the first part of the experiment. Please do not talk to your classmates and listen carefully. There will be breaks during the description of the experiment so that you can ask questions. Just raise your hand and someone will come to you.

In part 1 of the experiment you can earn money. We will ask you to choose between different payments, which you will receive at two different points in time. You will make several decisions on how to split money between an earlier point in time (e.g. today) and a later point in time (e.g. in 3 weeks). One of your decisions will be paid out in cash to you. You will only know which decision is paid out, once you have made all your decisions. We will determine it by drawing one decision at random in this classroom with your help. Each decision can be drawn for payment. Therefore, you should make each decision, as if it were the decision that is paid out.

A.1. Summary of the financial education program

Module	Topic	Activity
Shopping	Introduction	Brainstorming: words associated with "shopping"
	Discussion of shopping criteria	(a) Discussion: what did students buy last? Was it something they "needed" or "wanted"?
		(b) Comic strip: an adolescent receives money from his mother and spends it on unplanned expenses (chips and chocolate).
	Advertising	(a) Discussion: where do you see ads? Which instruments are used in advertising (emotions, logos, etc.)?
		(b) Typical messages in ads
	Buying a smartphone	(a) Discussion: what shopping criteria do you use?
		(b) Roleplay: adolescent wants to buy a smartphone, discussion with parents and friends.
Tips for students		*(1) Prioritise when making spending choices*
		(2) Be critical about advertising
		(3) Think about which criteria are important for you before buying
		(4) Compare different options before buying
Planning	Introduction	Brainstorming: words associated with "planning"
	Different kinds of plans	Exercise: linking different types of plans (e.g. school schedule) to their purposes
	Financial planning	(a) Discussion: why plan your expenses and income?
		(b) Discussion: where does your money come from and what do you spend it on?
		(c) Case study: Felix wants to buy a motorcycle; help him planning expenses, and discuss why Felix should not take on debt
Tips for students		*(1) Just as with other plans, you can plan your finances*
		(2) Have an overview of your income and expenses
		(3) A plan can help you reach your goals
		(4) Do not spend more money than you have
		(5) Purchases of durables can have running costs
Saving	Introduction	Brainstorming: words associated with "saving"
	Saving money	(a) Discussion: what do you do with money?
		(b) Discussion: how can you save money to reach your savings goal?
		(c) Discussion: why there are different savings products
		(d) Comic strip: savings product choice by an adolescent
	Risk, return, liquidity	(a) Discussion: trade-off between risk, return and liquidity
		(b) Case study: Paul (14 years old) receives money for his driving license (to be spent at 18), help him choose how to save it
	Definition of savings products	Find the product that matches the definition
Tips for students		*(1) Decide which is more important for you: return, risk or liquidity*
		(2) Do not choose the first offer made to you
		(3) Do not believe that one savings product can achieve everything (high return, low risk and high liquidity)
		(4) Decide which savings product fits best your objective

Any questions so far?

We have brought an example to show you how it works. This example shows how your decisions could look like (*put sheet on projector, show only the upper part including decision A1 only*).

You have to decide between payments today and in 3 weeks from today. As you can see, there is a small calendar at the top of the sheet, in which we marked the exact corresponding dates. Today is colored in green, and in 3 weeks is colored in blue. Just below the calendar you can see the decisions you will be asked to make. The payments

today and in 3 weeks are, respectively, colored in green and blue.

Let us look at the decision A1. For example, if I check the first box on the left, then I decide to get 12 Euro today and 0 Euro in 3 weeks. If I check the second box, then I decide to get 8 Euro today and 1 Euro in 3 weeks. If I check the third box, then I decide to get 4 Euro today and 2 Euro in 3 weeks. If I check the fourth box, then I decide to get 0 Euro today and 3 Euro in 3 weeks.

I have to check one of these four boxes. Suppose I would like to get 4 Euro today and 2 Euro in 3 weeks. Then, I will check the third box.

Any questions so far?

Please remember that we will pay out one of your decisions to you in cash. Therefore, choose each time what you really want. You indicate that by checking your preferred box. You may only check one of the four boxes in each row.

(*Uncover sheet completely*) As you can see, there are 7 rows on this sheet. The green payments, which you get today, become somewhat smaller in each row. The payments which you get in 3 weeks stay the same. As you can see, the last decision of this example (A7) would give you 30 cents today and 0 in 3 weeks if you check the first box. If you check the second box, how much will you get today and in 3 weeks? If you check the third box, how much will you get today and in 3 weeks? What about checking the fourth box?

In each row you make one decision, that is, you check one box. There is no right or wrong. You can decide differently in each row.

In this example most people choose the first option on the left in the beginning (in decision A1) and further down in the decision sheet they choose an option more to the right, for example the second, third, or fourth box. One possible way of making your decisions is thus to decide which option you prefer in the first row and then decide from which row onwards you would prefer a combination of payments to the right of the option you chose previously.

We will give you 3 sheets with different decisions. On each sheet the timing will be different. There are in total 3 different points in time: today, in 3 weeks, and in 6 weeks. The relevant points in time are indicated at the top of each sheet. Additionally, the exact dates are marked in the calendar.

Let us look at another example in which the points in time change. Here, it is (*show sheet with decisions between 3 and 6 weeks*). Here, you have to decide how much money

you would like to get in 3 weeks and in 6 weeks. "In 3 weeks" is still coloured in blue, while "in 6 weeks" is coloured in pink. Note that each point in time has its own colour. Apart from that, the rules stay the same. In each row you have to make one decision which determines how much money you will get. Any questions so far?

How does the payment work?
After you have made all decisions on the 3 sheets, you will return your decision sheets for part 1 of the experiment to us. In total, you will have made 7 decisions per sheet, A1-A7, B1-B7, and C1-C7. We will then choose the decision relevant for your earnings. You will help us to choose one decision at random. For that purpose, there are small cards, one for each decision (*show cards*). One of you will blindly draw one card out of this bag. This card will determine the decision, which is relevant for your payment.

Let us turn to the most important point: Suppose, we draw decision C4. As you can see on the sheet, the relevant points in time for your payment are in 3 weeks and in 6 weeks (*point to header*). No matter which decisions you made, you will get an extra Euro for both points in time in order to thank you for your participation (*use overhead marker to indicate extra euro above both points in time*).

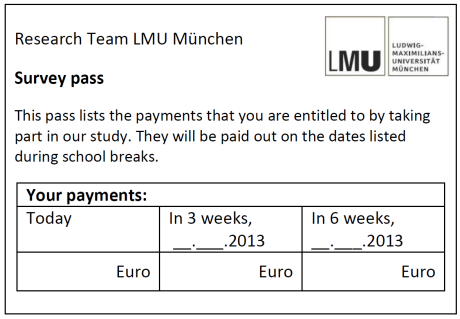
Suppose you chose the third box in C4. Then, in 3 weeks, you will get 1 Euro and 1.75 Euro, in total 2.75 Euro. In 6 weeks, you will get 1 Euro and 4 Euro, in total 5 Euro. Suppose you chose something else, for example the first box. Then, in 3 weeks you will get 5.25 Euro and 1 Euro, in total 6.25 Euro, and in 6 weeks 1 Euro.

Each of your 21 decisions can be drawn out of the bag. Thus, you should think about each decision very carefully.

How do you exactly receive your money?
Payments for today you will get at the end of this session. Payments at a later date, for example in 3 weeks, you will get in three weeks. We will come back and give you the money in class before the break starts or during the break. And in six weeks, the same will happen.

In order for us to know who gets how much money, we will give you a small card (*show card*). That is your receipt for your earnings. It is very important that you keep this card safe until we meet again. It helps us to know which decision you made. If you lose the card, your teacher will help us. He/She will safeguard a list with information on how much money you get at which point in time. At the end of this session, we will come to each of you and give you the card with your payments from part 1. We will

also ask you to put your name on the list next to the payments you will get at each point in time.



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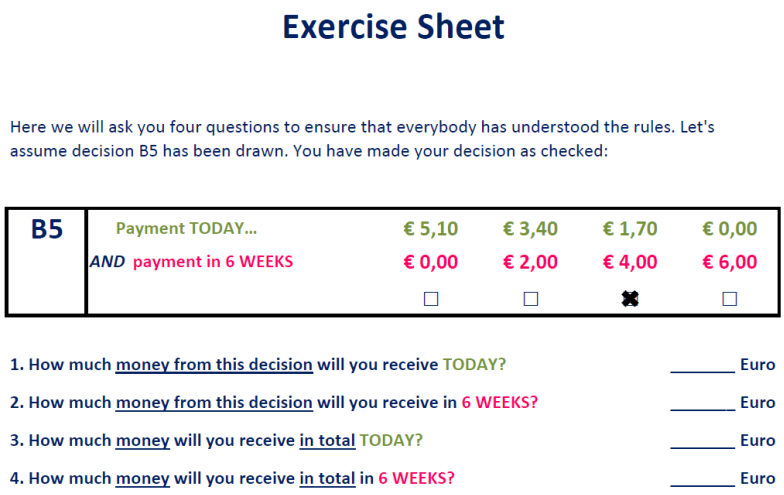
Survey pass

This pass lists the payments that you are entitled to by taking part in our study. They will be paid out on the dates listed during school breaks.

Your payments:		
Today	In 3 weeks, __.___.2013	In 6 weeks, __.___.2013
Euro	Euro	Euro

Figure A.1. Payment card (translated from German)

Now, please turn around the front page of part 1. There you can see another example. Please answer the questions on this sheet now and wait when you are done. We will go around and check your answers to make sure you understand everything.



Exercise Sheet

Here we will ask you four questions to ensure that everybody has understood the rules. Let's assume decision B5 has been drawn. You have made your decision as checked:

B5	Payment TODAY…	€ 5,10	€ 3,40	€ 1,70	€ 0,00
	AND payment in 6 WEEKS	€ 0,00	€ 2,00	€ 4,00	€ 6,00
		☐	☐	✖	☐

1. How much money from this decision will you receive TODAY? _____ Euro
2. How much money from this decision will you receive in 6 WEEKS? _____ Euro
3. How much money will you receive in total TODAY? _____ Euro
4. How much money will you receive in total in 6 WEEKS? _____ Euro

Figure A.2. Example to test comprehension of CTB task (translated from German)

TODAY and 3 WEEKS from today

April						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

May						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

June						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Choose in each decision (A1 to A7) the amounts that you want to receive with certainty today and in 3 weeks, by crossing the corresponding box. Do not forget to cross only one box for each decision!

A1.	Amount TODAY …	€6.00	€4.00	€2.00	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A2.	Amount TODAY …	€5.85	€3.90	€1.95	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A3.	Amount TODAY …	€5.70	€3.80	€1.90	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A4.	Amount TODAY …	€5.55	€3.70	€1.85	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A5.	Amount TODAY …	€5.10	€3.40	€1.70	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A6.	Amount TODAY …	€4.50	€3.00	€1.50	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
A7.	Amount TODAY …	€3.00	€2.00	€1.00	€0.00
	AND amount in 3 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐

Figure A.3. Decisions sheet for payment choices between today and in 3 weeks (translated from German)

TODAY and in 6 WEEKS from today

April						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

May						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

June						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Choose in each decision (B1 to B7) the amounts that you want to receive with certainty today and in 6 weeks, by crossing the corresponding box. Do not forget to cross only one box for each decision!

B1.	Amount TODAY …	€6.00	€4.00	€2.00	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B2.	Amount TODAY …	€5.85	€3.90	€1.95	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B3.	Amount TODAY …	€5.70	€3.80	€1.90	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B4.	Amount TODAY …	€5.55	€3.70	€1.85	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B5.	Amount TODAY …	€5.10	€3.40	€1.70	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B6.	Amount TODAY …	€4.50	€3.00	€1.50	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
B7.	Amount TODAY …	€3.00	€2.00	€1.00	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐

Figure A.4. Decisions sheet for payment choices between today and in 3 weeks (translated from German)

In 3 WEEKS and in 6 WEEKS from today

April						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Mai						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Juni						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Choose in each decision (C1 to C7) the amounts that you want to receive with certainty in 3 weeks and in 6 weeks, by crossing the corresponding box. Do not forget to cross only one box for each decision!

C1.	Amount in 3 WEEKS...	€6.00	€4.00	€2.00	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C2.	Amount in 3 WEEKS...	€5.85	€3.90	€1.95	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C3.	Amount in 3 WEEKS...	€5.70	€3.80	€1.90	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C4.	Amount in 3 WEEKS...	€5.55	€3.70	€1.85	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C5.	Amount in 3 WEEKS...	€5.10	€3.40	€1.70	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C6.	Amount in 3 WEEKS...	€4.50	€3.00	€1.50	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐
C7.	Amount in 3 WEEKS...	€3.00	€2.00	€1.00	€0.00
	AND amount in 6 WEEKS	€0.00	€2.00	€4.00	€6.00
		☐	☐	☐	☐

Figure A.5. Decisions sheet for payment choices between today and in 3 weeks (translated from German)

Appendix B: Additional Results

B.1. Effects of the financial education program on students' knowledge

After all students had completed the CTB task, we administered a survey. The survey instrument contained several questions on financial knowledge. These are a combination of standard financial literacy questions and questions that that are closely tailored to the contents of the program.

Table B.1. presents the effects of the program on the share of incorrect answers provided by students. Column (1) below presents the results for all questions. Column (2) focuses on the program-specific questions. Column (3) present the results for two PISA financial literacy questions on the value of money (PISA 2012 Financial Literacy Assessment Framework Report, 2012). Column (4) presents the results for four basic financial literacy questions designed by Lusardi and Mitchell (2014). They elicit numeracy regarding interest compounding, inflation, diversification and the definition of a share.

Table B.1. Treatment effect on financial knowledge

	(1)	(2)	(3)	(4)
	Share of incorrect questions			
	All questions	Program-specific questions	PISA financial literacy questions	Basic financial literacy (Lusardi and Mitchell, 2014)
Treatment	-0.028***	-0.034**	0.001	-0.033*
	[0.011]	[0.014]	[0.019]	[0.017]
Constant	0.435***	0.403***	0.212***	0.594***
	[0.007]	[0.010]	[0.013]	[0.012]
Observations	914	914	914	914
R-squared	0.008	0.006	0.000	0.004

Note: The dependent variable is the share of questions answered incorrectly. Column (1) presents the results including all questions. Column (2) focuses on the questions tailored to the program contents. Column (3) focuses on PISA financial literacy questions (on the value of money). Column (4) focuses on basic financial literacy questions developed by Lusardi and Mitchell (2014). Standard errors are shown in brackets. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

The treatment reduced the number of incorrect answers significantly. This effect stems both from questions that were tightly linked to the program as well as basic financial literacy questions. If we examine each basic financial literacy question in detail, we find increases in the knowledge of what a share is (a concept that was discussed in the

program), but no increase in correct answers for the remaining questions (on inflation, numeracy regarding compounding, and diversification).

B.2. Adolescents' financial situation

If adolescents' financial circumstances differ systematically between the treatment and control group, this may affect their choices in the CTB task. Table B.2 provides statistical tests regarding four descriptives of teenagers' financial situation, namely monthly income (pocket money plus family transfers and income from small jobs) and expenditures, and savings, measured as the existence of any savings and the log of total savings in the last month. We find no systematic differences in either of these financial outcomes between treatment and control.

Table B.2. Treatment effect on adolescents' financial situation

	(1) Monthly income	(2) Monthly spending	(3) Save	(4) Ln(savings)
Treatment	2.854	3.792	-0.107	-0.395
	[2.942]	[3.056]	[0.084]	[0.267]
Constant	32.957***	39.746***	0.052	0.609***
	[1.959]	[1.845]	[0.057]	[0.207]
Observations	769	827	894	881

Note: OLS regressions in columns (1) and (2), probit regression in column (3), tobit in column (4). All with robust standard errors clustered at the individual level. Monthly income is measured as the money available to adolescents each month; spending is measured using a one-shot total expenditure question; Save takes the value one if the teenager saved during the last month; ln(savings) is the log of the amount saved in the last month. Standard errors are shown in brackets. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

B.3. Allocation to sooner payment: Robustness tests

Table B.3 displays the regression results on the determinants of the allocation to the sooner payment, using an OLS regression model and an ordered probit model, instead of the interval regression used in Table 4 of the paper. All results are qualitatively similar.

Table B.3. Treatment effect on adolescents' financial situation

	Allocation to sooner payment date			
	(1)		(2)	
	OLS regression		Ordered probit	
	Coefficient	Std. Error	Coefficient	Std. Error
Treatment	3.728	[3.237]	0.135	[0.104]
Immediate Payment	5.696***	[2.189]	0.185***	[0.068]
Immediate Payment X Treatment	-5.256*	[3.158]	-0.167*	[0.099]
Delay is 6 w.	-3.599	[2.257]	-0.115	[0.071]
Delay is 6 w. X Treatment	6.218*	[3.235]	0.200**	[0.102]
Gross Interest	-18.913***	[1.604]	-0.577***	[0.049]
Gross Interest X Treatment	-2.043	[2.333]	-0.076	[0.075]
Female	-1.855	[1.512]	-0.083	[0.047]
Grade 8	-2.459	[1.662]	-0.077	[0.052]
Cognition score	-2.718***	[0.897]	-0.085***	[0.028]
Math grade	-2.749***	[0.757]	-0.087***	[0.024]
Migrant background	-0.576	[1.598]	-0.021	[0.050]
Single parent	-0.098	[1.775]	0.005	[0.056]
<25 books at home	3.528**	[1.590]	0.107**	[0.050]
Constant	84.590***	[4.186]		
Observations	17,724		17,724	

Note: OLS regressions in columns (1) and (2), order probit regressions in columns (3) and (4). The dependent variable is the budget share allocated to the sooner payment date, which is either 0, 33.3, 66.6 or 100. Immediate payment is a dummy variable that takes the value 1 if the sooner payment occurred immediately after the students completed the task and survey. Delay is 6 weeks is a dummy variable that takes the value 1 if the delay between the sooner and later payment was 6 weeks and not 3 weeks. Individual characteristics are defined as in Table 3. Month and location fixed effects are included. Interaction terms of the gross interest rate with delay as well as immediacy, and their interaction with treatment, are included in the regression. Robust standard errors are shown, clustered at the individual level. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

B.3. Corner choice patterns

Table B.4 presents the estimated marginal effects for the likelihood that an individual chooses to allocate 100% of the budget to the sooner payment date at a low interest rate (r), starting at $r = 0$, and then switches to allocating 100% of the budget to the later payment date at a higher interest rate. The dependent variable, labeled "corner choice pattern", is a dummy variable that takes value one if the individual behaves as described, zero otherwise.

Table B.4. Patterns of corner choices

	Corner choice pattern	
	Coefficient	Std. Error
Treatment	0.062**	[0.028]
Female	-0.068**	[0.029]
Grade 8	0.071**	[0.032]
Cognition score	0.023	[0.016]
Math grade	0.021	[0.014]
Migrant background	-0.004	[0.029]
Single parent	0.015	[0.033]
<25 books at home	-0.040	[0.028]
Observations	844	

Note: Probit regression, marginal effects shown, with robust standard errors clustered at the school level (25 clusters). Corner choice pattern takes value 1 if the individual always chooses to allocate 100% of the budget to the sooner payment date at $r = 0$ and as r increases he switches to allocating 100% of the budget to the later payment date immediately, and zero otherwise. Individual characteristics (gender, grade, cognition score, relative math grade, migrant background, single parent and books at home) are defined as in Table 3. The regression includes month and location fixed effects. Standard errors are shown in brackets. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

Appendix C: Estimation of time preferences

C.1. Econometric model

Following Andreoni and Sprenger (2012), we assume a time separable CRRA utility function within the $\beta - \delta$ model of quasi–hyperbolic discounting (e.g., Laibson, 1997),

$$U(x_t, x_{t+k}) = x_t^{\alpha} + \beta^{I_{t=0}} \delta^k x_{t+k}^{\alpha} \tag{1}$$

where the individual receives monetary amounts x_t and x_{t+k} at time t and $t+k$, and $I_{t=0}$ is an indicator variable that takes value one if payments are immediate. The preference parameters of interest are the discount rate δ, present bias β and utility curvature α. Individuals maximise utility subject to the budget constraint, $(1+r)x_t + x_{t+k} = m$. This yields the standard Euler equation, which can be written in logs as:

$$ln(\frac{x_t}{x_{t+k}}) = \frac{ln(\beta)}{\alpha - 1} I_{t=0} + \frac{ln(\delta)}{\alpha - 1} k + \frac{1}{\alpha - 1} ln(1+r), \tag{2}$$

The Euler equation establishes the optimal log ratio of payments across t and $t+k$, $x_j^* = ln(\frac{x_{t,j}}{x_{t+k,j}})$, in decision j, given the vector of preference parameters $\mu = (\frac{ln(\beta)}{\alpha-1}, \frac{ln(\delta)}{\alpha-1}, \frac{1}{\alpha-1})$ and the vector of decision characteristics $X = (I_{t=0}, k, (1+r))$. An individual i is offered four possible log ratios s_m in each decision problem j, where $m \in \{1, \ldots, M\}$ and $M = 4$. Hence, we estimate an interval data model (Wooldridge, 2001, p. 509).

More specifically, let us denote the vector of possible ratios as $s = (s_1, s_2, s_3, s_4)$. To simplify notation we drop the subscripts for each individual i and choice j. For each decision problem, an individual chooses

$$s = \begin{cases} s_1 & \text{if } x^* > s_2. \\ s_2 & \text{if } s_2 > x^* > s_3. \\ s_3 & \text{if } s_3 > x^* > s_4. \\ s_4 & \text{if } s_4 > x^*. \end{cases} \tag{3}$$

The probability that $s = s_m$, where $m \in \{1, 2, 3, 4\}$, depends on $X'\mu$. Additionally, as in von Gaudecker, van Soest and Wengström (2011) and Loomes, Moffatt and Sugden (2002), we model stochastic choice by allowing Fechner errors. These errors enter as weight τ on ε, which is assumed to be i.i.d across choices and individuals, and follow a

standard logistic distribution. Hence, we have that,

$$\begin{cases} P(s = s_1|X, \mu, \tau, s) & = 1 - \Lambda(\frac{1}{\tau}(s_2 - X'\mu)), \\ P(s = s_2|X, \mu, \tau, s) & = \Lambda(\frac{1}{\tau}(s_3 - X'\mu)) - \Lambda(\frac{1}{\tau}(s_2 - X'\mu)), \\ P(s = s_3|X, \mu, \tau, s) & = \Lambda(\frac{1}{\tau}(s_4 - X'\mu)) - \Lambda(\frac{1}{\tau}(s_3 - X'\mu)), \\ P(s = s_4|X, \mu, \tau, s) & = \Lambda(\frac{1}{\tau}(s_4 - X'\mu)), \end{cases}$$

where $\Lambda(t) = (1 + e^{-t})^{-1}$. Thus, the conditional log-likelihood is

$$ln\ L(\mu, \tau; X, s_m) = \sum_i \sum_j ln(P_{ij}(s = s_m|\mu, \tau; X, s) I_{(s=s_m)})$$

where $I_{(s=s_m)}$ is an indicator variable that takes value one if $s = s_m$.

At the individual level and in additional specifications, shown as robustness tests below, we add a trembling-hand error (e.g., Harless and Camerer, 1994), which allows for a probability ω that a student makes a random choice in a given decision. The results remain qualitatively similar with or without this additional type of stochastic choice.

An alternative stochastic choice model, which is frequently used in related studies, is the Luce model (e.g., Andersen et al., 2008). According to this model (Luce, 1959), the utility "index" of option m is the ratio of its utility, weighted by an "error" parameter σ, over the sum of the utilities of all other options. In particular,

$$u_m = \frac{U(x_{m,t}, x_{m,t+k})^{\frac{1}{\sigma}}}{\sum_{n=1}^{M} U(x_{n,t}, x_{n,t+k})^{\frac{1}{\sigma}}} \tag{4}$$

As $\sigma \to 0$ choice collapses to the deterministic choice model, while as σ increases choices become random. In this case, the likelihood that an individual chooses m is $P(s = s_m) = P(u_m + \varepsilon > 0) = \Phi(-u_m)$, where $\Phi(\cdot)$ is the cumulative standard normal distribution.

C.2. Estimated Aggregate Parameters: robustness tests

In this section, we show that the estimated aggregate parameters in Table 6 of the paper are robust to alternative models. The first alternative model, shown in columns (1) and (2) of Table C.1., is the non-linear least squares approach in Andreoni and Sprenger (2012). The second model, shown in columns (3) and (4), is the interval censored tobit (ICT) presented in section C.1. with an added trembling-hand error ω that is school-specific. The third model, shown in columns (5) and (6), adds a trembling-hand error that is homogeneous within the treatment and control group, respectively. The same result is obtained in all specifications, $\hat{\beta}$ is significantly smaller than 1 in the control group and not significantly different from 1 in the treatment group.

Table C.1: Estimated Aggregate Parameters: Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
	NLS		ICT with Fechner error and school-specific trembling hand		ICT with Fechner error and homogeneous trembling hand	
	Control	Treatment	Control	Treatment	Control	Treatment
$\hat{\beta}$	0.971	1.001	0.928	0.994	0.915	0.996
	[0.013]	[0.012]	[0.026]	[0.029]	[0.028]	[0.011]
$\hat{\delta}$	0.995	0.994	0.997	0.993	0.997	0.996
	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]
$\hat{\alpha}$	0.573	0.599	0.571	0.453	0.614	0.911
	[0.017]	[0.041]	[0.030]	[0.056]	[0.024]	[0.010]
$\hat{\tau}$			0.499	0.612	0.411	0.594
			[0.046]	[0.052]	[0.077]	[0.077]
Observations	10,332	8,862	10,332	8,862	10,332	8,862
H_0: $\hat{\beta} = 1$ (p-value)	0.0227	0.9649	0.0052	0.8420	0.0021	0.7458

Note: Columns (1) and (2) report the estimated preference parameters using the nonlinear least square specification in Andreoni and Sprenger (2012), setting the Stone-Geary consumption minima parameters equal to zero. Columns (3) and (4) report the estimated parameters by assuming ω is school-specific, in the interval regression model. Columns (5) and (6) report the estimated parameters by assuming ω is homogeneous within the treatment and control groups, respectively, in the interval regression model. All parameters are computed as nonlinear combinations, using the Delta method, of parameters estimated using maximum likelihood.

C.3. Estimated Individual Parameters

Next, we estimate individual parameters based on the model presented in Section C.1 with trembling-hand errors. Estimating alternative models that do not include Fechner

or trembling-hand errors yield similar results. Table C.2 presents the descriptive statistics for the estimated individual parameters $(\beta_i, \delta_i, \alpha_i, \tau_i, \omega_i)$. Please note that τ_i and α_i are only jointly identified in this model, so the individual estimates have no economic interpretation.[1]

Table C.2: Descriptive statistics for the estimated individual parameters

	Median	5^{th} Percentile	25^{th} Percentile	75^{th} Percentile	95^{th} Percentile
Control					
Present bias parameter ($\hat{\beta}_i$)	1.000	0.440	0.751	1.155	2.627
Discount factor ($\hat{\delta}_i$)	1.002	0.962	0.997	1.018	1.056
Curvature ($\hat{\alpha}_i$)	0.473	-1.411	0.097	0.736	1.738
Fechner error ($\hat{\tau}_i$)	0.335	0.025	0.225	0.515	1.867
Trembling-hand error ($\hat{\omega}_i$)	0.149	0.000	0.000	0.358	0.585
Treatment					
Present bias parameter ($\hat{\beta}_i$)	0.998	0.464	0.782	1.140	2.075
Discount factor ($\hat{\delta}_i$)	1.003	0.961	0.995	1.014	1.108
CRRA Curvature ($\hat{\alpha}_i$)	0.334	-3.341	-0.007	0.697	1.332
Fechner error ($\hat{\tau}_i$)	0.350	0.042	0.278	0.457	0.903
Trembling-hand error ($\hat{\omega}_i$)	0.000	0.000	0.000	0.189	0.581

Note: The subscript i indicates individual i. N=815.

Table C.3 displays the treatment effects on individual parameters. We first examine whether the share of students classified as time consistent varies with the treatment. Time consistency, implying the absence of change in allocations when the earlier payment is immediate or delayed, is reflected in a present bias parameter close to 1, more specifically, between 0.99 and 1.01, following Augenblick, Niederle and Sprenger (2015). We find a significant increase of between 8 and 10 percentage points in the share of students who are classified as time-consistent. The magnitude of this increase is large, as it implies that the share of time-consistent students almost doubles, moving from 9% in the control group to 17% in the treatment group. This finding is consistent with a decrease in narrow bracketing: when time-dated monetary payments are treated less as consumption and integrated within the students' budgets, students should appear

[1]We cannot estimate the parameters for 77 of the subjects, since their choices exhibit zero variance across allocation choices. The estimation does not converge for six subjects, and extreme values of β, smaller than 0.01 and larger than 9.6, are obtained for 18 subjects (top and bottom 1%). There is no difference in the distribution of subjects across treatment and control group (χ^2 test, p=0.559, for subjects exhibiting zero variance, and p=0.199, for extreme values of β.)

more time consistent.

Table C.3. Treatment effect on time consistency and individual time preference parameters

	(1) Time consistency	(2) Present bias ($\hat{\beta}_i$)	(3) Discount factor ($\hat{\delta}_i$)	(4) Trembling hand error ($\hat{\omega}_i$)	(5) CRRA curvature ($\hat{\alpha}_i$)	(6) Fechner error ($\hat{\tau}_i$)
Treatment	0.083**	-0.033	0.009	-0.074***	-0.266	-0.057
	[0.039]	[0.055]	[0.007]	[0.015]	[0.162]	[0.060]
Female	0.015	0.013	0.008	-0.013	-0.042	-0.050
	[0.031]	[0.056]	[0.007]	[0.015]	[0.166]	[0.061]
Grade 8	-0.107***	-0.067	0.005*	0.014	-0.193	-0.150**
	[0.041]	[0.055]	[0.007]	[0.015]	[0.162]	[0.060]
Cognition score	0.004	-0.005	-0.002	-0.014*	0.103	0.004
	[0.015]	[0.031]	[0.004]	[0.008]	[0.092]	[0.034]
Math grade	0.017	0.014	0.001	0.005	0.042	0.021
	[0.011]	[0.028]	[0.003]	[0.008]	[0.084]	[0.031]
Migrant background	-0.003	-0.089	0.007	-0.003	0.069	0.003
	[0.028]	[0.057]	[0.007]	[0.015]	[0.167]	[0.062]
Single parent	0.024	-0.098	-0.009	0.004	-0.091	0.040
	[0.028]	[0.065]	[0.008]	[0.017]	[0.191]	[0.071]
<25 books at home	0.017	-0.021	0.001	-0.017	0.021	0.102*
	[0.028]	[0.057]	[0.007]	[0.015]	[0.167]	[0.062]
Constant		1.218***	1.001***	0.215***	-0.356	0.580***
		[0.076]	[0.009]	[0.020]	[0.225]	[0.083]
Observations	749	749	749	749	749	749
Adj. R-squared		0.011	0.006	0.040	0.008	0.017

Note: Column (1) reports the marginal effects of a probit model on the likelihood that an individual is time-consistent, i.e., $\hat{\beta}_i$ falls within $0.99 < \hat{\beta}_i < 1.01$. Columns (2)-(6) report multivariate regression results on all estimated parameters. Treatment is a dummy variable that takes value 1 if the student participated in the education program. Individual characteristics are defined as in Table 3. Additional controls are location and month fixed effects. Robust standard errors, clustered at the school level, are computed. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

We also estimate a multivariate multiple regression model to examine the treatment effect on the jointly estimated parameters. The results reveal no significant changes in the present bias parameter, $\hat{\beta}_i$,[2] or in the estimated discount factor ($\hat{\delta}_i$), while the

[2]This result, together with the increase in time consistency, suggests that both the estimated present bias and future bias may have decreased. The data indeed reveal a decrease in the share of individuals who appear as strongly present biased, with $\hat{\beta}_i \leq 0.6$ (χ^2-test, p=0.07), but no significant decrease in the share of individuals that are classified as weakly present biased, i.e. $0.6 < \hat{\beta}_i < 0.99$. At the same time, we find no evidence of a significant decrease in the share of students who look like strongly

treatment strongly decreased the estimated trembling-hand error ($\hat{\omega}_i$).This result is in line with the increase in the share of choices consistent with the law of demand we showed in the descriptive analysis, suggesting increased understanding of intertemporal choice.

C.4. Estimated individual parameters and field behaviours

The treatment decreases the share of students that appear as time inconsistent and the rate of errors in intertemporal choice. The absence of changes in student income or spending across treatment and control suggests that changes in external consumption opportunities cannot explain the observed changes in intertemporal choice. An explanation for these findings is, as mentioned above, that the treatment may have changed how students view time-dated experimental payments, leading to more broad bracketing. If so, students' choices in the CTB task should exhibit a weaker correlation with field behaviours such as saving in the treatment group.

We explore this hypothesis by relating the estimated parameters to several field behaviours reported in the survey conducted after the CTB task. We consider savings behaviour, whether the student saves and, if so, how much. We additionally study self-reported impulsivity measures when shopping, based on Rook and Fisher (1995) and Valence, d'Astous and Fortier (1988). The measure is the average answer to four statements: "I buy impulsively"; "before I buy something, I consider carefully whether I can afford it" (reverse coded); "before I buy something important, I compare prices in the Internet or several shops" (reverse coded); and, "sometimes I regret having bought something new". The answers were given on a 5-item Likert scale, 1-strongly disagree to 5-strongly agree. We also include a measure of efficacy at achieving savings goals. This measure is the average answer to two statements: "when I plan to buy something, I manage to save for it"; "I am good at reaching my saving goals". The answers were provided on the same 5-item Likert scale.

Table C.4 displays the relationship between the estimated present bias parameter, $\hat{\beta}_i$, and these field behaviours. A higher $\hat{\beta}_i$, implying lower present bias, is related to increased savings amounts, directionally lower impulsivity and a higher self-reported efficacy at achieving savings goals. Additionally, $\hat{\delta}_i$ is related to the savings amount as expected. Overall, these correlations suggest that the estimated time preference parameters are informative of students' behaviour in the control group.

future biased individuals, with $\hat{\beta}_i \geq 1.4$, but we find a decrease in those who appear as weakly future biased individuals, with $1.4 > \hat{\beta}_i > 1.01$ (χ^2-test, $p<0.01$).

The estimates in Table C.4 for the interaction between $\hat{\beta}_i$ and the treatment provide suggestive evidence that the relationship between estimated parameters and field behaviours weakens with the treatment. In particular, we observe a marginally significant weaker relationship between $\hat{\beta}_i$ and savings amount in the treatment group. The same sign is obtained for $\hat{\delta}_i$, though it is not significant. We also observe a weaker relationship between $\hat{\delta}_i$ and efficacy at achieving savings goals in the treatment group, which is positive though not significant in the control group. Overall, this suggests that, while intertemporal choices in the control group capture underlying time preferences, in the treatment group choices may have become less informative about preferences.

Table C.4. Estimated parameters and field behaviours

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Save (0/1)		If save=1, ln(save)		Impulsivity		Saving goals	
Treatment	-0.037	-0.189	-0.083	3.331	0.049	-1.580	0.017	2.027*
	[0.039]	[1.102]	[0.135]	[2.246]	[0.067]	[1.140]	[0.094]	[1.113]
$\hat{\beta}_i$		0.030		0.317***		-0.018		0.094*
		[0.039]		[0.061]		[0.041]		[0.053]
$\hat{\delta}_i$		-0.226		4.196**		-1.227		1.330
		[1.064]		[1.851]		[1.116]		[0.970]
$\hat{\omega}_i$		0.037		-0.123		-0.141		0.383
		[0.103]		[0.439]		[0.253]		[0.276]
$\hat{\beta}_i$ * treatment		0.025		-0.225*		-0.178***		-0.021
		[0.048]		[0.117]		[0.063]		[0.100]
$\hat{\delta}_i$ * treatment		0.131		-3.064		1.718		-1.893*
		[1.071]		[2.225]		[1.131]		[1.019]
$\hat{\omega}_i$ * treatment		-0.018		-0.606		0.614		-0.364
		[0.161]		[0.539]		[0.493]		[0.386]
Constant			3.658***	-0.937	0.013	1.290	0.169	-1.357
			[0.192]	[1.893]	[0.073]	[1.123]	[0.109]	[1.041]
Observations	749	749	372	372	736	736	734	734
Adj. R-squared			0.024	0.055	0.038	0.054	0.049	0.060

Note: Columns (1)-(2) report estimated marginal effects of a probit model on the likelihood that an individual saves. Columns (3)-(8) report OLS regression results with the natural logarithm of savings, conditional on savings (columns 3 and 4), self-reported impulsivity (columns 5 and 6) and efficacy at achieving saving goals (columns 7 and 8) as dependent variables. The latter two measures are standardised. The table includes individual characteristics (gender, grade, cognition score, relative math grade, migrant background, single parent and books at home) as controls. All specifications include location and month fixed effects. Robust standard errors, clustered at the school level, are computed. ***, **, * indicate significance at the 1, 5 and 10 percent level, respectively.

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