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ADOLESCENT TIME PREFERENCES PREDICT LIFETIME OUTCOMES*

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This study investigates the relationship between time preferences and lifetime social and economic outcomes. We use a Swedish longitudinal data set that links information from a large survey on children's time preferences at age 13 to administrative registers spanning over five decades. Our results indicate a substantial adverse relationship between high discount rates and school performance, health, labour supply and lifetime income. Males and high-ability children gain significantly more from being future oriented. These discrepancies are largest regarding outcomes later in life. We also show that the relationship between time preferences and long-run outcomes operates through early human capital investments.

Every day people make decisions that involve balancing costs and benefits occurring at different points in time. Such choices include whether or not to drop out of school, search for a new job or start saving. Intertemporal decision-making has been a cornerstone in many economic models since Samuelson (1937), and a salient feature in human capital theory, where the notion is that people with high discount rates invest less in their future than people who are more future oriented (Mincer, 1958; Becker, 1964). As the full returns to many human capital investments are not revealed until some time later, it is remarkable that there are few empirical studies which link time preferences to long-term outcomes.[1] This lacuna is especially evident regarding investments made early in life. Needless to say, childhood represents a critical period when many important investments are made with potentially life-long consequences. With a small number of exceptions (Mischel *et al.*, 1989; Cadena and Keys, 2011; Moffitt *et al.*, 2011), the existing evidence on the connection between time preferences and real-world outcomes is cross-sectional in nature and focuses on the adult population.

This study investigates the relationship between time preferences during childhood and long-run social and economic outcomes. We use a Swedish longitudinal data set that links survey-based information on 11,907 children's time preferences at age 13 to administrative registers spanning over five decades. Time preferences are measured through a questionnaire in which children are asked to rate the extent to which they prefer SEK 900 (US$ 138) today over SEK 9,000 (US$ 1,380) in five years.[2] We

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[1] We use the terms impatience, high discount rate and high rate of time preference as synonyms.

[2] In 2013 year's price level.

document how time preferences are related to human capital investments in terms of educational choices and school performance as early as in compulsory school. We then follow the children throughout life, observing their completed education, results on military enlistment tests, fertility decisions, indicators of health, labour market success and lifetime income.

Our results indicate that time preferences are strongly associated with lifetime outcomes.[3] A higher discount rate is linked to weaker performance in both compulsory and secondary school, lower educational attainment and lower scores on military achievement tests at age 19. The magnitude of the discrepancy in compulsory school performance between more and less future oriented children is substantial and similar to the gender gap in performance between boys and girls. We also document an adverse relation with lifetime income, unemployment, welfare take-up, early death, obesity and teenage childbearing. Our results remain robust after controlling for potentially important confounding factors such as parental socio-economic status and cognitive ability.[4]

We continue by studying the association between time preferences and lifetime-outcomes in different segments of the population. Our results show that being future oriented is a more important trait for men when predicting long-run outcomes than for women. The same holds for individuals who scored above average on a cognitive spatial ability test included in the survey. Interestingly, while correlations between time preferences and long-run income are larger for females and low-ability individuals at age 27, the correlations become larger for males and high-ability individuals later in life.

A key result in our study is that the relationship between time preferences and lifetime outcomes is mediated by early human capital investments. There is some evidence that time preferences are malleable and that interventions in childhood environment may contribute in shaping time preferences.[5] The results in our study would in this case imply that early interventions that make individuals more future oriented potentially bring lifelong benefits.

The strength and novelty of our study lie in the use of a very rich data source. The data enable us to link time preferences at an early age to social and economic outcomes observed for a very long portion of the respondents' lives. We measure time preferences at age 13 and are able to follow individuals for more than five decades. No other data have enabled researchers to analyse the importance of time preferences for such an extended period. An additional substantial benefit is that our data are taken from a large sample of Swedish citizens with little scope for selection into or out of the sample. The survey at age 13 had a mandatory character as it was conducted in schools and all pupils present at school during that particular day took part in the survey. The outcomes later in life are taken from administrative registers so there is hardly any attrition in the data. A third benefit of our data is that it allows us to control for results

[3] This result is related to the work by Heckman *et al.* (2006) and Heineck and Anger (2010), who find evidence that personality traits predict later in life outcomes.

[4] For example Burks *et al.* (2009) and Dohmen *et al.* (2010) report that time preferences and cognitive ability are related.

[5] We discuss evidence on the malleability of time preferences in the Section 2.

on a cognitive ability test that was part of the survey. We believe that this is important, given the results in recent research that time preferences and ability interact in the adult population (Shamosh and Gray, 2007; Dohmen *et al.*, 2010).

Most earlier studies on the relationship between time preferences and outcomes are cross-sectional in nature or follow individuals over a short period of time. For instance, some studies have documented that time preferences in the adult population are significantly correlated with field outcomes such as occupational choice (Burks *et al.*, 2009), credit card borrowing (Meier and Sprenger, 2010) and substance use and nutrition (Chabris *et al.*, 2008). Recent articles by Bettinger and Slonim (2007), Castillo *et al.* (2011) and Sutter *et al.* (2013) focus on time preferences among children. Sutter *et al.* (2013) relate risk attitudes and time preferences to health-related field behaviour and savings decisions in an experimental setting. They find cross-sectional evidence that discount rates among 661 children aged 10 to 18 correlate with their body mass index (BMI) and savings as well as spending on alcohol and tobacco. Bettinger and Slonim (2007) measure time preferences among approximately 200 five to 16-year-old children and find hyperbolic preferences, differences between boys and girls and racial differences. Their cross-sectional evidence does not reveal a correlation with school achievement. Castillo *et al.* (2011) show that a one standard deviation increase in the elicited discount rate among 880 children aged 13–15 is associated with an increase in the number of disciplinary referrals in the following school year of 14%.

Only a few previous studies have been able to follow their subjects over a longer period of time and the focus of these investigations is on the concept of self-control. The seminal work by Mischel and co-authors analyses the relationship between self-control and children's subsequent behaviour (Mischel *et al.*, 1988, 1989; Shoda *et al.*, 1990). Their experiment measured delay of gratification by the time children aged 4 could wait for a larger treat relative to a smaller immediate treat. Around one decade later, the children who were able to delay their gratification for the longest period also scored highest on achievement tests. The sample used was small (95 children). Another psychological study in the same spirit but with a larger sample size is performed by Moffitt *et al.* (2011), who measure self-control at various ages by a composite that incorporates parental–teacher ratings of children's aggression, hyperactivity and impulsivity, with self-reports of attention problems and observational ratings of restlessness and stamina, for a cohort of around 1,000 New Zealand children. They follow the children from ages 3 to 32 and find substantial positive effects of the composite on health, wealth and crime. Related to this, in economics, a recent study by Cadena and Keys (2011) focuses on outcomes related to education and earnings using data from the National Longitudinal Survey of Youth (NLSY). As the NLSY does not contain a direct measure of time preferences, the authors use as a proxy for time preference: the assessment of the interviewer whether (s)he perceived the respondent as restless. The results suggest that restless individuals did worse in terms of educational attainment and labour supply in young adulthood.[6]

[6] Restlessness was measured rather late in the respondents' lives: at ages 15–27. By that age, most individuals have already undertaken important human capital investments, making the analysis to some extent susceptible to reverse causality.

Our analysis complements these earlier studies in various ways. The magnitude of the sample is larger, the length of the period in which the children were followed is longer and we observe a wider and economically more relevant range of outcomes. In addition, we focus also on analysing the extent to which relationships between time preferences and outcomes differ for various segments of the population. We pay particular attention to differences between boys and girls and between children with high and low cognitive ability. One other important difference between our study and that research lies in the measurement of the trade-off between the present and the future. The measures employed in the earlier work by psychologists relate more to self-control problems, whereas ours is related to measures of time preferences more commonly used by economists. It entails a hypothetical monetary trade-off between the present and the future.

Our study shows that time preferences at age 13 predict many lifetime outcomes. We do not make causal inferences as we cannot separate time preferences from various factors related to time preferences, such as parental desire that children succeed early in life. The literature on economic preference parameters typically focuses on the predictive value of preferences. Causal effects are not possible to elicit as – even in the setting of a laboratory where the researcher can control many aspects – it would not be possible to design an experiment which influences time preferences only. One cannot exclude the possibility that other preferences are influenced as well by the experiment. Our study highlights the importance of the predictive value of high time preferences at a young age. We make a step in the direction of analysing the robustness of our findings to important potential confounders by controlling for individual and parental characteristics.

The set-up of the study is as follows. Section 1 describes the data, Section 2 shows the results and Section 3 concludes.

1. Data

We use data from the Stockholm Birth Cohort Study (SBC), created in 2004/5 by means of a probability matching of two previously existing longitudinal data sets.[7] The first is the Stockholm Metropolitan Study 1953–85, which consists of all children born in 1953 who were living in the Stockholm metropolitan area on 1 November 1963. This data source contains a rich set of variables concerning individual, family, social and neighbourhood characteristics. The second is The Swedish Work and Mortality Database, an administrative data set which includes information on education, income, work, unemployment and mortality for all individuals living in Sweden in 1980 or 1990 who were born before 1985. The database contains information on the individuals up to 2001.

[7] The data sets have no personal identification codes. A unique identifier is created using 13 questions which are available in both data sets: county, municipality, sex, birth month, marital status, employment, profession, socio-economic index, number of apartments in the building, year of construction of the building, quality of the construction, index of overcrowding occupation of the property's manager. To verify the matches, additional data on birth year of one or both parents were used. For 96% of the original cohort, data were matched. See Stenberg and Vågerö (2006) for a description of the data set and the matching procedure. Codebooks of the data are available online at: http://www.stockholmbirthcohort.su.se/about-the-project/original-data-1953–83.

The SBC study includes survey data from a school study that was conducted in 1966 when the cohort members were 13 years old. During one school day, pupils at practically all schools in the county filled out two questionnaires, including the question which we use to elicit time preferences, and took a spatial cognitive ability test which we use to measure cognitive ability. An important aspect of the survey is that it took place at school which gave it a mandatory character. As a result, the non-response rate is only 9% (the percentage of pupils absent on that particular school day). The low non-response rate in combination with the fact that the survey was given to all students in the county is likely to increase the external validity of our study.[8] This is an advantage compared with laboratory-based studies in which the participants probably are self-selected on the basis of their discount rate. Impatient individuals could, for example be less likely to sign up for participation in a laboratory experiment.[9] On the other hand, laboratory-based studies benefit from the use of real payments, whereas our type of study relies on a hypothetical question about time preferences and it is not obvious that stated choices perfectly correspond to choices made in real life.

1.1. *Time Preferences*

We measure time preferences using the following question: 'If you had to choose between SEK 900 (US$ 138) now *versus* SEK 9,000 (US$ 1,380) in five years, which would you choose?'[10] The set of possible answers was as follows: 'certainly SEK 900 now' (1), 'probably SEK 900 now' (2), 'cannot choose' (3), 'probably SEK 9,000 in five years' (4) and 'certainly SEK 9,000 in five years' (5). The answers do not necessarily map into a monotonic scale. This is the reason why we provide all estimates in the main tables with separate dummy variables for each answer category. In the extensions, we use a dummy variable indicating high and low time preferences to keep the presentation of the results concise.[11]

Figure 1 shows the distribution of the answers. In spite of the very high implied annual discount rate of 58%, 13% of the children state that they prefer SEK 900 today over SEK 9,000 in five years. The discount rate is consistent with discount rates used in other experimental and field studies (Frederick *et al.*, 2002). Bettinger and Slonim (2007) report that one-third of their sample of children turned down a 150% return in two months in favour of immediately receiving compensation.

[8] Given the nature of our data it is relevant to ask whether our results can be generalised to other contexts. First, we can note that at the time when the data were collected, the Stockholm metropolitan area covered about one-fourth of the Swedish population, so quite a large part of the population is covered. Second, Lindahl (2011) compares summary statistics for the SBC data and a nationally representative sample of individuals also born in 1953 and finds, as expected, similar income averages and variances. Her estimates are also very similar to those found in Norwegian studies based on nationally representative samples. Therefore, it is likely that our sample resembles the Swedish population.

[9] Related to this, von Gaudecker *et al.* (2011) find that people in a laboratory have substantially lower risk preferences than subjects drawn from the (Dutch) population and that the heterogeneity among subjects in the laboratory is much lower than that in the population-wide sample. However they also show that self-selection into the experiments did much less harm than sampling from a narrowly defined distribution, such as a student population.

[10] Note that these amounts are presented in current prices.

[11] We have also performed all regressions with separate dummy variables for each category. The results do not lead to different answers to the questions we pose in these additional analyses.

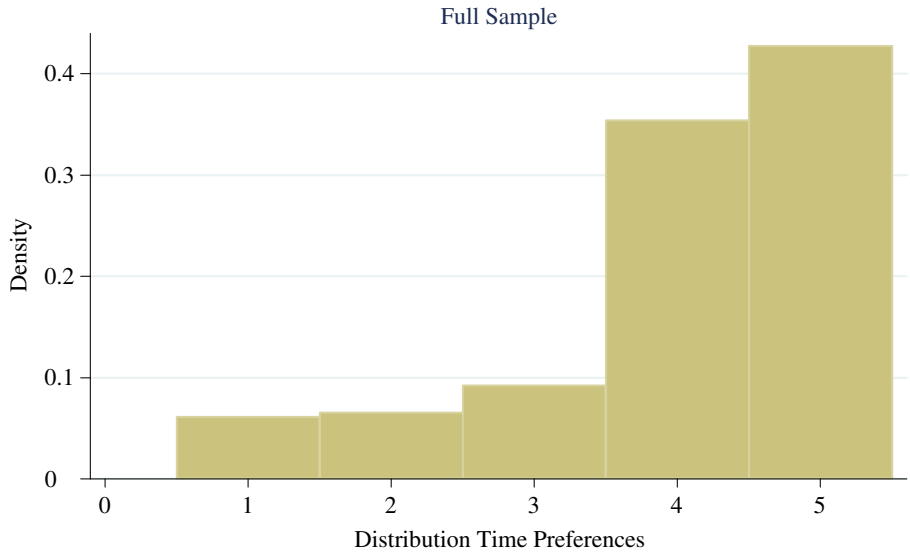

Fig. 1. *Distribution of Time Preferences*

Notes. Figure 1 shows the distribution of answers to the question: 'If you had to choose between SEK 900 (US$ 138) now *versus* SEK 9,000 (US$ 1,380) in five years, which would you choose?'. Categories (1)–(5) represent respondents stating: 'certainly SEK 900 now' (1), 'probably SEK 900 now' (2), 'cannot choose' (3), 'probably SEK 9,000 in five years' (4) and 'certainly SEK 9,000 in five years' (5). The amounts are presented in current prices. The sample consists of all children born in Stockholm county in the year 1953. The survey was administered to children aged 13. The number of respondents is 11,907.

1.2. *Cognitive Ability*

We use a spatial cognitive ability test as a measure of cognitive ability. The test, which was also taken at age 13, consists of 40 figures which are unfolded and need to be folded mentally. Similar to the Raven progressive matrices test, this spatial cognitive ability test measures fluid intelligence which is often considered to be a purer measure of intelligence than tests of crystallised intelligence, such as regular IQ tests or achievement tests. Scores on crystallised intelligence tests are in part determined by intelligence but also partly by personality traits (Borghans *et al.*, 2012).[12]

1.3. *Human Capital*

Human capital theory posits that people with high discount rates invest less in education than people who prefer to delay their rewards (Mincer, 1958; Becker, 1964). Our data contain many outcomes that are related to human capital investments. We observe grade-point averages in compulsory school and high school and the highest education level completed with a diploma (e.g. high school, college). The grade-point averages are taken from local school registers in grade 9 in compulsory school and in

[12] Note that IQ as measured by standard IQ tests would give an average of 100 (and SD 15). Our measure of IQ, the spatial ability test, is not a standard IQ test and therefore the average is different from 100.

the last year of upper secondary school.[13] Next to this, we analyse the link between discounting and the choice of whether or not to enrol in the science track in high school.

We also observe achievement test scores at military enlistment (at age 19), calculated as an average of four sub-tests including rapid comprehension, inductive ability, verbal comprehension and spatial ability. Such enlistment test scores are often interpreted as measures of cognitive ability but may also be described as achievement test scores: a reflection of acquired knowledge (Borghans *et al.*, 2012). Scores on achievement tests are not only related to cognitive ability but also associated with personality traits (Borghans *et al.*, 2012; Segal, 2012).

1.4. *Long-run Labour Market Performance*

Our next set of outcomes relates to long-run labour market performance. Time preferences may not only be related to human capital investments but could also predict labour supply decisions. DellaVigna and Paserman (2005) show that impatient individuals accept a lower reservation wage but stay unemployed longer than patient individuals. Data on long-run labour market outcomes are collected from several sources. We use the 1980 Census to collect information on earnings and disposable income at age 27. Administrative registers available between the years 1990 and 2001 are used to measure income at ages 37 and 47 respectively. We also proxy long-run income by averaging incomes between ages 37 and 48 years (Böhlmark and Lindquist, 2006; Haider and Solon, 2006). Annual labour income, measured in thousands of SEK, comes originally from registers based on employers' compulsory reports to the tax authorities. It includes sickness benefits, parental benefits and income from self-employment and farming activity but excludes capital income, pensions, unemployment benefits and social assistance. Disposable income is the total of all taxable and non-taxable income minus taxes and negative transfers. Our measures of parental socio-economic status include both the father's and the mother's total annual labour income in 1963. These were taken from the official tax register and all amounts are presented in current prices.

For the same period we calculate the average annual number of unemployment days per year and the share of years receiving welfare.

1.5. *Health*

We also study the relationship between time preferences and health. Grossman (1972) posits that an individual's discount rate is adversely related to health investments so that individuals who are less future oriented invest less in their health. There is cross-sectional evidence on this relationship but no longitudinal evidence. Fuchs (1982) reports weak relationships between time preferences and smoking. Bickel *et al.* (1999) find that people with high time preferences are more likely to be smoking. Borghans

[13] In the 1960s, grades were on a scale of 1–5 and relative to the performance of other students. The population grade distribution was assumed to be normal, which generates a national average for each cohort of 3.0.

and Golsteyn (2006) show that high time discounters have a higher BMI. We analyse whether time preferences are related to obesity (BMI > 30) at military enlistment and early death (by age 50).[14]

1.6. *Sample Selections and Descriptive Statistics*

The original SBC data set matched with administrative registers consists of 13,606 observations.[15] After selecting out observations with missing values on the time preferences variable, our data contain 11,907 observations. Table 1 gives the descriptive statistics of the variables included in our analysis.

Before proceeding to our results it is useful to illustrate the correlation between time preferences and various individual characteristics. Table 2 provides least-squares estimates where the dependent variable is a dummy set to unity if the child with certainty or almost certainty prefers to delay his/her rewards and zero otherwise. We can see that ability and gender are strongly correlated with time preferences. A one standard deviation higher ability at age 13 is related to 2.3 percentage points (or approximately 5%) higher likelihood of being patient. Women are 2.4 percentage points less likely to have preferences for delaying the timing of their rewards. These results are consistent with findings in Dohmen *et al.* (2010).[16,17]

In addition, we investigate the role of parental socio-economic status for their children's time preferences.[18] We find a significant association between parental socio-economic status and time preferences. Children to parents with higher education tend to be more future oriented. The relationship between parental income and time preferences is ambiguous: a positive association for fathers' income and a negative one for mothers' income. This finding stresses the need to control for parental socio-economic status in the regressions.

2. Results

This Section presents the results of our analysis of the link between time preferences and lifetime outcomes. We start by examining early measures of human capital. Then

[14] Our choice of variables is driven by data availability. Some additional data on health are available but unfortunately this information is considered extra sensitive by the Swedish board of ethical approval and by the principal investigators of the SBC. We applied for the data but were not granted access. Therefore, we had to restrict our analysis to the measures that were made available to us, that is BMI and all-cause mortality.

[15] A total of 15,118 children were born in 1953 in Stockholm county. But not all children still lived in Stockholm at the time of the school survey (around 1%) and around 9% did not participate in the school survey, which leaves us with 13,606 observations.

[16] Jamison *et al.* (2012) report that there is no clear consensus on whether time preferences differ between men and women but the preponderance of evidence suggests that women have lower discount rates than men (Bettinger and Slonim, 2007; Castillo *et al.*, 2011).

[17] Due to the young age and potential variation in maturity among the children in the sample, it might also be important to examine the correlation between time preferences and the age of the child. If time preferences are affected by a child's maturity, it could be the case that December-born children are more impatient than children born in January. This is also potentially important as it is well known that children who are born earlier during the year tend to outperform those born later (Bound *et al.*, 1995). As shown in Table 2, this is not supported by our data.

[18] Parental income was taken from the official tax register in 1963, that is prior to the survey.

Table 1

Descriptive Statistics

	Mean	SD
Outcome measures		
Compulsory school GPA (scale 1–5)	3.180	0.770
Upper secondary school GPA (scale 1–5)	3.340	0.650
Completed upper secondary school	0.503	0.500
Completed college	0.189	0.391
Enrolled in science track in upper secondary school	0.215	0.411
Military enlistment test score (scale 1–9)	5.180	2.490
log(earnings) at age 27	6.186	0.802
log(earnings) at age 37	12.121	0.707
log(earnings) at age 47	12.360	0.820
log(long-term earnings)	12.094	0.901
log(disposable income) at age 27	10.785	0.785
log(disposable income) at age 37	11.646	0.526
log(disposable income) at age 47	12.075	0.667
log(long-term disposable income)	11.942	0.501
Average annual days unemployed	13.336	32.582
Share of years on welfare	0.060	0.162
Obese at enlistment (males only)	0.05	0.05
Early death (deceased by age 50)	0.027	0.163
Teenage mother (first birth by age 19)	0.026	0.158
Control variables		
Female	0.492	0.500
Income father (SEK)	23,133	20,439
Income mother (SEK)	4,289	6,457
Age father at birth	31.168	6.491
Age mother at birth	28.375	5.777
IQ at age 13	22.742	7.124
Achievement test scores at age 13	68.437	17.965
Education of parent with highest level of education		
Compulsory school	0.746	0.435
Upper secondary school	0.167	0.373
College	0.087	0.282

Notes. The Table shows summary statistics for variables included in the analysis. The sample consists of all children born in Stockholm county in 1953 ($N = 11{,}907$). Earnings are the annual labour income, measured in thousands of SEK, that comes originally from registers based on employers' compulsory reports to the tax authorities. It includes sickness benefits, parental benefits and income from self-employment and farming activity but excludes capital income, pensions, unemployment benefits and social assistance. Disposable income is the total of all taxable and non-taxable income minus taxes and negative transfers. Our measures of parental socio-economic status include both the father's and the mother's total annual labour income in 1963. These were taken from the official tax register and all amounts are presented in current prices.

we proceed to investigating the relationship between time preferences and long-run labour market outcomes and health.

Our main analysis includes two sets of estimates. The first uses dummies for all categories of the question on time preferences. The reference group here is individuals who with certainty prefer the immediate reward, i.e. impatient persons. The second specification pools different categories of the time preferences variable into a dummy that equals 1 if the individual with certainty or almost certainty prefers to delay the timing of reward and 0 otherwise. To conserve space we use this single dummy variable when performing robustness checks and subgroup analyses. All regressions control for month of birth, gender, the educational level of the parent with the highest education

Table 2

The Relationship Between Time Preferences and Individual Characteristics

	(1)	(2)
Female	−0.028***	−0.024***
	(0.006)	(0.006)
Education of highest educated parent		
Upper secondary school	0.020**	0.013
	(0.008)	(0.008)
College	0.028**	0.019*
	(0.011)	(0.011)
Income father (standardised)	0.008***	0.007**
	(0.003)	(0.003)
Income mother (standardised)	−0.006*	−0.006*
	(0.003)	(0.003)
Age father	0.000	0.000
	(0.001)	(0.001)
Age mother	−0.001	−0.001
	(0.001)	(0.001)
February born	−0.009	−0.008
	(0.015)	(0.015)
March born	−0.031**	−0.031**
	(0.015)	(0.015)
April born	−0.013	−0.012
	(0.014)	(0.014)
May born	0.001	0.002
	(0.014)	(0.014)
June born	−0.002	0.001
	(0.014)	(0.014)
July born	−0.024	−0.020
	(0.015)	(0.015)
August born	−0.019	−0.017
	(0.015)	(0.015)
September born	−0.021	−0.017
	(0.015)	(0.015)
October born	−0.003	0.002
	(0.015)	(0.015)
November born	−0.013	−0.010
	(0.015)	(0.015)
December born	−0.020	−0.015
	(0.016)	(0.016)
Ability (standardised)		0.023***
		(0.003)
Observations	11,907	11,907

Notes. The Table shows the OLS coefficients on variables used as controls in the empirical analysis. Dependent variable = 1, if the respondent certainly or probably prefers to delay reward and zero otherwise The sample consists of children born in Stockholm county in 1953. ***Significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

(three levels), each parent's income (linearly) and each parent's year of birth (linearly). We only present estimates for our main variable of interest. The estimates of the control variables can be found in online Appendix A.

Table 3 reveals that a low discount rate is an important trait for a successful school career. People who were more patient at age 13 achieved higher grades in compulsory school and in upper secondary school. Next to this, they more often enrolled in the science track in upper secondary school, which at that time was a prerequisite for

Table 3

Time Preferences and Educational Achievement

	Compulsory school GPA (standardised)	Upper secondary school GPA (standardised)	Completed upper secondary school	Completed college	Enrolled in science track in upper secondary school	Enlistment test scores (standardised)
(A) Timing of reward						
Certainly immediate	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Probably immediate	0.281***	0.141*	0.107***	0.040**	−0.025	0.227***
	(0.049)	(0.082)	(0.024)	(0.016)	(0.030)	(0.076)
Indifferent	0.194***	0.115	0.072***	0.025*	0.022	0.084
	(0.046)	(0.080)	(0.022)	(0.014)	(0.031)	(0.071)
Probably delay	0.372***	0.276***	0.144***	0.072***	0.039	0.338***
	(0.039)	(0.069)	(0.018)	(0.012)	(0.026)	(0.057)
Certainly delay	0.383***	0.316***	0.154***	0.086***	0.051**	0.337***
	(0.038)	(0.069)	(0.018)	(0.012)	(0.026)	(0.055)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.113	0.085	0.120	0.119	0.068	0.055
(B) Timing of reward						
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	0.210***	0.196***	0.085***	0.053***	0.059***	0.214***
	(0.027)	(0.042)	(0.013)	(0.009)	(0.016)	(0.041)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.108	0.082	0.117	0.117	0.067	0.049
Observations	11,120	5,649	11,907	11,907	5,649	6,047

Notes. The Table shows the coefficients on dummies set to unity if the child at age 13 probably prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, is indifferent or either probably or certainly prefers SEK 9,000 in five years. The amounts are presented in current prices. All regressions are estimated by OLS. Each column represents a separate regression. The sample consists of children born in Stockholm county in 1953. All regressions control for dummies for month of birth, gender, educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

entering university. Patience also correlates positively with the likelihood of attaining an upper secondary school or university diploma.

The magnitude of the estimated coefficients is sizable. We find that individuals who prefer to delay their reward have 0.21 standard deviations higher GPA in compulsory school and 0.20 standard deviations higher GPA in upper secondary school. There are also indications of a 'dose–response' relationship between the outcomes and the different answer categories. Individuals who are completely certain that they want to delay the timing of reward tend to have better outcomes than those who probably want to delay the reward. We can also see that individuals who delay their reward are 5.9 percentage points (or about 30%) more likely to attend the science track in upper secondary school.[19] Patience also increases the probability to attain an upper secondary school diploma with approximately 8.5 percentage points and the likelihood to complete college with 5.3 percentage points. Table 3 additionally shows that patient boys achieve 0.21 standard deviation higher scores on the military enlistment achievement test.

The relationship between time preferences and human capital appears to be strongest among individuals who were absolutely certain that they would choose the immediate reward. This can be seen by examining the individual coefficients on the multiple dummies. From these it is clear that there is a large difference in the outcomes between the reference group and children who responded that they probably would choose the immediate reward. Even though the magnitude of the coefficient increases in the degree of certainty in which an individual would choose the delayed reward over the immediate reward, the jump is largest between children who would certainly prefer compared with probably prefer the immediate reward.

After having documented a link between time preferences and early measures of human capital we proceed to looking at long-run income in Table 4. In this analysis we focus on earnings and disposable income. We observe these outcomes at three points during the life span: at the ages of 27, 37 and 47. We also use average annual income between the ages of 37 and 48. Time preferences are strongly associated with earnings and income at all periods in life. Again we find that the coefficients are sizable and almost always statistically significant. Being more patient is related to substantially higher earnings and disposable income. For example, at the age of 27, individuals who answered that they certainly preferred to delay the timing of reward have about 6.4% higher income than those who were certain that they wanted the immediate reward. Interestingly, the connection between patience and earnings seems to grow stronger later in life. At age 37, the corresponding figure is 7.4% and at age 47 it is 11.0%. The same pattern also holds for disposable income. One explanation of this result is that income at younger ages is a more noisy measure of lifetime income. If so, our results show that it is crucial to have information on income over an extended period to assess the relationship between time preferences and an individual's true earnings capacity correctly. Note that the size of the estimates for disposable income is slightly lower than for earnings. One reason for this result may be that disposable income includes government transfers which are likely to be less strongly correlated with an individual's time preferences.

[19] Note that as impatience is related to attaining a high school diploma, the relationship between impatience and high school GPA is likely to be underestimated.

Table 4

Time Preferences and Income Over Life

	log(Earnings)				log(Disposable income)			
	Age 27	Age 37	Age 47	Long-term income	Age 27	Age 37	Age 47	Long-term income
(A) Timing of reward								
Certainly immediate	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Probably immediate	0.042	0.047	0.097**	0.074	0.024	0.065**	0.091***	0.054**
	(0.044)	(0.037)	(0.043)	(0.045)	(0.040)	(0.027)	(0.032)	(0.023)
Indifferent	0.078**	0.073**	0.097**	0.054	0.056	0.049*	0.074**	0.033
	(0.039)	(0.032)	(0.040)	(0.043)	(0.036)	(0.025)	(0.029)	(0.022)
Probably delay	0.076**	0.061**	0.114***	0.124***	0.064**	0.075***	0.099***	0.078***
	(0.033)	(0.029)	(0.034)	(0.036)	(0.030)	(0.022)	(0.025)	(0.018)
Certainly delay	0.064*	0.074***	0.110***	0.111***	0.054*	0.082***	0.112***	0.078***
	(0.033)	(0.028)	(0.034)	(0.036)	(0.030)	(0.021)	(0.025)	(0.018)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.056	0.093	0.053	0.052	0.054	0.046	0.049	0.063
(B) Timing of reward								
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	0.049**	0.044**	0.060***	0.071***	0.046**	0.042***	0.056***	0.045***
	(0.023)	(0.020)	(0.023)	(0.024)	(0.021)	(0.015)	(0.017)	(0.013)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.055	0.093	0.053	0.052	0.054	0.045	0.048	0.062
Observations	11,537	11,032	10,392	11,456	11,648	11,556	11,252	11,193

Notes. The Table shows the coefficients on dummies set to unity if the child at age 13 probably prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, is indifferent, or either probably or certainly prefers SEK 9,000 in five years. The amounts are presented in current prices. All regressions are estimated by OLS. Each column represents a separate regression. The sample consists of children born in Stockholm county in 1953. All regressions control for dummies for month of birth, gender, educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). Long-term income is calculated as average income over ages 37–48. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 5 displays results for other dependent variables related to labour supply, health and fertility. We can see that patience predicts significantly less use of welfare and fewer days on unemployment between the ages of 37 and 48. Children who at age 13 preferred to delay the timing of reward had for instance 1.6 fewer unemployment days per year at middle age. In relation to the mean of the dependent variable this translates into a reduction of about 15%.

Time preferences are also significantly related to health outcomes. In Table 5 we see that patient men are 1.5 percentage points less likely to be classified as obese at military enlistment. Patient respondents are also 0.9 percentage points less likely to die before age 50. Our findings for obesity are consistent with the results in Borghans and Golsteyn (2006) who study the relationship between time preferences and the BMI among adults. One reason for this relationship can be that impatient people may value sweets, fast food and other instant satisfiers more than patient people.

As a robustness check, we investigate to what extent our results remain similar when we do not control for parental socio-economic status. Children's answers to the survey could reflect parental socio-economic status. If this is the case we would expect our

Table 5

The Link Between Time Preferences and Welfare, Unemployment, Obesity, Death and Teenage Pregnancy

	Share of years on welfare	Annual unemployment days	Obese at enlistment	Early death	Teenage mother
(A) Timing of reward					
Certainly immediate	Ref.	Ref.	Ref.	Ref.	Ref.
Probably immediate	−0.016*	−0.123	−0.030**	−0.012	−0.033**
	(0.009)	(1.772)	(0.012)	(0.010)	(0.015)
Indifferent	−0.007	−1.119	−0.023*	−0.013	−0.026*
	(0.009)	(1.598)	(0.012)	(0.009)	(0.015)
Probably delay	−0.026***	−2.418*	−0.030***	−0.019**	−0.033**
	(0.007)	(1.383)	(0.011)	(0.008)	(0.013)
Certainly delay	−0.020***	−1.256	−0.034***	−0.013*	−0.027**
	(0.007)	(1.384)	(0.011)	(0.008)	(0.013)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.023	0.006	0.796	0.006	0.014
(B) Timing of reward					
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	−0.013***	−1.654*	−0.015**	−0.009*	−0.011
	(0.005)	(0.944)	(0.006)	(0.005)	(0.008)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.021	0.006	0.796	0.005	0.012
Observations	11,696	11,657	6,047	11,907	5,860

Notes. The Table shows the coefficients on dummies set to unity if the child at age 13 probably prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, is indifferent, or either probably or certainly prefers SEK 9,000 in five years. The amounts are presented in current prices. All regressions are estimated by OLS. Each column represents a separate regression. The sample consists of children born in Stockholm county in 1953. All regressions control for dummies for month of birth, gender, educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). The dependent variables, share of years on welfare and annual unemployment days, are calculated as the average over ages 37–48. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 6

Robustness Checks

	Baseline	No control for parental background
Dependent variable		
Compulsory school GPA (standardised)	0.210***	0.250***
	(0.027)	(0.028)
Upper secondary school GPA (standardised)	0.196***	0.209***
	(0.042)	(0.042)
Completed upper secondary school	0.085***	0.105***
	(0.013)	(0.014)
Completed college	0.053***	0.068***
	(0.009)	(0.009)
Science track in upper secondary school	0.059***	0.066***
	(0.016)	(0.016)
Enlistment test (standardised)	0.214***	0.242***
	(0.041)	(0.041)
Log(earnings) age 27	0.049**	0.048***
	(0.023)	(0.023)
Log(earnings) age 37	0.044**	0.051***
	(0.020)	(0.020)
Log(earnings) age 47	0.060***	0.071***
	(0.023)	(0.023)
Log(long-run earnings)	0.071***	0.083***
	(0.024)	(0.024)
Log(disposable income) age 27	0.046***	0.047***
	(0.021)	(0.021)
Log(disposable income) age 37	0.042***	0.048***
	(0.015)	(0.015)
Log(disposable income) age 47	0.056***	0.068***
	(0.017)	(0.017)
Log(long-run disposable income)	0.045***	0.055***
	(0.013)	(0.013)
Annual days unemployed	−1.654*	−1.873**
	(0.944)	(0.942)
Share of years on welfare	−0.013***	−0.015***
	(0.005)	(0.005)
Obese at enlistment (males only)	−0.015**	−0.015***
	(0.006)	(0.006)
Early death	−0.009*	0.015***
	(0.005)	(0.016)
Teenage mother	−0.011	−0.012*
	(0.008)	(0.008)

Notes. Each cell presents the coefficient of the time preference dummy variable (0 if the child at age 13 probably or certainly prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, or is indifferent, and 1 if it either probably or certainly prefers SEK 9,000 in five years) from a separate regression where the dependent variable is given in the left column. The amounts are presented in current prices. The sample consists of children born in Stockholm county in 1953. Long-term income is calculated as average income over ages 37–48. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

estimates to change when not controlling for parental education and income. Table 6 reveals that the coefficients indeed become larger (in absolute terms) when excluding these controls. However, the changes are small, which suggests that not controlling for parental socio-economic status does not bias the estimates to a large extent.

2.1. *Extensions of the Analysis*

We continue by analysing whether the link between time preferences and lifetime outcomes differs for various segments of the population. An interesting question is whether the relationships differ between men and women or between people with high and low cognitive ability. An important stream of literature indicates large gaps between women and men with respect to education and later in life outcomes, such as wages. Likewise, scores on IQ tests have often been shown to be highly predictive of such future outcomes. For some outcomes it is especially important to analyse the relationships separately for men and women. For example, female labour force participation rates were still lower than male labour force participation rates in the period of investigation. Therefore, it is important to analyse the relationship between the wage and time preferences separately for men and women.

The question we can analyse with our data is how patience affects outcomes for men, women, high and low-ability children. Information about the elasticities of patience and the outcomes for these subgroups can give a first indication of the potential effectiveness of investments in patience to alleviate the gaps. We analyse this by running separate regressions for these groups. Our results are presented in Table 7.

Men appear to benefit more from being patient than women. Both when it comes to early human capital investments and long-run income, being future oriented is a more important trait for men than for women. For long-run earnings the difference is substantial: whereas patient males have 12.1% higher long-run earnings, the corresponding estimate for women is only 2.8% (and not statistically significant). We also find that children who scored above average on the spatial ability test taken at age 13 benefit more from being patient than children with below average ability. Although the gap is present already in school, it is strongest for long-run income and health. It is worth mentioning that (in unreported regressions) we also examined whether the link between time preferences and lifetime outcomes differed depending on parental socio-economic background. We found no evidence of this.

2.2. *Potential Pathways*

So far we have shown that time preferences are associated with both human capital investments and long-run labour market and health. As early human capital investments are strongly linked to labour market performance, it is interesting to ask to what extent the relationship between time preferences and long-run outcomes operates through human capital. To investigate this we ran regressions where we controlled for educational attainment as well as our measure of spatial ability at age 13.[20] Our results,

[20] For all outcomes, we run three regressions with the following independent variables: (1) time preferences; (2) time preferences and spatial cognitive ability and (3) time preferences, spatial cognitive ability, and human capital. The first regression shows the total relationship between time preferences and the outcome. The second regression gives the relationship between time preferences and the outcome which remains after controlling for ability. The difference between the first and the second regression reveals how much of the total relationship between time preferences and an outcome is driven by ability. Likewise, the difference between the first and third regression shows the extent to which the relationship between time preferences and outcomes is driven by ability and human capital. These estimates show suggestive evidence of potential pathways, but should not be interpreted in a causal way as there may be potentially important confounders (see Pearl (2012) for a review of mediation analysis).

Table 7

Subgroup Analyses

	Baseline	Men	Women	Low ability	High ability
Compulsory school GPA (standardised)	0.210*** (0.027)	0.264*** (0.041)	0.167*** (0.035)	0.157*** (0.036)	0.201*** (0.036)
Upper secondary school GPA (standardised)	0.196*** (0.042)	0.197*** (0.065)	0.187*** (0.054)	0.168*** (0.065)	0.199*** (0.054)
Completed upper secondary school	0.085*** (0.013)	0.084*** (0.019)	0.087*** (0.018)	0.075*** (0.017)	0.07*** (0.019)
Completed college	0.053*** (0.009)	0.068*** (0.013)	0.041*** (0.012)	0.036*** (0.011)	0.06*** (0.015)
Science track in upper secondary school	0.059*** (0.016)	0.112*** (0.025)	0.017 (0.02)	0.023*** (0.02)	0.071*** (0.022)
Enlistment test (standardised)	0.214*** (0.041)	N/A	N/A	0.151*** (0.05)	0.177*** (0.058)
Log(earnings) age 27	0.049** (0.023)	0.001 (0.026)	0.086*** (0.037)	0.052* (0.031)	0.042 (0.035)
Log(earnings) age 37	0.044** (0.020)	0.063*** (0.03)	0.027 (0.027)	0.025 (0.028)	0.056** (0.029)
Log(earnings) age 47	0.060*** (0.023)	0.076*** (0.033)	0.046 (0.032)	0.029 (0.034)	0.076*** (0.031)
Log(long-run earnings)	0.071*** (0.024)	0.121*** (0.041)	0.028 (0.029)	0.006* (0.034)	0.116*** (0.035)
Log(disposable income) age 27	0.046*** (0.021)	0.002 (0.024)	0.08*** (0.034)	0.064* (0.03)	0.024 (0.031)
Log(disposable income) age 37	0.042*** (0.015)	0.047** (0.023)	0.036** (0.019)	0.025 (0.021)	0.051*** (0.021)
Log(disposable income) age 47	0.056*** (0.017)	0.103*** (0.003)	0.013 (0.019)	0.029 (0.025)	0.056*** (0.017)
Log(long-run disposable income)	0.045*** (0.013)	0.065*** (0.021)	0.025* (0.019)	0.03* (0.018)	0.066*** (0.024)
Annual days unemployed	−1.654* (0.944)	−2.647* (1.504)	−0.753 (1.186)	−0.232 (1.328)	−2.898*** (1.355)
Share of years on welfare	−0.013*** (0.005)	−0.015** (0.008)	−0.011* (0.006)	−0.007 (0.007)	−0.014*** (0.006)
Obese at enlistment (males only)	−0.015** (0.006)	N/A	N/A	−0.003 (0.008)	−0.026*** (0.01)
Early death	−0.009* (0.005)	−0.014** (0.009)	−0.005 (0.006)	−0.01 (0.008)	−0.006 (0.007)
Teenage mother	−0.011 (0.008)	N/A	N/A	−0.01 (0.011)	−0.009 (0.010)

Notes. Each cell presents the coefficient of the time preferences dummy variable (0 if the child at age 13 probably or certainly prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, or is indifferent, and 1 if it either probably or certainly prefers SEK 9,000 in five years) from a separate regression where the dependent variable is given in the left column. The amounts are presented in current prices. The sample consists of children born in Stockholm county in 1953. All regressions are estimated by OLS and control for dummies for month of birth, gender, educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). Long-term income is calculated as average income over ages 37–48. Low ability is defined as individuals who scored below average on the spatial ability test at age 13. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

presented in Tables 8 and 9, reveal that controlling for spatial ability reduces the coefficients but does not affect the significance of the estimates. When including controls for educational attainment the point estimates fall substantially. Most of the estimates are no longer statistically significant and many are also close to zero. This is

Table 8

Time Preferences and Income Over Life: With and Without Controlling for Ability and Educational Attainment

	log(Earnings)				log(Disposable income)			
	Age 27	Age 37	Age 47	Long-term income	Age 27	Age 37	Age 47	Long-term income
(A) Baseline (as in Table 4)								
Timing of reward:								
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	0.049**	0.044**	0.060***	0.071***	0.046**	0.042***	0.056***	0.045***
	(0.023)	(0.020)	(0.023)	(0.024)	(0.021)	(0.015)	(0.017)	(0.013)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.055	0.093	0.053	0.052	0.054	0.045	0.048	0.062
Observations	11,537	11,032	10,392	11,456	11,648	11,556	11,252	11,193
(B) Controlling for ability at age 13								
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	0.046**	0.036*	0.044*	0.051**	0.042**	0.034**	0.042**	0.034***
	(0.023)	(0.020)	(0.023)	(0.024)	(0.021)	(0.015)	(0.017)	(0.012)
Ability	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.056	0.097	0.062	0.065	0.054	0.051	0.058	0.074
Observations	11,535	11,030	10,390	11,454	11,646	11,554	11,250	11,191
(C) Controlling for educational attainment								
Immediate or indifferent	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	0.039*	0.013	0.013	0.012	0.038*	0.019	0.015	0.012
	(0.023)	(0.020)	(0.022)	(0.024)	(0.022)	(0.014)	(0.016)	(0.012)
Education attainment	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Ability	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.063	0.131	0.122	0.134	0.062	0.080	0.124	0.147
Observations	11,330	11,030	10,362	11,413	11,431	11,554	11,214	11,191

Notes. The Table shows the coefficient of the time preferences dummy variable (0 if the child at age 13 probably or certainly prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, or is indifferent, and 1 if it either probably or certainly prefers SEK 9,000 in five years). The amounts are presented in current prices. Each column represents a separate regression. All regressions are estimated by OLS. The sample consists of children born in Stockholm county in 1953. All regressions control with dummies for month of birth, gender educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). Long-term income is calculated as average income over ages 37–48. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 9

The Link Between Time Preferences and Welfare, Unemployment, Obesity, Death and Teenage Pregnancy With and Without Controlling for Ability and Educational Attainment

	Share of years on welfare	Annual unemployment days	Obese at enlistment	Early death	Teenage mother
(A) *Baseline (as in Table 5)*					
Timing of reward:					
Immediate/ indifferent	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	−0.013***	−1.654*	−0.015**	−0.009*	−0.011
	(0.005)	(0.944)	(0.006)	(0.005)	(0.008)
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.021	0.006	0.796	0.005	0.012
Observations	11,696	11,657	6,047	11,907	5,860
(B) Controlling for ability at age 13					
Immediate/indifferent	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	−0.009*	−1.312	−0.014**	−0.008	−0.010
	(0.005)	(0.951)	(0.006)	(0.005)	(0.008)
Ability	Incl.	Incl.	Incl.	Incl.	Incl.
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.036	0.009	0.796	0.007	0.015
Observations	11,694	11,655	6,047	11,905	5,860
(C) Controlling for educational attainment					
Immediate/indifferent	Ref.	Ref.	Ref.	Ref.	Ref.
Delay	−0.004	−0.504	−0.012*	−0.001	−0.007
	(0.005)	(0.945)	(0.007)	(0.004)	(0.008)
Education attainment	Incl.	Incl.	Incl.	Incl.	Incl.
Ability	Incl.	Incl.	Incl.	Incl.	Incl.
Full set of controls	Incl.	Incl.	Incl.	Incl.	Incl.
R^2	0.077	0.029	0.801	0.010	0.025
Observations	11,643	11,605	6,047	11,643	5,729

Notes. The Table shows the coefficient of the time preferences dummy variable (0 if the child at age 13 probably or certainly prefers SEK 900 (US$ 138) today *versus* SEK 9,000 (US$ 1,380) in five years, or is indifferent and 1 if it either probably or certainly prefers SEK 9,000 in five years). The amounts are presented in current prices. Each column represents a separate regression. All regressions are estimated by OLS. The sample consists of children born in Stockholm county in 1953. All regressions control with dummies for month of birth, gender educational level (3 levels) of the parent with the highest education, each parent's income (linearly) and each parent's year of birth (linearly). The dependent variables, share of years on welfare and annual unemployment days, are calculated as the average over ages 37–48. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

true both when it comes to earnings and income and also for our other measures of labour supply and health.

From this evidence, we conclude that (1) the relationship between time preferences and outcomes does not seem to be driven by intelligence and (2) that the association between time preferences and lifetime outcomes seems to be explained by the positive relationship between time preferences and educational attainment. The latter result is potentially important in the sense that if time preferences are malleable and to some degree truly affect the outcomes, our results imply that early interventions that make individuals more future oriented can potentially bring life-lasting benefits.

In an influential study, Becker and Mulligan (1997) posit that people could learn to be more future oriented. The question whether time preferences are malleable is, however, still open to debate. There is some evidence from recent field experiments that time preferences could be influenced by the environment. Perez-Arce (2011) demonstrates empirically that college students in Mexico who were randomly admitted from a pool of applicants were more patient than individuals in the control group, which indicates that education has an impact on time preferences. Other studies show that exogenous events seem to govern individual time preferences. Voors *et al.* (2012) use a field experiment in Burundi to examine the consequences of exposure to conflict on time preferences. The results suggest that individuals who are plausibly exogenously exposed to violence have higher discount rates. Cullen (2011) shows that Sri Lankan workers who were exposed to the 2005 tsunami exhibited more patience than those who happened to work just above the water mark and therefore were unaffected. Recent research has also suggested that active decision making and optimal default choices can potentially moderate high discount rates (Carroll *et al.*, 2009). Although these studies do not provide definite answers to the question whether time preferences are malleable, they do show that certain types of plausibly exogenous events seem to play a role in shaping individuals' discount rates.

3. Conclusions

This study analyses the relationship between time preferences and outcomes later in life. Early theoretical contributions posit that people with high discount rates invest less in their future than people who are more future oriented. This motivates the question whether time preferences indeed play an important role in predicting important economic outcomes later in life. Using unique longitudinal data spanning over five decades, we find evidence that impatience is related especially to less educational attainment and to weaker performance in both compulsory and secondary school. The main contribution of this study is that our analysis provides new evidence to a remarkably small literature on the role of time preferences when young for later in life outcomes. We show that high discount rates are related to lower incomes at middle age, more days in unemployment, higher risk of obesity and teenage motherhood. The results are robust when controlling for important confounding factors such as parental income and education and cognitive ability of the child. Concerning the results on income, time preferences are strongly associated with income throughout all periods in life and the coefficients are sizable and almost always statistically significant. Regarding both early human capital investments and long-run income, patient men have better outcomes than patient women. The same holds for individuals who scored above average on a spatial ability test taken at age 13. We also find that the relationship between time preferences and lifetime outcomes appears to be mediated by early human capital investments.

As mentioned earlier on, our analysis does not capture causal effects because of potentially important omitted variables. However, our results, in combination with earlier evidence that time preferences may be malleable, do motivate a policy discussion on the potential importance of time preferences rates. More research is

needed to corroborate our findings, especially data with other measures of time preferences would be an important complement to our analysis.

Another important challenge for further research is to investigate the anatomy of time preferences. In their critical review of the time preferences literature, Frederick *et al.* (2002) suggest that time preferences may be perceived as a container of deeper parameters rather than a unitary construct. Such underlying parameters may have different predictions for outcomes. For instance, it may be that one parameter relates to obesity, whereas another relates to income. It would be very interesting to know which of the underlying parameters is driving which result. Related to this point, Borghans and Golsteyn (2007) show that time preferences are a function of a pure preference for the future relative to the present and an ability to imagine future outcomes. Being more able to imagine a future outcome lowers the rate of time preferences for that outcome. Imagination as an underlying parameter of time preferences can explain why time preferences differ between people, why a person may have different rates of time preferences for various outcomes and why people with high time preferences often regret their choices. Thinking about time preferences as a container of deeper parameters reveals that policy directed at lowering time preferences is not the same as policy which helps to improve early childhood environments. For instance, giving children funds may enrich their environment, but it may not improve their ability to imagine their future. To give people a better image of the future, stimulating people to meet a study counsellor may, for instance, be more important than funds.

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Additional Supporting Information may be found in the online version of this article:

Appendix A. Results For All Control Variables.
Data S1.

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