Time Preferences and Lifetime Outcomes*

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Abstract

This paper investigates the consequences of a preference for immediate over delayed utility for long-run social and economic outcomes. We use a unique Swedish longitudinal dataset linking survey based information on individuals' time preferences measured at age 13 to administrative registers spanning over five decades. Our results indicate a substantial adverse relationship between impatience and outcomes later in life. The strongest relations are found with educational performance. Our results show that failure to control for cognitive skills substantially magnifies the role of time preferences for lifetime outcomes.

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1. Introduction

Every day people make decisions involving tradeoffs among costs and benefits occurring at different points in time. Examples of such choices include whether or not to drop out of school, quit smoking or start saving. Intertemporal decision making has for long been recognized by economists and is a cornerstone in most economic models (e.g. Samuelson 1937). It is also 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 prefer to delay their rewards (e.g. Mincer 1958; Becker 1964). Despite its significance, there is little empirical evidence on the consequences of high time preferences.[4] The evidence that does exist is mostly cross-sectional in nature, which makes the analyses susceptible to reverse causality. With a small number of exceptions, there is no longitudinal evidence. The lack of knowledge is especially evident when it comes to the consequences of impatience among children and adolescents. Indeed, many important investment decisions with potential life-lasting implication are made early in life.

The aim of this paper is to investigate the link between time preferences during childhood and long-run social and economic outcomes. We use a unique Swedish dataset linking survey based information on 12,667 individuals' time preferences at age 13 to administrative registers spanning over five decades. Time preferences are measured through a questionnaire in which children are asked about the extent to which they prefer SEK 100 (USD 13) today over SEK 1000 (USD 130) in five years. We document how time preferences are related to human capital investments in terms of educational choices and school performance as early as in primary school. We then follow the children as they age, observing their subsequent educational outcomes, results on military enlistment tests,

[4] We use the terms time preferences, time discounting and impatience as synonyms.

fertility decisions, encounters with the criminal justice system, labor market performance, welfare use, and also lifetime income.

Our results indicate that time preferences are strongly associated with lifetime outcomes. Among other things, a higher discount rate is linked to weaker performance in both compulsory and secondary school, lower educational attainment, and lower scores on cognitive tests at age 19. The magnitude of the relationships is substantial: the implications of one standard deviation increase in the discount rate for school performance surpasses that of well-known educational interventions such as the Tennessee STAR-project (cf. Krueger 1999). We also find evidence for an adverse relation with lifetime earnings, receiving welfare and Body Mass Index (BMI) although the statistical power for these estimates is weaker.

In our analyses, we control for various potential confounders, such as parental educational background and the cognitive ability of the child (measured also at age 13). Ability correlates positively with patience in our sample. This finding is in line with the work of Dohmen et al. (2010). Controlling for ability is often overlooked in earlier studies which relate time preferences to outcomes. We show that the role of patience is substantially overestimated if one does not control for ability.

We also study the association between time preferences and lifetime outcomes in different segments of the population. The results show that the link is significantly stronger for females and individuals with high ability but there is no evidence of heterogeneity by parental socioeconomic background. In auxiliary analyses we exploit the fact that our data contains information on time preferences within pairs of twins. Although there is a great deal of statistical uncertainty, our twin fixed effect estimates are roughly in line with those for the overall population.

Our paper relates to recent studies that have shown that time preferences predict real world outcomes such as occupational choice (Burks et al. 2009), credit card borrowing (Maier and Sprenger 2010), and substance use and nutrition (Chabris et al. 2008). A few previous studies have also focused on children. Castillio et al. (2012) show that one standard deviation increase in the discount rate among children aged 13 to 15 is associated with an increase in the number of disciplinary referrals in school (in the following school year) by 14 percent. Sutter et al. (2011) find that impatience is a significant predictor of the body mass index and savings as well as spending on alcohol and tobacco among youths aged 10 to 18. As these papers observe outcomes measured around the same time as the measurement of time preferences, they say little about the long term consequences of time preferences.[5] Cadena and Keys (2011) also investigate long term outcomes using the National Longitudinal Survey of Youths (NLSY). They find that individuals perceived as impatient do worse in terms of educational attainment and labor supply at early ages. Since their data do not contain a direct measure of time preferences, they measure patience using the assessment of the interviewer whether or not the respondent was restless. One potential problem with this measure is that it may be more related to impulsivity than to the economic notion of time discounting. Another complication is that impatience is measured rather late in the respondents' lives: at age 15-27. This means that many individuals have already undertaken important human capital investments, making the analysis more subject to reverse causality. This concern is especially relevant considering the results in Perez-Arce (2011) who show that time preferences are influenced by

[5] Psychologists have found evidence for the effects of time preferences on later outcomes for very young children: 4 year old children who were more able to delay gratification did better at school at age 14. Mischel, Shoda and Rodriguez (1989) review the literature in this field.

education. Becker and Mulligan (1997) also posited that people could learn to be more forward thinking.[6]

Our study contributes to the literature in several important ways. First, we measure individuals' time preferences at a young age and observe a richer set of outcomes for a longer time period. In fact, this is the first study to link survey information on time preferences to administrative records. As the survey was conducted in school, all children who were present in school at the day of the survey are included. This means that we have a representative sample, which greatly increases the external validity of our results compared to most other studies.[7] Another benefit is that the data allow us to control for ability as measured by scores on cognitive tests taken at the same time as the survey. We believe that this is important given the results in recent research that time preferences and ability interact in the adult population (Dohmen et al 2010; Shamosh and Gray, 2007). As already mentioned, our results suggest that failure to control for ability greatly increases the risk of overstating the relationship between time preferences and lifetime outcomes. Last, our study is the first to investigate the relationship between time preferences and lifetime outcomes within pairs of twins. We are thereby able to control for all environmental factors shared by the twins, such as parental and neighborhood characteristics, and partly also genes.

In a broader sense, our paper also adds to the recent literature about the importance for personality traits for human development. Heckman, Stixrud and Urzua (2006) and Heineck and Anger (2010) show the returns of cognitive skills and personality traits to outcomes later in life. Borghans et al. (2008) and Almlund et al. (2011) review the

[6] Borghans et al. (2008) review the evidence on changes in time preferences. They report that although no longitudinal studies have measured changes in time preferences, there are a number of cross-sectional studies which report that time preferences differs across age.

[7] An additional benefit with the linked survey-register data is that sample attrition becomes less of a concern when studying long-term outcomes.

literature. An important conclusion in this literature is that personality is more malleable than cognitive skills and that investing in traits which matter for outcomes can be very profitable. Our results indicate that time preference is such a trait which matters highly in life. The set-up of the paper is as follows. Section 2 describes the data. Section 3 shows the results. Section 4 concludes.

2. Data

We use data from the *Stockholm Birth Cohort Study* (SBC), created in 2004/2005 by means of a probability matching of two previously existing longitudinal data sets.[8] The first is the *Stockholm Metropolitan Study 1953-1985,* which consists of all children born in 1953 who were living in the Stockholm metropolitan area on November 1, 1963. This data source contains a rich set of variables concerning individual, family, social and neighborhood characteristics. The second is *The Swedish Work and Mortality Database*, an administrative data set which includes information on education, income, work, unemployment, in-patient and mortality data for all individuals living in Sweden in 1980 or 1990 who were born before 1985.[9] The database contains information on the individuals up to 2001.

The SBC study includes survey data from a school study that was conducted in 1966 when the Stockholm cohort was 13 years old. During one school day, pupils at practically all schools in the area filled out two questionnaires, including the question which we use to elicit time preferences, three mental tests which we use to measure cognitive ability, measures of attitudes to school and education, and leisure activities. An important aspect of the survey is that it took place at school which gave it a compulsory character. As a

[8] See Stenberg and Vågerö (2006) for a full description of the dataset and the matching procedure. Codebooks are available upon request and will soon be made available online.
[9] The Swedish Work and Mortality data base consists of administrative register information from the Louise data base from the years 1991-2002.

result, the non-response rate is only 9 per cent (the percentage of pupils absent on that particular school day). This low non-response gives our study high external validity compared to studies using experimental data. One concern with laboratory based studies is for instance that the participants may be 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.[10]

Our data also contains information on time preferences for a subsample of twins. We use variation in time preferences within-twin pairs to net out factors that are shared by the twins, regardless of whether these are genetic or environmental.

We measure time preferences with the following question: "If you had to choose between SEK 100 [USD 13] now versus SEK 1000 [USD 130] in five years, which would you choose?". There were 5 answer categories: "Certainly SEK 100 now" (1), "Probably SEK 100 now" (2), "Cannot choose" (3), "Probably SEK 1000 in five years" (4), "Certainly SEK 1000 in five years" (5). We recode the answers to a dummy variable with value 0 if the answer was 4 or 5 (the patient group) and 1 if the answer was 1, 2 or 3 (the impatient group). We pool the first and last two categories because the difference between certainly preferring an option and probably preferring an option is subtle. Those who answered category 3 "cannot choose" are indifferent between receiving SEK 100 now or SEK 1000 in five year. They therefore have a high implied discount rate of 58% which is the reason why we add them to the impatient group.[11]

[10] Related to this, von Gaudecker, van Soest and Wengström (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.

[11] As a robustness check, we consider that answer 3 implies that people did not know how to answer the question. Dropping these observations leads to similar results as the original analysis. The same holds if we would add category 3 to the patient group.

Graphs 1-4 show the distribution of the answers for various segments of the population. Graph 1 shows that in spite of the very high implied annual discount rate of 58%, 13% of the children state that they prefer SEK 100 (USD 13) today over SEK 1000 (USD 130) in five years. This number is well in line with discount rates measured in experimental and field studies (see Frederick et al. 2002). The distribution of answers in the twin sample is very similar to the distribution in the full sample. Graph 2 shows that men are more patient than women. This finding has also been documented in other studies (e.g. Dohmen et al. 2010). Graph 3 reveals that people who scored below the median on the cognitive tests are more impatient than those who scored above the median. Graph 4 shows that respondents with at least one highly educated parent are more patient than those with low educated parents.

- Graphs 1-4 -

Our data contains many outcomes later in life which one could expect to be related to time preferences. One obvious outcome is achievements in education. Human capital theory posits that people with high discount rates invest less in education than people who prefer to delay their rewards (e.g. Mincer 1958, Becker, 1964). We observe grades in compulsory school and high school and the highest level completed with a diploma (e.g. high school, college). The grade point averages are taken from local school registers in grade nine in compulsory school and in the last year of high school.[12]

[12] 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. From 1996 onward, grades are set according to specific goals in the curriculum and not related to the performance of other students. In the 1960s, grades in the compulsory school were given already in 6th grade.

We also observe enlistment test scores, calculated as an average of four sub-tests including rapid comprehension, inductive ability, verbal comprehension and spatial ability. Enlistment test scores are often interpreted as measures of cognitive ability but actually reflect knowledge acquired in school. They can therefore better be categorized as achievement tests, not IQ tests (Borghans et al., 2012). Scores on achievement tests are related to personality traits (Borghans et al., 2012; Segal, 2012). Our hypothesis is that people who are willing to invest in their future may do better at these tests.

We also analyze the link between discounting and educational attainment as well as the choice of whether or not to enroll in science track in high school. At that time, having a high school diploma in science was a prerequisite for entering university.

Human capital theory also predicts that time preferences are liked to achievements on the labor market. Individuals who prefer immediate rewards may for instance be less likely to invest in education and work (e.g. DellaVigna and Paserman 2005) and could therefore suffer from worse labor market outcomes. We examine the link between time preferences and unemployment experiences between the years 1993 and 2001, which corresponds to age 43-51 of the cohort. [13] We construct this variable as a dummy equalling 1 if the individual has had an unemployment episode at least once during those years.

Then we examine whether time preferences are related to long-run income. The long-run income measure is an average over the years 1990-2001, requiring at least one positive income year during that period. We also use data on whether the individual received social security payments (at least once) during the years 1990-2001.

We also study the relationship between time preferences and measures of risky behavior. Grossman (1972) posits that time preferences are adversely related to

[13] Optimally, we would have wanted information on unemployment episodes during all of the cohort's working life, but these data are only available from 1993

investments in health. There is cross-sectional evidence on this relationship but no longitudinal studies. Fuchs (1982) found weak relationships between time preferences and smoking. Bickel, Odum and Madden (1999) find that people with high time preferences are more likely to be smoking. Borghans and Golsteyn (2006) show that high time discounters have a higher BMI. We analyze whether time preferences are related to BMI and other risky behaviors: teen parenting and criminal behavior (between age 15 and 31). For the girls in the cohort, we use information on teenage motherhood and for the boys we use BMI calculated from information on weight and length at age 18 or 19 from draft board data. Information on crime is based on convictions in criminal courts. We measure crime using a dummy set to unity for any conviction between age 15 and 31, zero otherwise.

We use three groups of control variables. The first is a group that we call "predetermined characteristics" which include month of birth, gender and the grade in which the questionnaire was answered.[14] The second group controls for parental background characteristics including information on each parent's education from Statistics Sweden's census data (three levels), each parent's income (linearly) and each parent's year of birth (linearly). The parent's incomes were taken from the official tax register in 1963, i.e. prior to the survey. The third group of controls include ability as measured by standardized scores on cognitive tests taken at the same time as the survey was administrated. The test score data from the school survey include one verbal comprehension test, one spatial ability test and one integer sequences test. The maximum

[14] The survey was directed to children in birth cohort 1953 and the majority of the cohort answered the survey in grade 6. Part of the cohort started school one year earlier than usual (2%) and part of the cohort had to retake a year (7%). Therefore these fractions of pupils answered the survey in fifth grade and seventh grade respectively.

score of each test is 40 points, and the test score variable used in the analysis is the sum of the results of these tests, which gives a maximum score of 120 points.[15]

The original SBC data set consists of 15118 observations. After selecting out observations with missing values on our main variables, our data contains 12,677 observations. About half of the sample is female and almost half attains a high school degree. 19% attains a university degree. Table A1 in the appendix gives the descriptive statistics on all outcome variables. Table A2 gives information about the relation between time preferences and these variables. Ability and gender are strongly correlated with time preferences. A one standard deviation higher ability at age 13 is related with 5 percentage points (or approximately 25%) lower likelihood of being impatient. Women are 8 percentage points more likely to be impatient. These results are in line with findings by Dohmen et al. (2010). The other control variables have no meaningful relationship with time preferences, a finding that is also reported in Sutter et al. (2011).

3. Results

This section presents the main results of our analysis of the link between time preferences and lifetime outcomes. We start by examining early measures of human capital. Then we proceed to investigating the relationship between time preferences and long-run labor market outcomes and measures of risky behavior.

Table 1 reveals that patience is a very important trait for a successful school career. People who were more patient at age 13 achieved higher school grades in compulsory schools and in high school. Next to this, they more often enrolled in the science track in high school which at that time was a prerequisite for entering university. Patience also improves the likelihood to attain a high school or university diploma.

[15] In the analysis we standardize this variable to mean 0 and standard deviation 1.

The estimated coefficients are sizable. We find that being impatient relates to 0.23 standard deviations lower GPA in comprehensive school and 0.19 standard deviations lower GPA in high school. On average, 21.4% of the sample enrolled in the science track in high school. Those with high time preferences were 4.7 percentage points less likely to attend this track. On average 50.5% of the sample attained a high school diploma. Impatience thus lowers the probability to attain a high school diploma with approximately 9.6 percentage points.[16] Regarding university diplomas, on average 18.8% of the sample attained a university degree and impatience therefore reduced the probability to attain this diploma with 6.7 percentage points.

Table 1 additionally shows that patient boys achieve higher scores on an achievement test which was held during enlistment. Being more impatient is related to a 0.21 standard deviations lower score on this test.

Although we measure patience at an early age and outcomes later in life, we cannot infer a causal relationship from these predictions since there may be potentially important unobserved confounders. One important confounder may be cognitive ability. The analyses displayed in the second and third rows of Table 1, show that including controls for parental education, parental income parental year of birth and cognitive ability measured at age 13 reduces the magnitude of the coefficients but the estimates remain statistically significant by a wide margin.[17] The table clearly shows the importance of controlling for ability. Analyses in earlier papers usually do not control for ability and may therefore overestimate the effects of time preferences.

The data also allow a comparison within twin pairs so that we can eliminate more unobserved confounders. We find that the estimates have the same sign but many are no

[16] Note that since impatience is related to attaining a high school diploma, the relationship between impatience and high school GPA is underestimated.
[17] The reductions in the coefficients are significant at the 10% level in columns 1, 4, and 5.

longer statistically significant, possibly due to the limited sample size. The point estimates on time preferences for attaining a high school and university exam increase in size and remain significant. One reason for the increased effect size could be measurement error, which tends to be exacerbated in twin fixed effect models (e.g. Griliches 1977). The point estimates for comprehensive school and high school GPA, of the enrolment in the science track and for cognitive test scores taken at military enlistment are reduced are no longer statistically significant.

-- Table 1 –

Table 2 shows the association between impatience and several labor market outcomes and risky behavior. Overall, we see that impatience at young age predicts adverse labor market outcomes and risky behavior but the relationships are weaker than for education. When we control for ability, only the relationships with receipt of welfare and BMI remain significant. One reason for this can be a lack of power. If impatience affects educational attainment which in turn affects income, then we may need more data to be able to detect any effect of impatience on income. Another reason is that impatience may be more important in school than in the labor market. We will elaborate on this idea below.

As can be seen in Table 2, impatience increases the probability of experiencing an unemployment spell between 1993 and 2001 (i.e. between the ages of 40 and 48) with 1.7 percentage points. The estimate does not change when we control for parental background. However, within twin pairs, the effect is much larger. The impatient twins are 20 percentage points more likely to have an unemployment spell than their patient twin sibling.

We also find that impatient people earn 8% less than patient people. Part of this relationship is apparently driven by cognitive ability as the inclusion of such controls reduces the point estimate to approximately 3%. This estimate is only marginally insignificant at the 10 percent level.

Table 2 also shows that the probability to receive social assistance between age 37 and 48 is 3.4 percentage points higher for impatient people than for patient people. This estimate also reduces when controlling for cognitive ability but remains significant.

Next, we examine the relationship between impatience and teen pregnancy. We have information on teenage parenthood for girl only, and the occurrence of teen pregnancy in this cohort is low (3.3%). The estimates show that there does not seem to be a strong relationship between impatience and teen pregnancy.

In line with the cross sectional evidence provided in Borghans and Golsteyn (2006), we find that impatience is associated with a higher BMI. Being impatient is related to 2.4 percentage points higher likelihood to be obese (a Body Mass Index over 30). As discussed by Borghans and Golsteyn, one reason may be that impatient people may value candy, fast food and other instant satisfiers more than patient people. Finally, iImpatient people are also more likely to be convicted of a crime between the ages of 15-31. However, this relationship seems to a large extent be driven by cognitive ability.

-- Table 2 --

Sensitivity analyses

The results presented so far rely on our impatience variable being specified as a dummy variable equaling 1 if people answer that they are certain, almost certain or indifferent toward choosing the 1000 SEK in five years option relative to the 100 SEK today option.

We chose to pool these three categories because of subtle differences in the answer categories.

Table 3 shows robustness analyses with other specifications of the impatience variable. The results show that if we pool the answer category "indifferent" with the answer categories (almost) certainly not, the results change only marginally and if anything become stronger (e.g. for science track, unemployment and criminal conviction).

In column 3, we do not pool any of the categories. The column shows that, except for unemployment, all relationships are robust to this change in the coding of the time preferences variable. One advantage of this specification is that we can more easily interpret the effect size. For instance, the estimates reveal that one standard deviation more impatience is related to 2.6 percent less income. The magnitude of the effect of impatience on compulsory school grades is substantial: a one standard deviation increase in our measure of impatience almost corresponds to the gender gap in school performance.

In the fourth column we use the principal component of different proxies for discount rates available in our data set. Except for teen parenting the results are remarkably stable. The results now indicate that a one standard deviation increase in impatience is associated with 2.8 percent less income.

-- Table 3 --

Extensions of the analysis

Having established that our results are robust to changes in how we measure impatience, we continue by analyzing 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, between people with high and

low cognitive test scores, or between people with rich and poor parental background. We analyze this by interacting our measure of impatience with respectively a dummy for sex, our measure of ability at age 13, and with a dummy whether the respondent had a highly educated father.

The results in table 4 show that the interaction with sex is statistically significant for GPA, choosing a science track, income and crime. This implies that for women it appears to be less harmful to be impatient early in life than for men.

The interaction with ability gives ambiguous results. At school, those with more ability suffer more from being impatient than those with low ability, while later in life more able people seem to suffer less from impatience. One (speculative) explanation for this may that one underlying aspect of time preferences is some form of restless energy. At school, it harms students to be restless. At work later in life, it could potentially lead to higher productivity.

The interaction between parental socioeconomic status and impatience is never statistically significant.

-- Table 4 --

4. Conclusions

This paper analyzes the relationship between impatience and outcomes later in life. Using unique longitudinal data, we find evidence that impatience is related especially to worse educational attainment, but also to a number of labor market outcomes and risky behaviors.

Our analyses provide first evidence of the importance of impatience when young for later in life outcomes. This result is important in combination with earlier evidence that

time preferences are malleable. A recent paper by Perez-Arce (2011) shows for instance that education affects time preferences and Bishai (2004) shows that time preferences rates change substantially after age 29. Results from personality psychology confirm the finding that the ability to delay gratification can develop over time (Mishel and Ayduk, 2003; Carduchi, 2009). Recent research has suggested that active decision making and optimal default choices can potentially moderate high discount rates (e.g. Carroll et al. 2009). Time preferences therefore appear to be more malleable than for instance intelligence. This result has also been documented for personality traits. A large body of psychological research has stressed that personality traits may be influenced by the environment during childhood and that they do not stabilize until late during adolescence (e.g. Borghans et al. 2008). The malleability of patience thus provides scope for policy to reduce time preferences rates. To the extent that our estimates capture causal effects, our analysis indicates that the returns of such interventions are potentially high.

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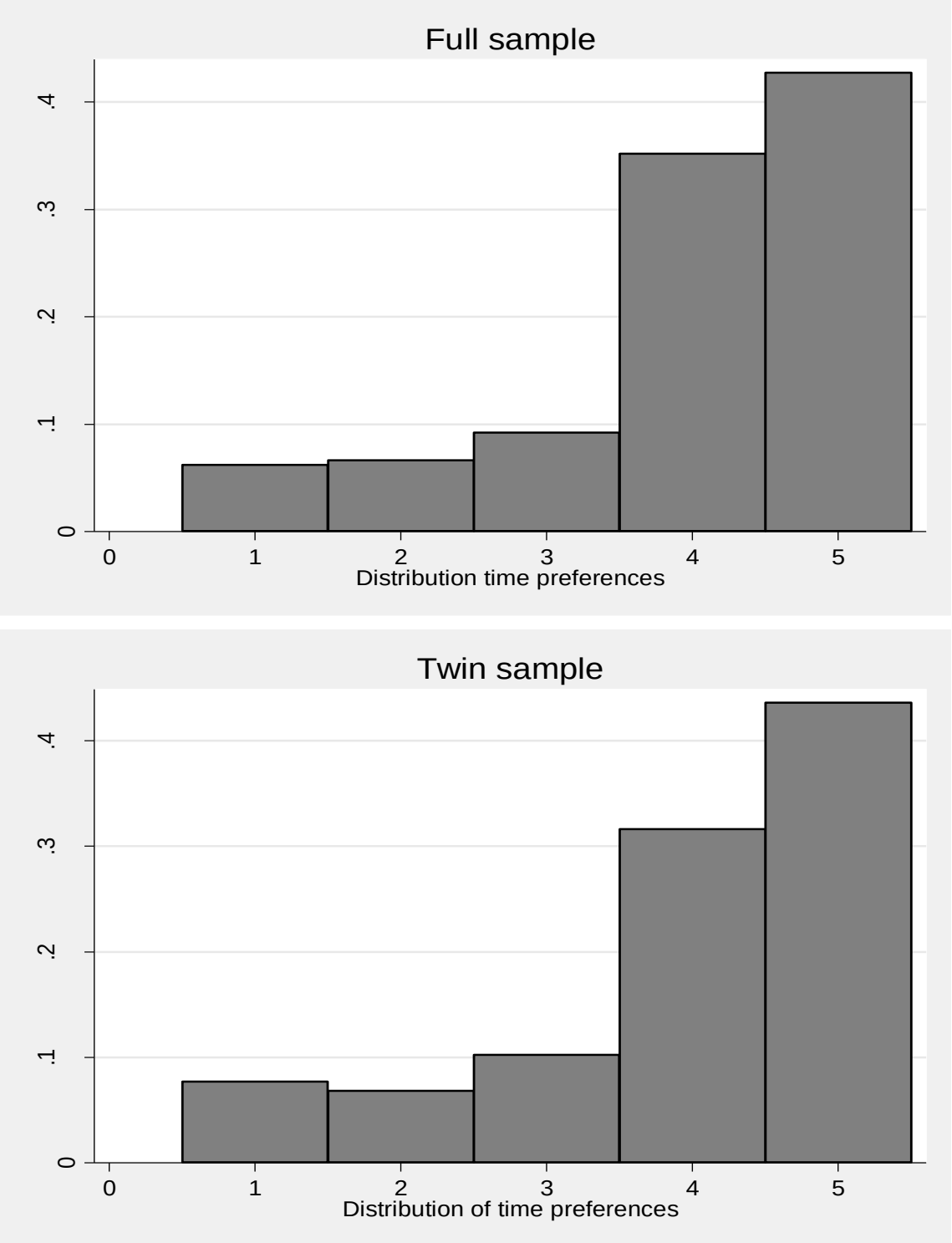
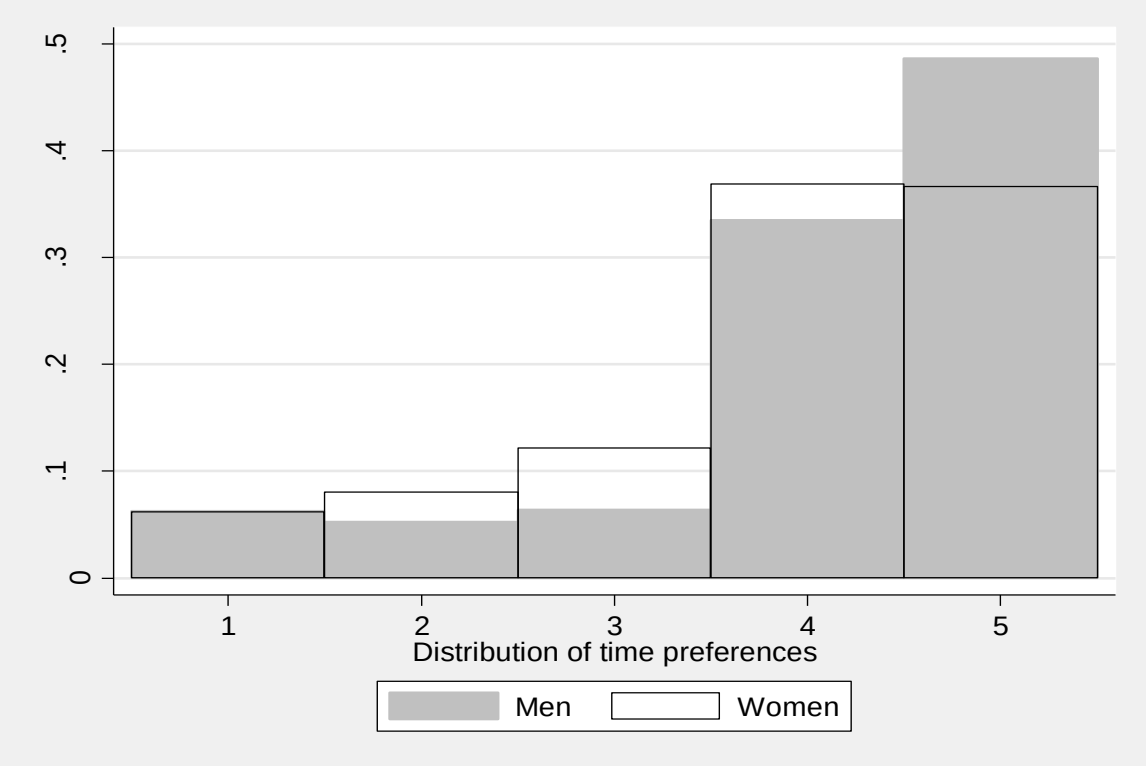
Figure 1 Distribution of time preferences



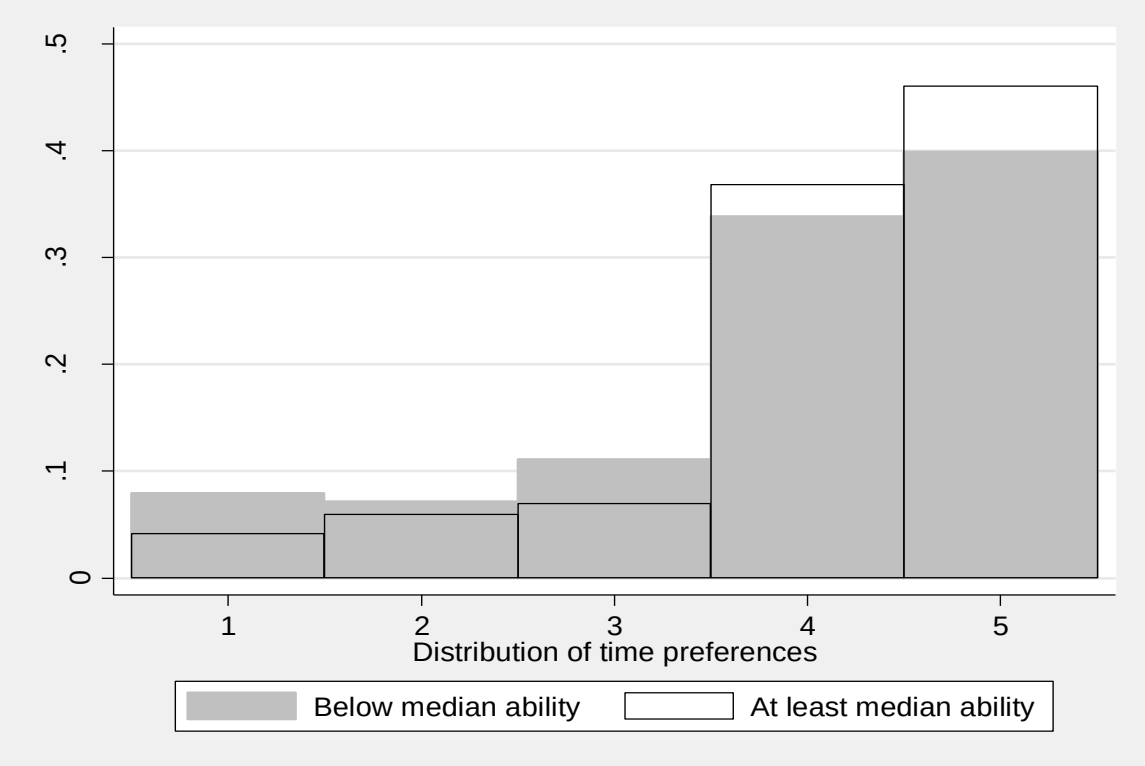
Notes: Figure 1 shows the distribution of answers to the question: "If you had to choose between SEK 100 [USD 15] now versus SEK 1000 [USD 150] in five years, which would you choose?". Categories (1) to (5) represents respondents stating: "Certainly SEK 100 now" (1), "Probably SEK 100 now" (2), "Cannot choose" (3), "Probably SEK 1000 in five years" (4), "Certainly SEK 1000 in five years" (5). The sample consists of all children born in Stockholm county in the year 1953. The survey was administrated in grade 6 when most respondents were aged 13. The number of respondents who answered the question is in the full sample 12,715 and in the twin sample 256.

Figure 2 Gender differences in the distribution of time preferences



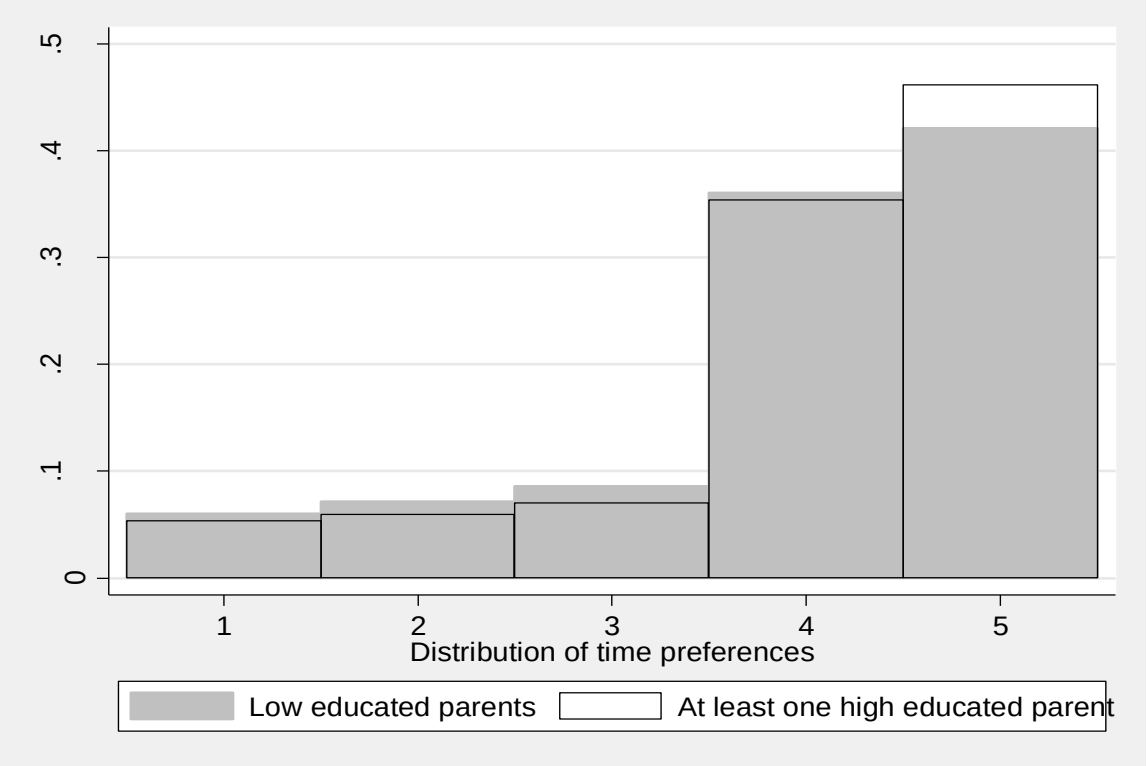
Notes: Figure 2 shows the distribution of answers to the question: "If you had to choose between SEK 100 [USD 15] now versus SEK 1000 [USD 150] in five years, which would you choose?". Categories (1) to (5) represents respondents stating: "Certainly SEK 100 now" (1), "Probably SEK 100 now" (2), "Cannot choose" (3), "Probably SEK 1000 in five years" (4), "Certainly SEK 1000 in five years" (5). The sample consists of all children born in Stockholm county in the year 1953. The survey was administrated in grade 6 when most respondents were aged 13. The number of female respondents who answered the question is 6,267 and the number of male respondents is 6,448.

Figure 3 Ability differences in time preferences



Notes: Figure 3 shows the distribution of answers to the question: "If you had to choose between SEK 100 [USD 15] now versus SEK 1000 [USD 150] in five years, which would you choose?". Categories (1) to (5) represents respondents stating: "Certainly SEK 100 now" (1), "Probably SEK 100 now" (2), "Cannot choose" (3), "Probably SEK 1000 in five years" (4), "Certainly SEK 1000 in five years" (5). The sample consists of all children born in Stockholm county in the year 1953. The survey was administrated in grade 6 when most respondents were aged 13. The number of respondents who scored at least median in cognitive tests taken at the same time as the survey is 6,907 and the number of respondents who scored below the median is 5,808.

Figure 4 Differences in time preferences by parental education



Notes: Figure 4 shows the distribution of answers to the question: "If you had to choose between SEK 100 [USD 15] now versus SEK 1000 [USD 150] in five years, which would you choose?". Categories (1) to (5) represents respondents stating: "Certainly SEK 100 now" (1), "Probably SEK 100 now" (2), "Cannot choose" (3), "Probably SEK 1000 in five years" (4), "Certainly SEK 1000 in five years" (5). The sample consists of all children born in Stockholm county in the year 1953. The survey was administrated in grade 6 when most respondents were aged 13. The number of respondents with parents having at most compulsory education is 5,720 and the number of respondents with at least one parent having completed education beyond the compulsory level is 4,670.

Table 1. The link between time preferences and human capital

	Compulsory school GPA	High school GPA	=1 if science track in high school | graduating	=1 if graduated high school	=1 if graduated university	Cognitive skills at enlistment
	(1)	(2)	(3)	(4)	(5)	(6)
A. Full sample						
Controlling for predetermined characteristics (i)	–.230*** (.022)	–.189*** (.033)	–.047*** (.013)	–.096*** (.011)	–.067*** (.007)	–.211*** (.031)
Controlling for parental background (ii)	–.199*** (.021)	–.177*** (.032)	–.041*** (.012)	–.081*** (.010)	–.056*** (.007)	–.191*** (.031)
Controlling for cognitive test scores age 13 (iii)	–.079*** (.019)	–.120*** (.031)	–.016* (.012)	–.036*** (.010)	–.031*** (.007)	–.081*** (.028)
Mean of dependent variable	N/A	N/A	.213	.499	.185	N/A
Number of observations	11,814	5,980	5,980	12,677	12,677	6,426
B. Twin sample	–.055 (.156)	–.147 (.223)	–.077 (.075)	–.171* (.095)	–.114* (.068)	–067 (.171)
Mean of dependent variable	N/A	N/A	.214	.481	.185	N/A
Number of twin pairs	112	72	72	121	121	85

Notes: The table shows the coefficient on a dummy set to unity if the child at age 13 with certainty, almost certainty or indifferently prefers 100 SEK (15 USD) today versus 1000 SEK (150 USD) in five years. Each cell represents a separate regression. The sample consists of children born in Stockholm county in 1953. Continuous dependent variables are standardized. Row (i) controls with dummies for month of birth, gender and the grade when the questionnaire was answered. Row (ii) additionally controls for each parent's education (three levels), each parent's income (linearly) and each parent's year of birth (linearly). Row (iii) additionally controls for ability as measured by standardized scores on cognitive tests taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table 2. The link between time preferences, long–run labor market outcomes and measures of risky behavior

	=1 if unemployed in 1993–2001	log Long–run income	=1 if received welfare in 1990–2001	=1 if teen parent (girls only)	=1 if BMI>30 (boys only)	=1 if criminal conviction between age 15 and 31
	(1)	(2)	(3)	(4)	(5)	(6)
A. Full sample						
Controlling for predetermined characteristics (i)	.017*	–.078***	.035***	.010*	.024**	.021***
	(.010)	(.021)	(.009)	(.006)	(.011)	(.008)
Controlling for parental background (ii)	.016	–.069***	.030***	.008	.023**	.018**
	(.010)	(.021)	(.009)	(.006)	(.011)	(.008)
Controlling for cognitive test scores age 13 (iii)	.005	–.031	.017*	.004	.021*	.004
	(.010)	(.021)	(.009)	(.006)	(.011)	(.008)
Mean of dependent variable	.291	12.06	.282	.033	.116	.198
Number of observations	12,667	12,236	12,236	6,066	6,426	12,677
B. Twin sample	.200**	–.504	.20**	.033	.083	–.086
	(.098)	(.360)	(.100)	(.058)	(.081)	(.085)
Mean of dependent variable	.272	12.08	.257	.034	.040	.162
Number of twin pairs	121	117	117	117	85	132

Notes: The table shows the coefficient on a dummy set to unity if the child at age 13 with certainty, almost certainty or indifferently prefers 100 SEK (15 USD) today versus 1000 SEK (150 USD) in five years. Each cell represents a separate regression. Each cell represents a separate regression. The sample consists of children born in Stockholm county in 1953. Row (i) controls with dummies for month of birth, gender and the grade when the questionnaire was answered. Row (ii) additionally controls for each parent's education (three levels), each parent's income (linearly) and each parent's year of birth (linearly). Row (iii) additionally controls for ability as measured by standardized scores on cognitive tests taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table 3. OLS estimates based on alternative measures of impatience

	Measure of impatience			
	Baseline	= 1 if child with certainty, almost certainty chooses immediate reward	Linear measure (normalized)	Measure from factor analysis (normalized)
	(1)	(2)	(3)	(4)
Comp. school GPA	–.199***	–.210***	–.086***	–.104***
	(.019)	(.026)	(.009)	(.008)
High school GPA	–.177***	–.196***	–.079***	–.087***
	(.032)	(.040)	(.014)	(.013)
=1 if science track in high school │ graduating	–.041***	–.062***	–.019***	–.022***
	(.012)	(.015)	(.005)	(.005)
=1 if graduated high school	–.081***	–.084***	–.038***	–.050***
	(.010)	(.013)	(.004)	(.004)
=1 if graduated university	–.056***	–.056***	–.025***	–.032***
	(.007)	(.009)	(.003)	(.003)
Cognitive skills at enlistment	–.191***	–.176***	–.072***	–.086***
	(.031)	(.036)	(.012)	(.011)
=1 if unemployed in 1990–1992	.016	.029**	.007	.006
	(.010)	(.012)	(.004)	(.004)
log long run income	–.069***	–.069***	–.026***	–.028***
	(.021)	(.024)	(.008)	(.008)
=1 if received welfare at least once in 1990–2001	.030***	.029***	.009**	.010***
	(.010)	(.012)	(.004)	(.004)
=1 if teen parent	.008	.011	.004	.005**
	(.006)	(.007)	(.003)	(.003)
=1 if BMI>25	.023**	.037**	.014***	.013***
	(.012)	(.015)	(.005)	(.005)
=1 if criminal conviction between age 15–31	.018**	.024**	.008**	.011***
	(.008)	(.010)	(.003)	(.003)

Notes: Each cell represents a separate regression. Column (1) shows the baseline estimates on a dummy set to unity if the child at age 13 with certainty, almost certainty or indifferently prefers 100 SEK (15 USD) today versus 1000 SEK (150 USD) in five years. Column (4) shows estimates from factor analysis (oblique) standardized according to modified group method from principal components. See appendix for details on the specific questions included. The sample consists of all children born in Stockholm county in the year 1953. GPA and scores on enlistment tests (males only) are normalized to mean zero, std. 1. Regressions controls with dummies for month of birth, grade when the questionnaire was answered, gender parental education (three levels), parental income (linearly) and parental year of birth (all variables are defined for each parent). *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table 4. Interaction between time preferences and background characteristics

	Coefficient on the interaction between time preferences and		
	Female (1)	Ability (2)	High educated fathers (3)
Comp. school GPA	.076** (.038)	–.087*** (.020)	.039 (.054)
High school GPA	–.052 (.063)	–.089*** (.034)	.069 (.081)
=1 if science track in high school graduating	.050** (.025)	–.041*** (.013)	–.008 (.033)
=1 if graduated high school	–.011 (.019)	–.021*** (.008)	.039 (.027)
=1 if graduated university	.001 (.014)	–.037*** (.007)	–.001 (.026)
Cognitive skills at enlistment	N/A	–.017 (.026)	.054 (.091)
=1 if unemployed in 1993–2001	–.018 (.020)	.008 (.010)	.007 (.029)
log long run income	.104** (.042)	.098*** (.018)	.024 (.062)
=1 if received welfare in 1990–2001	–.010 (.019)	–.053*** (.008)	–.038 (.026)
=1 if teen parent	N/A	–.016*** (.005)	–.001 (.014)
=1 if BMI>30	N/A	–.000 (.011)	.020 (.034)
=1 if criminal conviction between age 15 and 31	–.045*** (.017)	.026*** (.008)	.006 (.022)

Notes: The table shows the OLS coefficient on an interaction term between the measure of time preferences and the individual characteristics in each column. Each cell represents a separate regression. The sample consists of children born in Stockholm county in 1953. All regressions control with dummies for month of birth, gender, grade when the questionnaire was answered, each parent's education (three levels), each parent's income (linearly), each parent's year of birth (linearly) and ability as measured by standardized scores on cognitive tests taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table A.1 Summary statistics

	Full sample		Twin sample	
	Mean (1)	Sd. Dev (2)	Mean (3)	Sd. Dev (4)
Outcome variables:				
Comp. school GPA	3.18	.77	3.23	.73
High school GPA	3.33	.65	3.35	.65
=1 if science track in high school | graduating	.213	.409	.214	.411
=1 if graduated high school	.499	.500	.478	.501
=1 if graduated university	.185	.388	.185	.389
Cognitive skills at enlistment	5.10	2.50	5.17	2.23
=1 if unemployed in 1993–2001	.291	.454	.272	.446
log lifetime income	12.03	1.08	12.03	1.08
=1 if received welfare in 1990–2001	.307	.461	.304	.461
=1 if teen parent	.033	.179	.030	.171
=1 if BMI>30	.116	.320	.041	.199
=1 if criminal conviction between age 15 and 31	.198	.398	.162	.369
Control variables:				
Time preferences (1–5)	4.016	1.159	3.974	1.231
Female	.493	.500	.474	.500
Cognitive test scores at age 13	68.302	17.975	64.224	18.910
Mother age at birth	28.488	6.046	30.012	4.882
Father age at birth	30.978	7.781	32.5	5.736
Mother compulsory school	.870	.336	.879	.327
Mother high school	.130	.336	.121	.327
Mother University	.044	.206	.048	.215
Father compulsory school	.721	.448	.687	.465
Father high school	.278	.448	.313	.465
Father University	.143	.350	.183	.388
Mother income (in SEK at time of survey)	4,286	6,516	3,549	5,790
Father income (in SEK at time of survey)	23,015	20,905	22, 977	23,995

Notes: The table shows summary statistics for variables included in the analysis. The sample consists of children born in Stockholm county in 1953. Information on parents is conditional on no missing value. Mother and father's income is the yearly net income.

Table A.2 The association between observed characteristics and time preferences

	Dependent variable =1 if individual with certainty, almost certainty or indifferently chooses immediate reward (N=12,677; sample mean: .221) (1)
Cognitive test scores age 13 (standardized)	–.050***
	(.004)
Female	.080***
	(.007)
Mother compulsory school	Ref.
Mother high school	–.012
	(.017).
Mother University	.015
	(.027)
Father compulsory school	Ref.
Father high school	.003
	(.014)
Father University	–.005
	(.018)
Mother income	–.000
	(.000)
Father income	.001**
	(.001)
Mother year of birth	.000
	(.000)
Father year of birth	.000
	(.001)

Notes: The table shows the OLS coefficients on variables used as controls in the empirical analysis. The sample consists of children born in Stockholm county in 1953. Cognitive skills (standardized) are from a test taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table A3. Coefficients on selected control variables in Table 1

	Compulsory school GPA	High school GPA	=1 if science track in high school | graduating	=1 if graduated high school	=1 if graduated university	Cognitive skills at enlistment
	(1)	(2)	(3)	(4)	(5)	(6)
Control variables:						
Cognitive test scores age 13	.505***	.382***	.167***	.184***	.102***	.484***
	(.009)	(.015)	(.006)	(.004)	(.003)	(.012)
Female	.180***	.393***	–.106***	.016**	–.017***	N/A
	(.016)	(.024)	(.010)	(.008)	(.006)	
Father high school	.182***	.197***	.034*	.155***	.107***	.050
	(.032)	(.043)	(.018)	(.015)	(.016)	(.046)
Father University	.077**	.050	.054**	–.010	.058***	–.054
	(.039)	(.052)	(.023)	(.018)	(.021)	(.061)
Mother high school	.068*	.098*	.021	.024	.087***	.070
	(.039)	(.052)	(.023)	(.018)	(.020)	(.055)
Mother University	.034	.189**	.000	–.009	–.003	–.109
	(.062)	(.081)	(.036)	(.027)	(.032)	(.098)
Father income	.003***	.002***	.001***	.000	.002***	.002***
	(.001)	(.001)	(.000)	(.001)	(.000)	(.001)
Mother income	.001	.002	–.001	.003***	.001**	–.001
	(.001)	(.002)	(.001)	(.000)	(.001)	(.002)

Notes: The table shows the OLS coefficients on selected control variables used in Table 1 row (iii). The sample consists of children born in Stockholm county in 1953. Continuous dependent variables are standardized. Ability is the standardized score on cognitive tests taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.

Table A4. Coefficients on selected control variables in Table 2

	=1 if unemployed in 1993–2001	log Life–time income	=1 if received welfare in 1990–2001	=1 if teen parent	=1 if BMI>30	=1 if criminal conviction between age 15 and 31
	(1)	(3)	(4)	(5)	(6)	(7)
Control variables:						
Cognitive test scores age 13	–.045***	.160	–.055*	–.017	–.012***	–.054***
	(.005)	(.009)	(.004)	(.005)	(.004)	(.004)
Female	.004	–.312***	.019***	N/A	N/A	–.264***
	(.008)	(.017)	(.008)			(.007)
Father high school	–.020	.006	–.024	–.020	.026	–.044***
	(.016)	(.038)	(.014)	(.006)	(.017)	(.012)
Father University	.011	.097**	–.000	.002	.018	.016
	(.020)	(.044)	(.017)	(.006)	(.021)	(.016)
Mother high school	.029	.027	.028	–.001	–.011	.060***
	(.020)	(.041)	(.018)	(.007)	(.019)	(.016)
Mother University	–.021	–.115	–.020	.018	.071 **	–.064***
	(.031)	(.067)	(.027)	(.013)	(.034)	(.025)
Father income	–.000*	.000	–.000	–.000	–.001	–.001***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Mother income	–.001	.000	.000	.000	–.000	.001
	(.001)	(.000)	(.000)	(.000)	(.001)	(.001)

Notes: The table shows the OLS coefficients on selected control variables used in Table 2 row (iii). The sample consists of children born in Stockholm county in 1953. Ability is the standardized score on cognitive tests taken at the same time as the survey was administrated. *** = significant at the 1 % level ** = significant at the 5 % level * = significant at the 10 % level.